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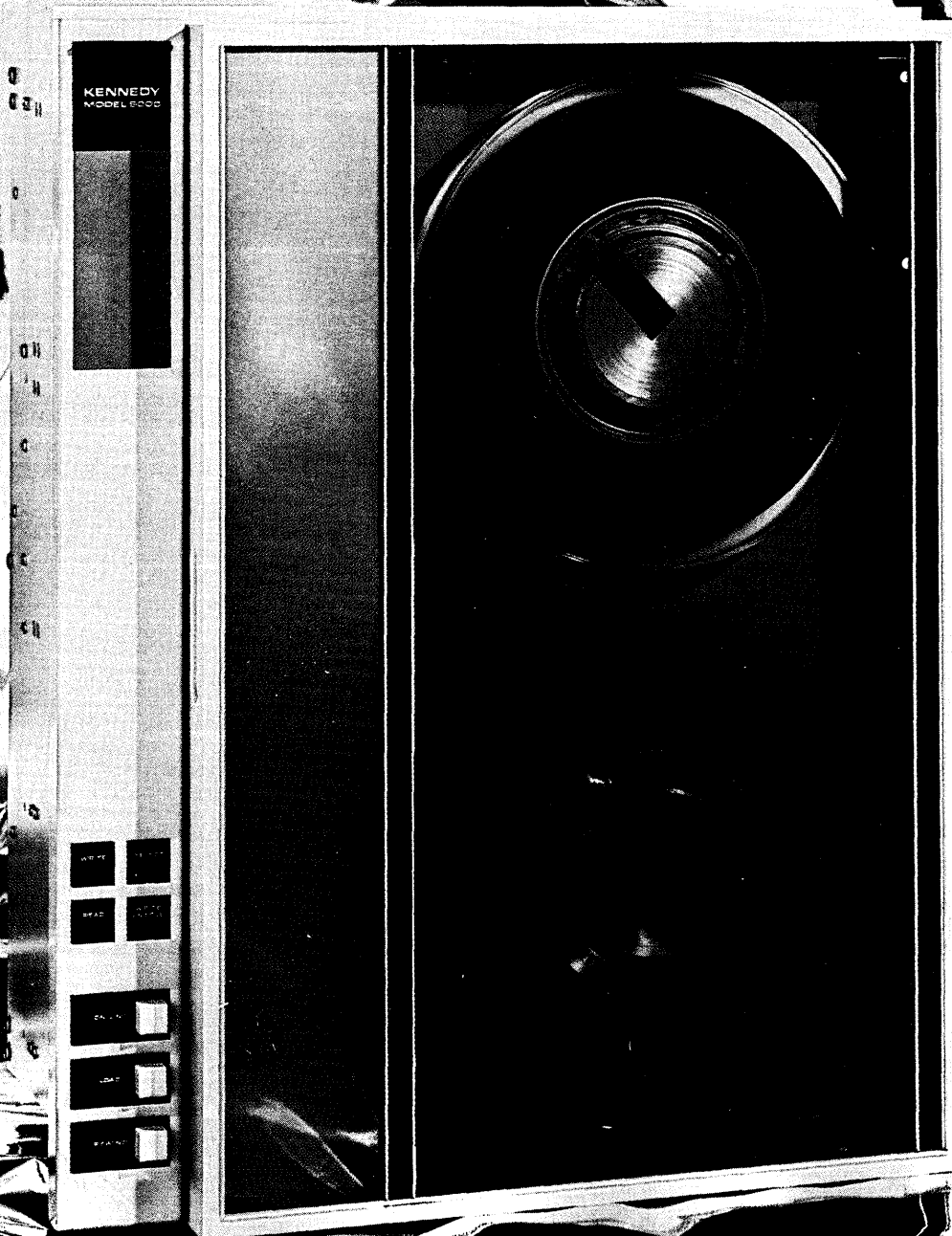
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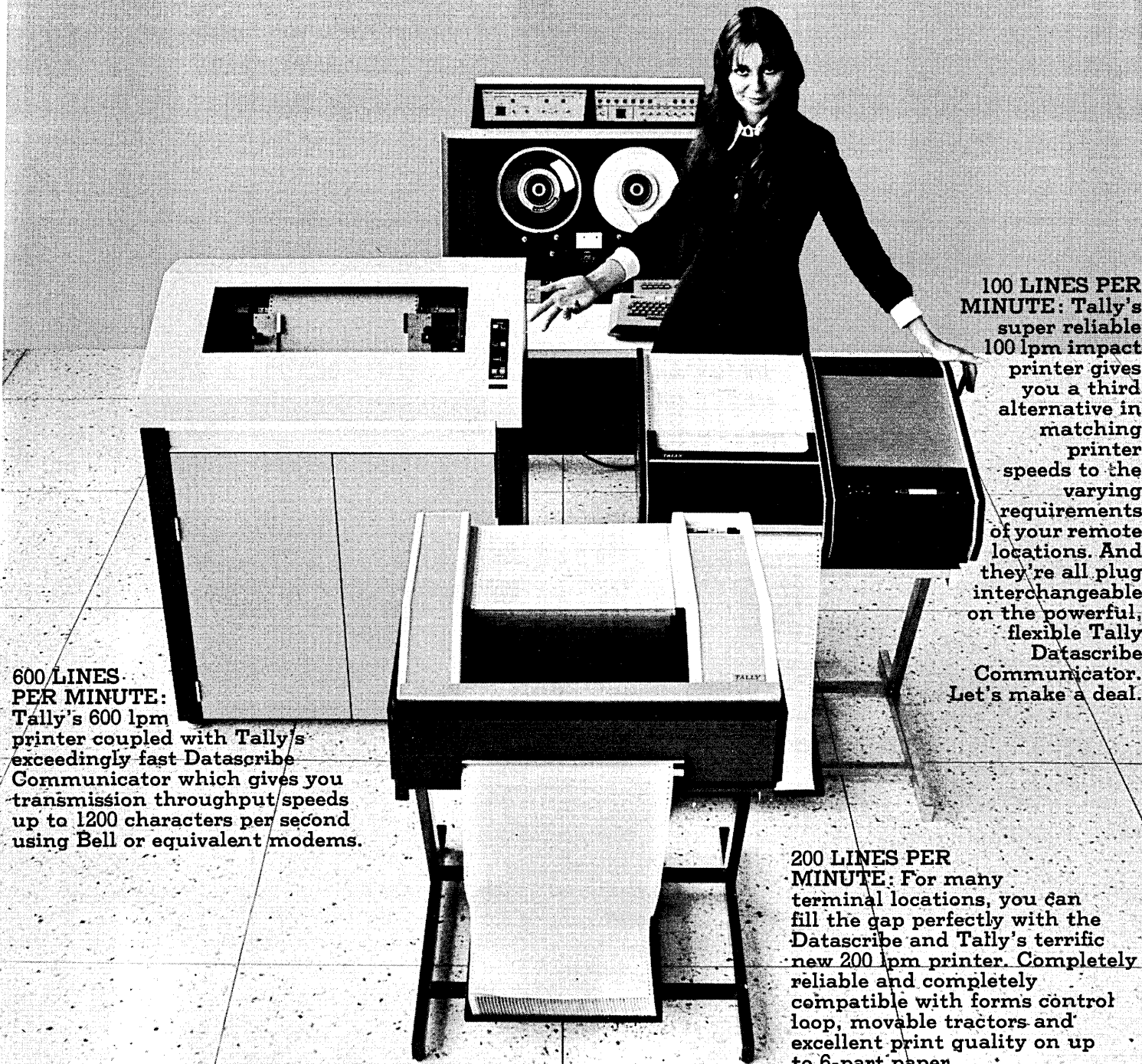
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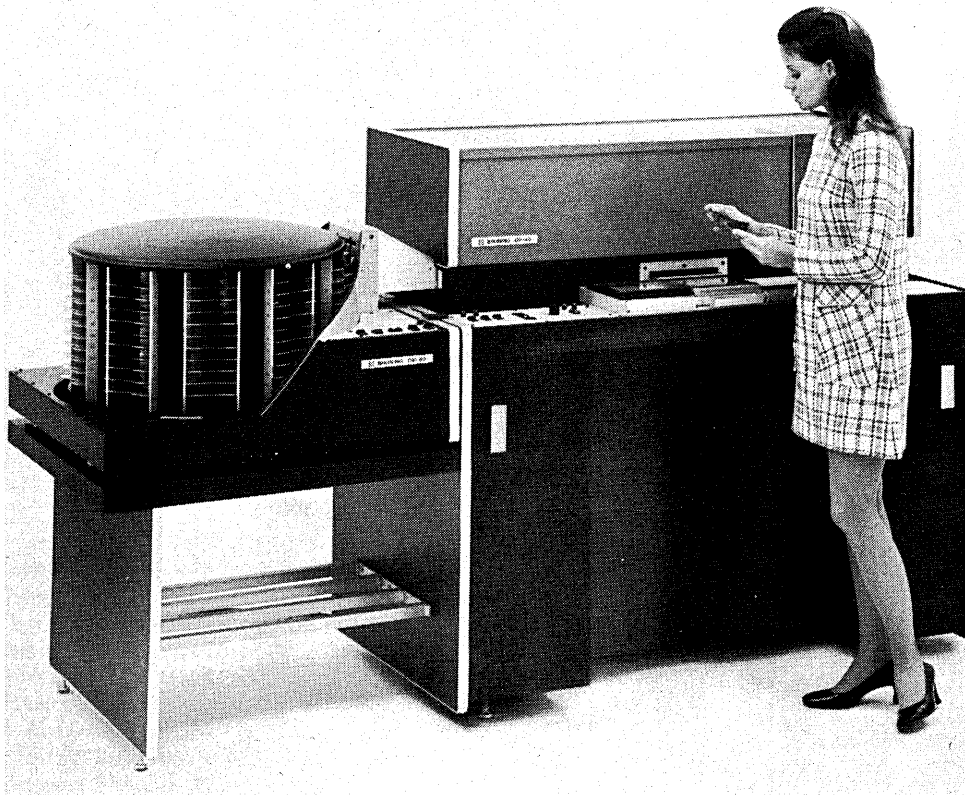
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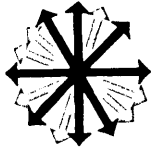
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FEBRUARY, 1973
volume 19 number 2
This issue 116,400 copies

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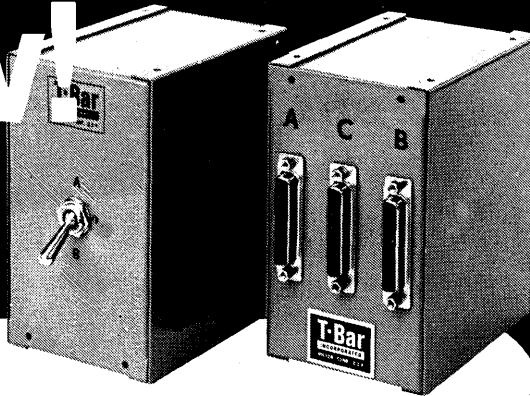
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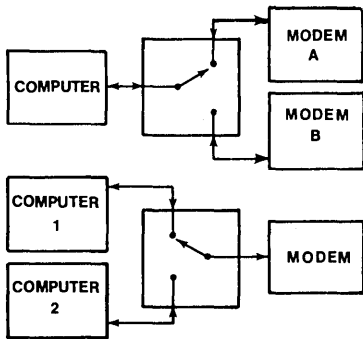
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New!

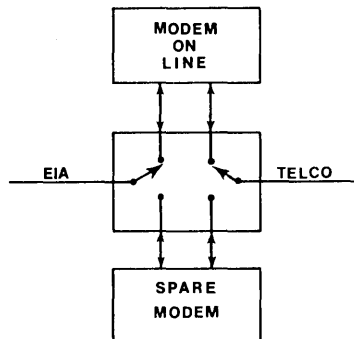


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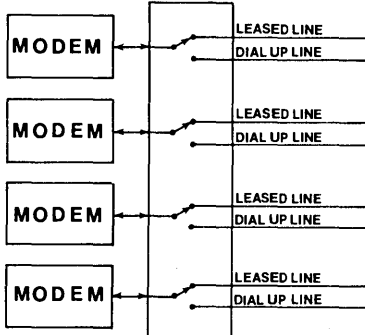
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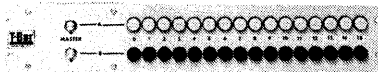
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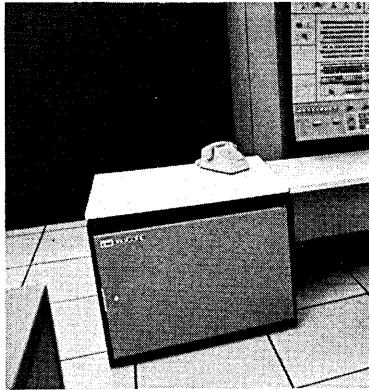
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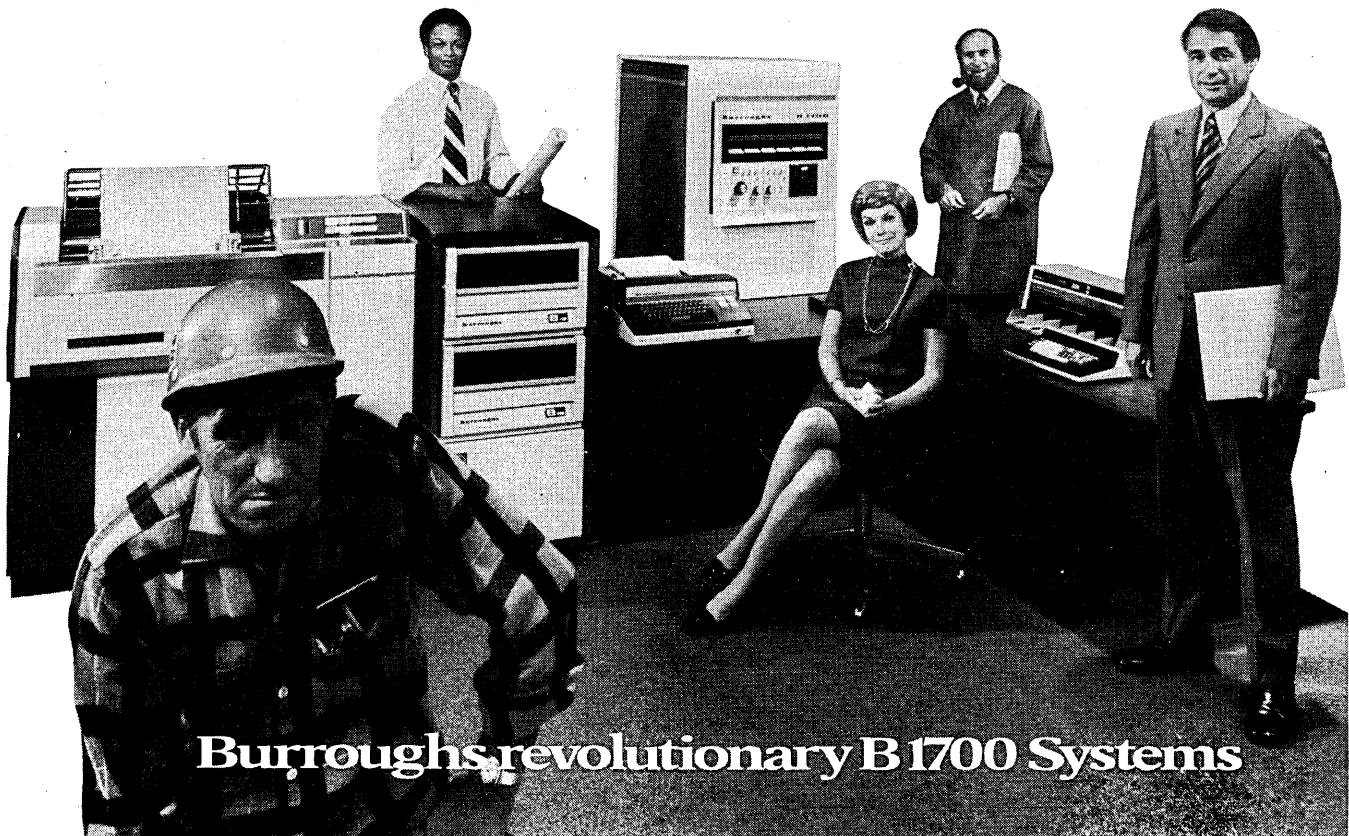
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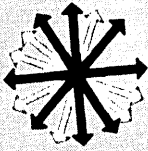
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Look Ahead

RETRIEVAL SYSTEM FOR LITIGANTS...

Part of the \$15 million IBM agreed to pay Control Data for legal expenses covers five information retrieval systems CDC built to prepare for the antitrust trial. Since 1967, some 60,000 man hours are thought to have gone into building and improving the systems which would have given CDC lawyers rapid access during the trial to 10 tons of documents from a terminal in the courtroom.

One was a massive indexing system for all the documents. Others were built to handle sensitive "privileged" documents and to access written summaries, IBM census data, and any part of the legal brief CDC filed in Federal Court in St. Paul. The systems first ran on a CDC 3300 computer, but as the discovery material began to balloon into a warehouse of some 27 million pages, the developers switched to a larger 6600.

Although the data base and index were destroyed, Control Data retains the software and, at writing, planned to market it. Prospective customers would be litigants in cases involving lengthy discovery proceedings. But CDC isn't saying whether it considers the Justice Dept. to be one of these prospects.

AS DATA BASE DESTRUCTION IS DENOUNCED

Shock and anger still are the chief emotions of many in the industry in the wake of the destruction of the Control Data index and data base. Adapso wrote the U.S. Attorney General to request a Grand Jury investigation into the matter. And Telex, complaining about the destruction, filed a motion in St. Paul requesting that the CDC-IBM settlement be set aside.

CDC BECOMES SERVICE BUSINESS LEADER

The Control Data-IBM settlement establishes the Minneapolis supercomputer builder as a big contender in the computer-based services business. Acquisition of IBM's Service Bureau Corp. triples the 100-man force selling CDC's Cybernet service. Three of the IBM-funded research and development contracts (see p. 98) are related to data services. And IBM is out of the picture for six years (much to the disappointment of some of Service Bureau's 1,700 employees, whom IBM agreed not to rehire for that period).

CDC executives have long predicted that the services industry, by the mid-'70s, will get a third of all the dollars spent on data processing; so IBM's offer to underwrite some of CDC's efforts in this direction was hard to turn down. IBM further sweetened the offer by saying it would pay \$15 million for CDC's legal costs, an expenditure CDC already had written off.

IBM WORLD TRADE STILL IN THERE

Although IBM has withdrawn from the U.S. service bureau business, it still has an undetermined number of centers offering contracted services around the world, some of these with on-line Call/360 and 370 service. While World Trade itself was struggling to define for us the number and types of centers it has (apparently there is confusion over the intertwining of customer support and contracted services in some centers), one source guessed that it grosses about \$80-100 million annually in that business, more than SBC in the U.S.

This source thinks the SBC sale widens the gap between World Trade and domestic philosophy. He notes IBM here has never accepted

Look Ahead

the idea that such services are of growing importance to the U.S. manufacturer and is not likely to return to that market when the CDC-stipulated six years of abstinence are up. For one thing, it's not lucrative enough for a multibillion-dollar operation, but also, he claims, IBM is interested here only in the \$1,000/month and up customer--and that user can afford a System/3. Elsewhere in the world, however, IBM must start with a less affluent customer and grow him to the System/3 and 370, meaning continued emphasis on service bureau operations.

CONTROL DATA--SUPERSTAR?

Seven-day-a-week work schedules are producing progress on Control Data's giant STAR-100 computer at the Arden Hills, Minn., research laboratory. Two of the machines are perhaps 98% complete, with "keels being laid" for two more. Herb Grosch recently toured the facility, and upon seeing the 11-ton behemoth destined for the Lawrence Livermore Laboratory was heard by one of the machines's designers to utter, "last of the dinosaurs." The designer considered (but thought better of it) telling Herb about a new logic family that Motorola is thinking of developing called MECL 20,000. "That logic would give us a machine much more compact than the STAR-100, but with maybe three and one-half times the performance," says our source. "We have maybe four times the cooling capacity required for this machine, so the substitution could be made relatively easily." The name for the machine? SUPERSTAR, of course.

AFIPS: A CHANGE OF MIND

Last month's election of two affiliate societies to full membership in Afips wasn't as sweet and smooth as implied by official news releases. Only a month earlier, ISA (Instrument Society of America) and SIAM (Society for Industrial and Applied Mathematics) had been denied membership, and their representatives had stalked out of the Afips board meeting.

A combination of persuasion and pressure from ex-Afips officers changed four votes. Three of them came from the ACM after president Tony Ralston, seeing the error of his ways, asked his Council to reinstruct him. The switch, which reportedly angered many ACMers, was termed by one professional society bigwig as "statesmanlike."

BURROUGHS BEEFING UP 1700 LINE

Burroughs will have some announcements this month--mostly enhancements to the B1700 line. The big machine will be the 1736, which essentially is dual 1726s. The 1726 will be souped up with increased memory capacity from 96 to 128K. Also in the wings are the 700, a smaller version of the 712; front-end communications preprocessors; and disc drives. Further down the line will be the 1746, on the high end of the 1700 family. Burroughs also is continuing work on another large-scale version of the 6700.

NAVY EXPANDS COBOL VALIDATION PROGRAM

The Navy reportedly is willing to let nongovernment users see the "validation summaries" it prepares for DOD agencies on Cobol compilers (see p. 119). Each summary shows why and where a particular supplier's compiler doesn't meet the 1968 standard. The Navy also has offered to validate compilers submitted by outsiders, and prepare summaries, on a cost-reimbursable basis. Each summary

(Continued on page 161)

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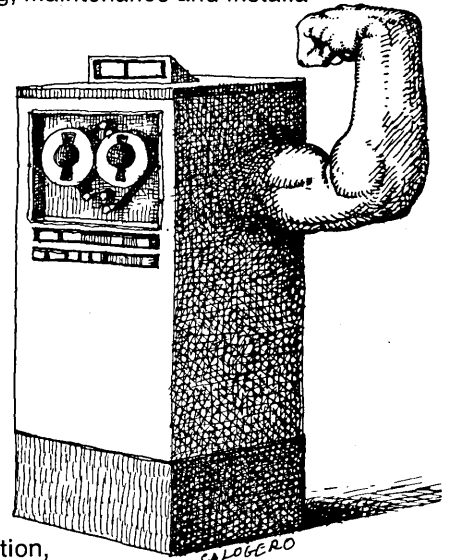
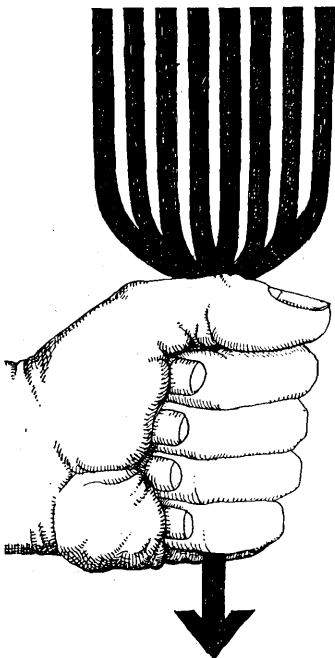
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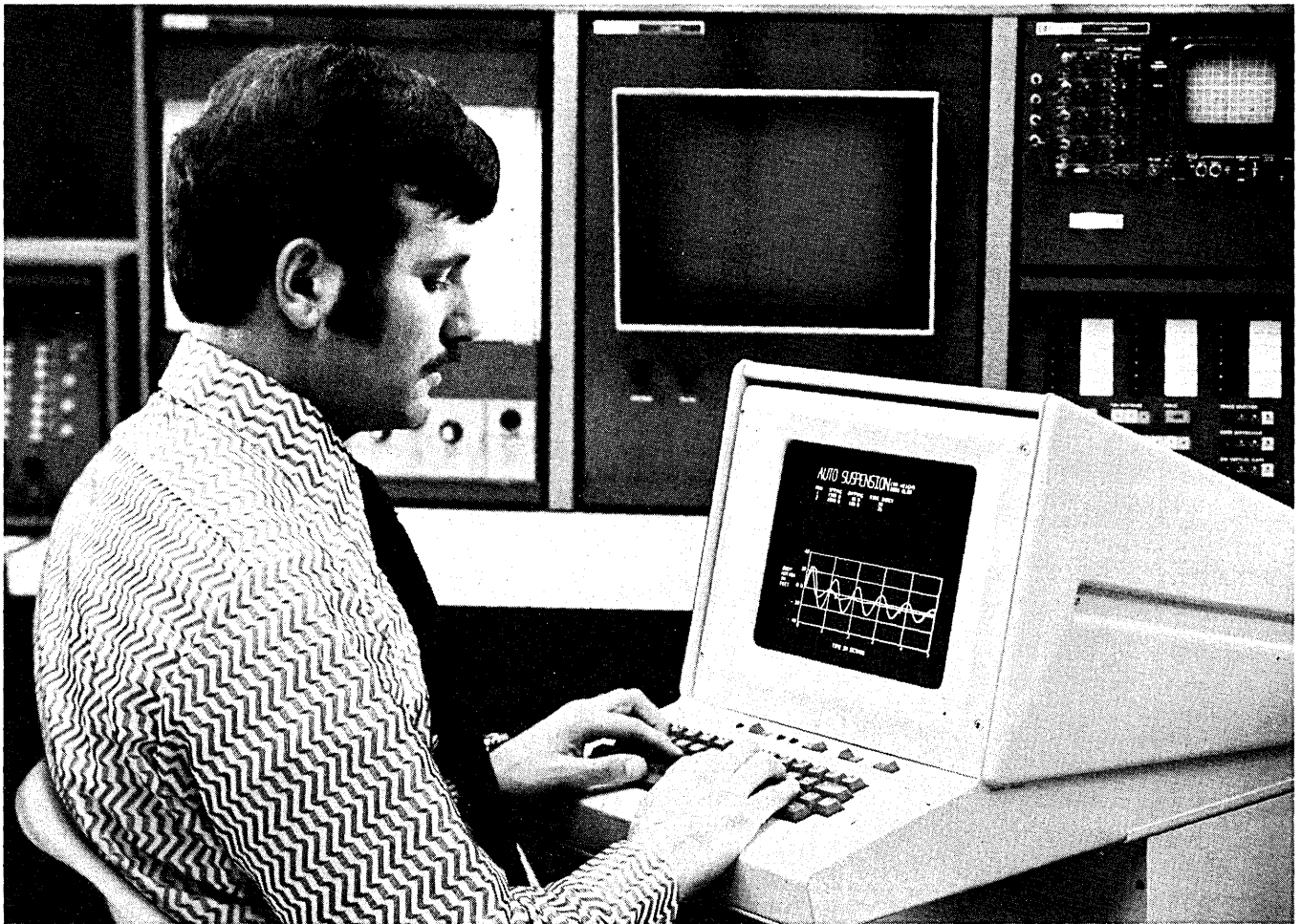
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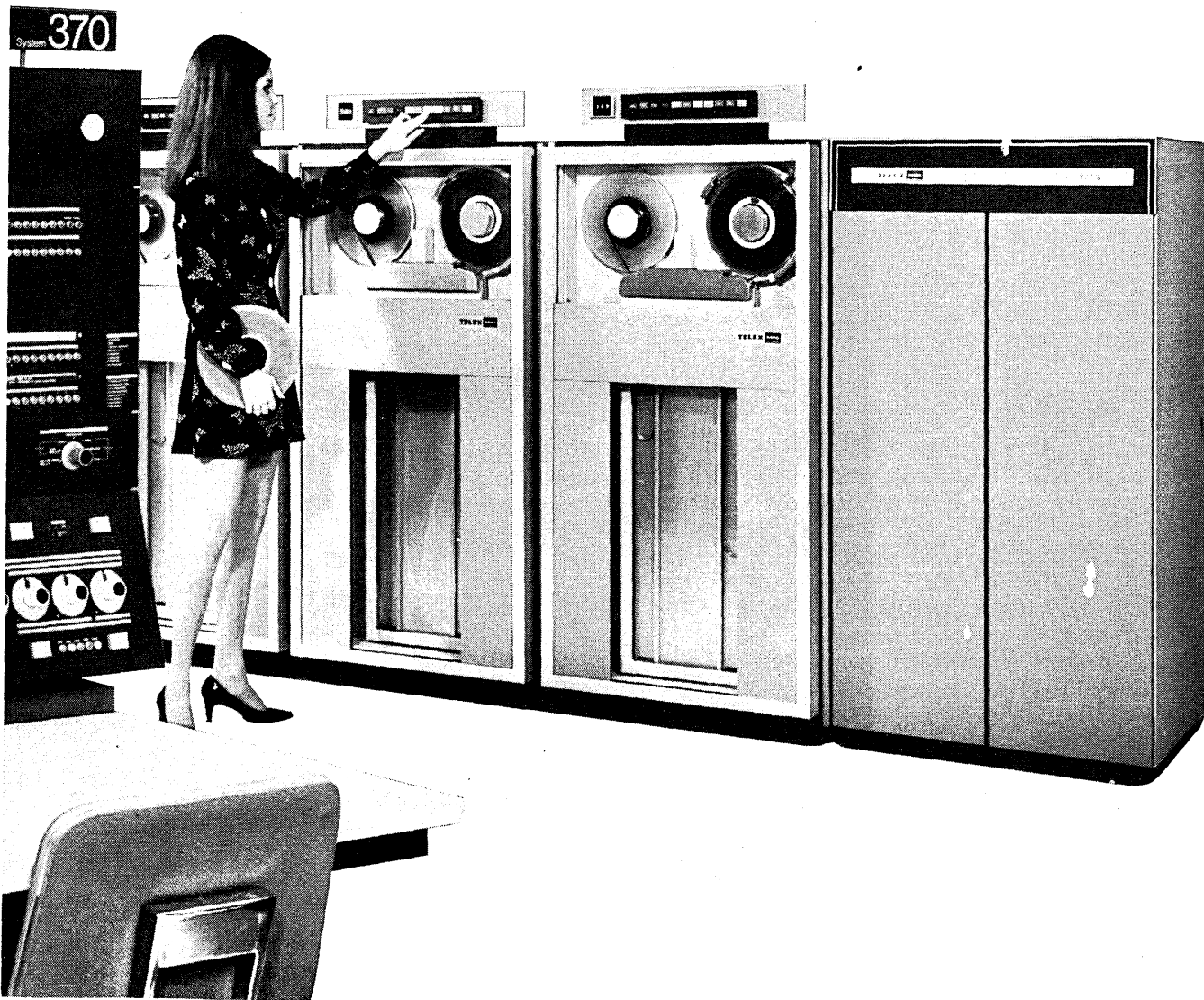
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TELEX tape drive models 6420-3 through 6420-7 are direct replacements for the IBM 3420 series units, and offer two additional tape speeds with corresponding data rates not available from IBM models. Dual density permits operation at either 800 BPI NRZI or 1600 BPI Phase Encoded. Optional seven track or nine track recording allows for data densities of 200 BPI, 556 BPI or 800 BPI NRZI. The TELEX two-control, three-control and four-control switch features allow the accessing of up to 16 tape drives through two, three or four controllers. The two-channel switch allows two data paths to the maximum of 16 drives through one TELEX controller.

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A major feature of the TELEX 6803 Tape Controller is the Radial Device Attachment which allows each tape drive to connect to the controller independently. This provides the

ability to switch any drive off-line without interfering with the functioning of the remainder of the subsystem.

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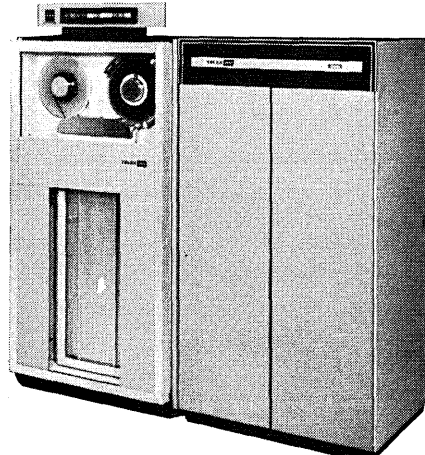
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Calendar

FEBRUARY

Ontario Universities Computing Conference, Feb. 22-23, Toronto. Purposes of the conference are to explore the question of what can reasonably be accomplished in the next 5-10 years in the application of the computer within the university and to bring together faculty, staff, and students to pursue their interests in computing. Registration fee: \$30; students, \$15. Contact: David S. Macey, Office of Computer Coordination, Council of Ontario Universities, 102 Bloor St. West, Toronto M5S 1M8, Ont. (416/920-6865).

MARCH

ACM Seminars on the Psychology of Computer Programming, March and April, New York City, Washington, D.C., Chicago, Montreal, Albuquerque, Los Angeles, San Francisco. The seminars will be given by Gerald Weinberg, author of the well-known book, *The Psychology of Computer Programming*. He will capsule the book and then bring attendees up to date on current research on the same subjects. The seminar is oriented toward senior-level dp personnel. Attendance will be limited. Fee: \$190, ACM, IEEE Computer Group, DPMA, and CIPS members; \$235, others. For program and exact dates in the various locations, contact: Joseph M. Surkis, Director of Professional Development, ACM, 1133 Ave. of the Americas, New York, NY 10036, 212/265-6300.

ABA Trust Operations and Automation Workshop, March 18-21, Atlanta. Topics include trust information systems, automated methods of tax accounting, computer output microfilm, unionism, alternative approaches to securities handling problems, and current legislative issues. Registrants will also meet with suppliers of software packages and services. Registration: \$125 for bankers; others, \$150. Contact: Fred Tippet, Operations and Automation Div., American Bankers Assn., 1120 Connecticut Ave., N.W., Washington, DC 20036.

CSMA Data Communications Seminar, March 23, Philadelphia. Registrants can attend one of two programs: The Basic Data Communications session will cover modems and various types of data terminals. Topics at the Advanced Data Communications session will include simulation of private line services and the use of multiplexors. The morning portion of the seminar will consist of instructional theory, while the afternoon session will show actual applications and offer discussion and solutions to class problems. Contact: Communications Systems Management Assn., 1102 West St., Wilmington, DE 19801, 302/658-4117.

Data Processing Inst. Conference and Trade Show, March 26-28, Ottawa. DPI is a professional society for public servants involved in computers and information processing. Attendance at the conference is open to Canadian and U.S. federal and local government personnel and members of educational institutions. Approximately 30 sessions will be

divided between five parallel programs: General Directions of EDP in Governments; Operations; Programming; Management Sciences; and Special Interest, including training and career development, future hardware innovations, and unusual applications. Admission: \$7.50, DPI members; \$15, others. Contact: Derek Hasler, Conference/73, Box 2458, Ottawa, Canada K1P 5W6.

Conference on Industrial Robot Technology, March 27-29, Nottingham, England. Program on the first day includes reviews of industrial utilization of robots in Japan, U.S., Scandinavia, and the U.K. Papers on the second day will deal with current developments and user experiences. Future trends, including economics, social aspects, and union reactions in the U.K. and elsewhere, will be discussed on the final day. A small exhibition of commercially available industrial robots will be held. Registration fee of £38 includes accommodations, meals, and proceedings. Contact: CIRT Organising Secretary, Dept. of Production Engineering and Production Management, Univ. of Nottingham, Nottingham NG7, 2RD, England.

APRIL

Minicomputers—Trends and Applications, April 4, Gaithersburg, Md. Symposium featuring papers on trends in minicomputer design and economics from a user's point of view; trade-offs in the use of minis vs. time-sharing; and applications in the fields of design, medicine, transportation, education, and process control. Registration fee (including lunch and Proceedings): IEEE members, \$10; others, \$13; at door, add \$2. Contact: Minicomputer Symposium, P. O. Box 639, Silver Spring, MD 20901.

Datafair 73, April 10-12, Nottingham, England. Three major events: a symposium at which papers on all aspects of computing will be given; presentations put on by the computing industry; and an exhibition of computing machinery and services. (See related story in News in Perspective.) Contact: The British Computer Society, 29 Portland Place, London W.1., England.

Civil Engineering Program Applications Conference, April 11-13, San Francisco. CEPA is an independent association of professionals using computers in civil engineering and provides a means for exchanging information and for the cooperative development and exchange of computer programs and systems pertaining to civil engineering. Fee: \$50. Contact: Jack Thompson, Wiley & Wilson, 2310 Langhorne Rd., Lynchburg, VA 24501.

Numerical Control Society 10th Anniversary Annual Meeting and Technical Conference, April 16-18, New York City. Forty-six split technical sessions on the theme of "NC/CAM Profits for the '70s," as well as a basic workshop, plant tours showing NC in action, plus 12-15 other workshop and panel sessions. Fee schedule: \$95, NCS, AIEE, and IMMS members; \$120, others; add \$15 after April 7. Contact: William H. White, P. O. Box 138, 524 St. Clair Ave., Spring Lake, NJ 07762.

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Imagine my surprise and delight to discover a company that designs computers for the way people really use them. Instead of chasing nanoseconds they put all of the systems software together first, and then built a fast, low-cost box where it could do its exercises. Finally, somebody has developed a system that asks not what the software can do for the hardware but vice versa. The result is a computer with more software available now than most computers ever hope to have: DOS, RTOS, FORTRAN IV, MACRO assembler, IOCS, the works. With that kind of software available, I wonder what's small about the PRIME 200?

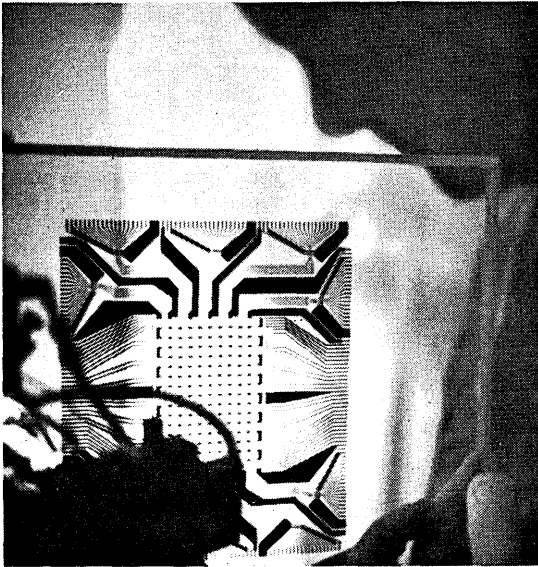
The PRIME 200 16-bit computer raises a lot of interesting questions for which we have prepared detailed answers. Let us send them to you. Prime Computer, Inc., 17 Strathmore Road, Natick, Mass. 01760. (617) 655-6999.

Prime 200 small computer

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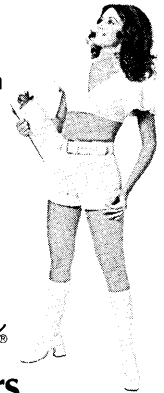
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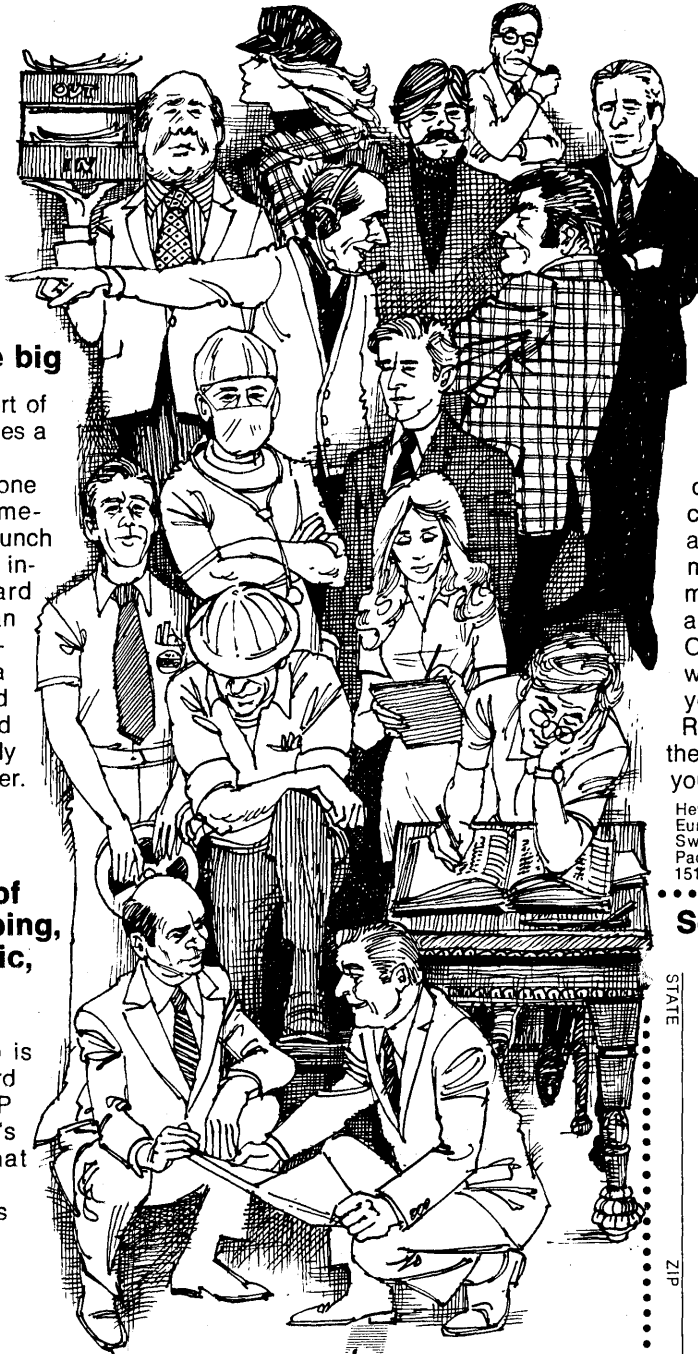
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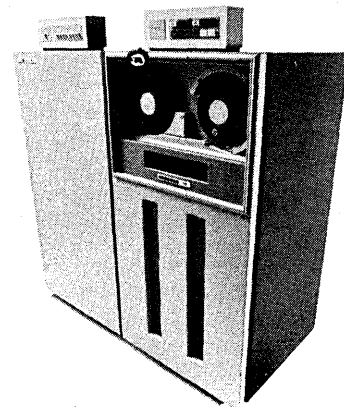
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Letters

Kludge kudo

Kludge Komputer Korp. has made such progress with its vsp (Nov., p. 88) that no shop can avoid obsolescence without it. They have made us an offer we can't refuse. Obviously, if manufacturers of peripheral hardware can't keep up with such developments, they don't deserve to compete.

It is my sincere hope that M. L. Coleman has gained recognition through his summary of this fine system; he has earned it. There are many in our field who have been looking for someone who speaks our language. Now that we have found him, let's hear more.

Art Buchwald, eat your heart out.

DENNIS C. PHIPPS
Washington, D. C.

Running up the score

Gerald M. Weinberg scores again with "The Psychology of Improved Programming Performance" in your November issue (p. 82). He scores high with me because he verbalized so well those attributes of programming which I have observed over 20 years in the trade.

One attribute of programmers he has not discussed, to my recollection, is that of nit-picking, to wit:

In the article he seems to make a case for "beautifying" a program *after* the analysis-code-debug process, with the objective of increasing "program clarity." I dispute that such an objective can be practically achieved in this way.

"Program clarity" depends on lots more than mere cosmetics—the *structure* of a program, which is set (explicitly or implicitly, usually the latter by default) in the initial analysis stage, is the basic determinant of program clarity. For a given specification one structure will be "easier" to explicate than another; yet once a programmer has committed himself to a particular structure, he is usually stuck with it, especially if "promptness" is the initial goal.

I have sometimes attempted to "clarify" monsters created to an objective other than "program clarity" and have usually wound up redoing the whole job from scratch. These experiences have led me to the maxim: "You can't document a mess."

The programmer who has a "particular flair" for the esthetic concept of clarity will, I expect, when asked to "beautify" some other programmer's horror, point out that he would never have written the damn thing that way in the first place.

I eagerly anticipate the publication of *Structured Programming Using PL/C* (or using anything else) by Weinberg et al. I'll bet it goes into this very subject. With clarity.

DICK BUTTERWORTH
Lynn, Massachusetts

Complicating the simple

I noted with interest in your December issue (p. 139), a blurb under Rumors and Raw Random Data about a "six-module manufacturing management system" being available for large plants. These modules as mentioned are supposedly further enhanced by being available in COBOL.

I could not help but think of our own situation. We have put together what I presume to be the same six modules (Engineering, Requirements Planning and Order Policy, Purchasing Control, Shop Floor Control, Costing, and Capacity Planning), all of which will perform equally well for any size manufacturing plant in either mass or batch processing. (We have four plants.)

My reaction upon reading of this supposed accomplishment was twofold:

1. Why does the emphasis, interest, and reward (?) always appear to be in the expensive-computer, wasteful-language environment?

2. Why, when this type of achievement is already a reality on a small-scale computer, written in a simple language (RPG), doesn't anyone notice?

BOB BLEASE
Columbia Products Company
Columbia, South Carolina

Documentation timing

I should like to comment on the excellent article, "How to Write a Readable FORTRAN Program," by Daniel D. McCracken and Gerald M. Weinberg in the October issue (p. 73). When so many textbooks are written as if it is the author's function to describe impartially the features in the compiler, this article shows the positive action of these authors in making their presentation imbued with their own good judgment in a way that will develop good work habits in students and trainees as well as an awareness and appreciation of the significant over the relatively unimportant features available in a programming language.

Their worthy attempt regarding early documentation, however, is less likely to be successful than their other recommendations. Programmers resist documentation while writing the program because they are very anxious to get on with the analysis and testing and may be uncertain about whether what they are trying is completely right. It is

extremely difficult for a programmer to have to reread and revise his documentation every time a test shows that some further change is necessary in his programming. If the supervisor would just wait and then press for the documentation *after* the subroutine or program segment is checked out, he will generally find ready cooperation from the programmer, who then knows that what he is documenting actually does work—that he can, in effect, now wrap it up.

Regarding the lack of completion of the overall documentation for the job as a whole, the supervisor himself may actually be at fault. He is often so anxious to have the programmer get started on a new job that he gives the specifications to the programmer to "just think about" while he is still doing the comprehensive documentation of the old job. But analyzing the new job is so much more appealing to the programmer that his thoughts soon go in that direction rather than toward the completion of the documentation.

Much improvement in final documentation could be accomplished if the supervisor would refrain from giving the programmer a new assignment until he finishes the documentation of the old job. The programmer would then sense that the supervisor really means it when he lectures the programmers about the importance of documentation.

JACK M. WOLFE
Brooklyn, New York

Clarity and readability

In the October issue, McCracken and Weinberg told us "How to Write a Readable FORTRAN Program." I wish they had followed their own advice in the example that they gave. Said example has so many comments in it that it is unreadable. I agree that program documentation is a long-neglected and important problem. And placing a comment card before each statement in a program *does* document it. It also makes the program unreadable. Grouping FORTRAN comments and program statements into logical blocks makes *both* of them readable with very little loss of clarity.

NEAL PARIS
Durham, North Carolina

At the brink

I found some interest in reading Mr. Brink's remark (Dec. Letters, p. 136) about ADR's "good software" since we use their Librarian source program maintenance system. In particular, the December DATAMATION arrived on the same day that ADR acknowledged that their package makes gratuitous, intentional, and unavoidable though un-

letters

documented changes in the Users' source (certain special characters in column 1 are translated). This property is, of course, seldom made manifest, so the incidence of programmer suicide is not materially affected.

RICHARD H. KARPINSKI
*University of California
San Francisco, California*

Robert Caughey, Applied Data Research's Librarian product manager, replies: ADR's Librarian does translate certain characters in column 1, a characteristic of the system that was implemented in response to requests from our users. This is documented in ADR's latest Librarian technical literature.

IBM's gentle nudge

The editorial remark following Don Stroud's letter (Dec., p. 25) about objective measurement for virtual memory planning prompts this note.

I am starting a private practice in the field of computer measurement and have just completed an engagement measuring an IBM 370/145 (virtual) system operating under OS-VS1. Page faults, segment faults, and segment ID's were traced along with the more common points involved in a hardware measurement effort. Address jumps on real memory systems (and discs) have also been measured.

One surprise on this system was the close correlation between page faults and problem state processing. The problem state did increase quite a bit in this changeover to virtual, which tends to support IBM's gentle nudge that modular programming is out. Another surprise was the small amount of segment faults (which might mean a great deal to disc suppliers if this were a valid user sample).

This demonstrates the ability to gain significant insights into the before and after of virtual memory. But this capability cannot be represented as an "instant" decision maker. More work is needed.

Realizing the cumbersome manner in which IBM executes its software and how the relatively undisciplined core and JCL conventions are observed in user shops, one sees some real disasters shaping up.

In Stroud's letter, I see a respected (non-IBM) user expressing a desire for information from the leading industry publication, who in turn says "let's watch ACM." I am a member of the greater SICME (ACM Special Interest Committee on Measurement and Evaluation) and participate as much as geography permits. I feel I know the thrust of their activities and am sure no effort is being made in this direction. Further, I'm convinced that nothing

will be done until somebody, other than SICME, is willing to pay for it.

Is there anybody interested in sponsoring such an effort?

DONALD C. HARDER
*Computer EKG
8921 Brecksville Road
Cleveland, Ohio 44141*

Evaluated in New Zealand

The article, "Computer Evaluation for New Zealand Universities," by Mr. Good and Mr. Moon (Nov., p. 96), was interesting as far as it went, but it ended just where things began to get interesting. The evidence presented in the article offers no reasons for choosing the B6700 and, in fact, overwhelmingly supports the Univac 1108 and CDC 6400. There are obviously some much more important factors, such as price/performance or political considerations, but these are ignored. Thus, the article is a disappointment.

DENNIS J. FRAILEY
*Southern Methodist University
Dallas, Texas*

The authors reply: Our paper did not discuss "why the New Zealand universities chose Burroughs," but rather our measurement of the computer power they needed and the extent to which various machines could supply it. There were other technical aspects, as we pointed out, and price/performance was also without doubt an important consideration. It might be surmised that other factors with some bearing included the ability of the supplier to support the operation, a reluctance to rely too heavily upon data communications, and a wish to obtain as many stand-alone systems as were consistent with equivalent service to all. These things are as may be—what we described was the quantitative evaluation that we ourselves carried out.

Made in Japan

I read Mr. Levine's remarks on Japan in the October issue (p. 116) and agree with the article in general. A portion of the information was based on an interview with me that was then

passed on to Mr. Yasaki. In the process of passing it on to a third party, some information might be subject to misunderstanding; so for the sake of exactness I would like to elaborate on two points.

I have been in Japan over 12 years. After a few years in Japan the concepts of Com-Stute were conceived. The planning for such a company was started 10 years ago, but the government approval was given only 5 years ago, at which time the company formally came into existence.

Hitachi, like most manufacturers, has a range of software for their computers. This is especially true of the 8700 because the configuration can make a big difference in its power. Com-Stute feels quite honored that they were selected to assist in the development of their most advanced version of FORTRAN. The compiler is now undergoing quality assurance testing. When it is released, we believe it will be one of the most advanced compilers incorporating the latest state-of-the-art concepts.

JOSEPH C. BERSTON
*Com-Stute, Inc.
Yokohama, Japan*

Not inherently virtuous

I don't understand why you keep printing those top-of-the-head good advice articles about documentation, inevitably including a list of 4, 8, 12, 16, or 20 vague but essential items of documentation. Dozens such articles appear every year, and each makes clear at the start, by noting the deplorable state of the art, that none of its predecessors has worked very well.

Articles these days should emphasize how to develop good documentation standards rather than propose all-pur-

For you Frank Marchuk watchers who have been writing us, here is a letter published in reply to a recent article in Data Exchange, magazine of the Diebold Research Program—Europe.

I have read with interest the press release on the development of the Atomic Computer in Data Exchange 1972. Based on the data in this press release, I have performed some very simple calculations with startling results.

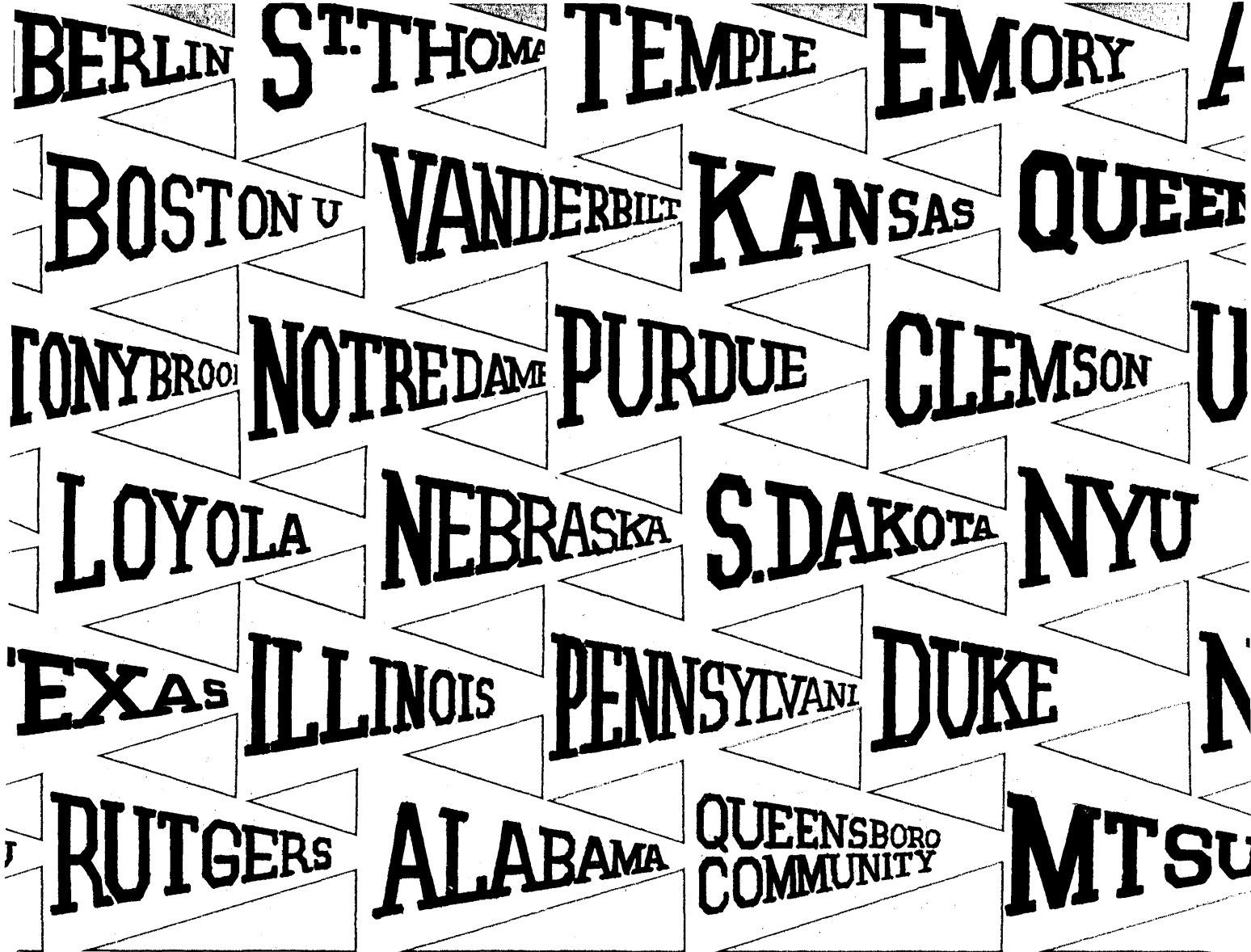
Consider the weight of the lightest atom, hydrogen, which is about 5×10^{-25} grams. Assume now that one bit of storage in the Atomic Computer is associated with just one hydrogen atom. The weight of a 10^{40} bit memory would then be $10^{40} \times 5 \times 10^{-25} = 5 \times 10^{15}$ grams = 5×10^9 metric tons. This is, for example, the weight of 5 km^3 of water, which

may explain why the vastness of Nevada is needed for the construction of the computer.

The press release also states that the memory will be capable of accessing 1000 bits of data from the 10^{40} bit atom-lattice planes every 3.0 nanoseconds. Even at this impressive speed it will take about 3×10^{28} seconds, or 10^{21} years, to load (or access) the full memory. This time is much longer than the age of the universe.

DR. MENACHEM DISHON
*Head, MAMRAM Computer
Center
Tel-Aviv, Israel*

(Continued on page 157)

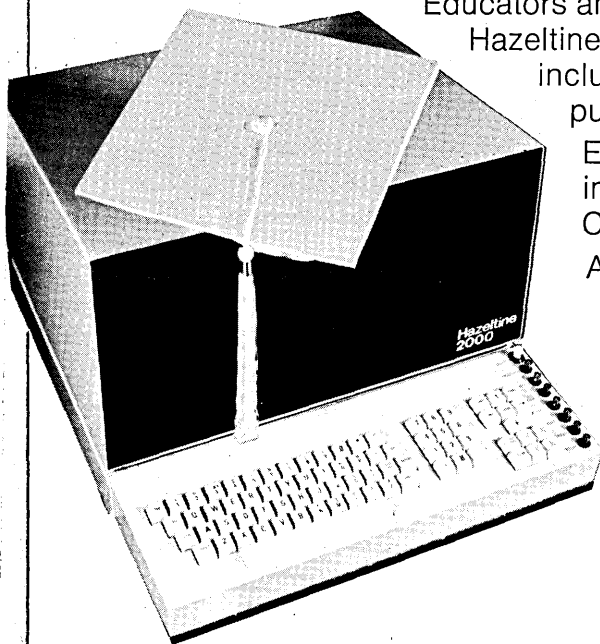


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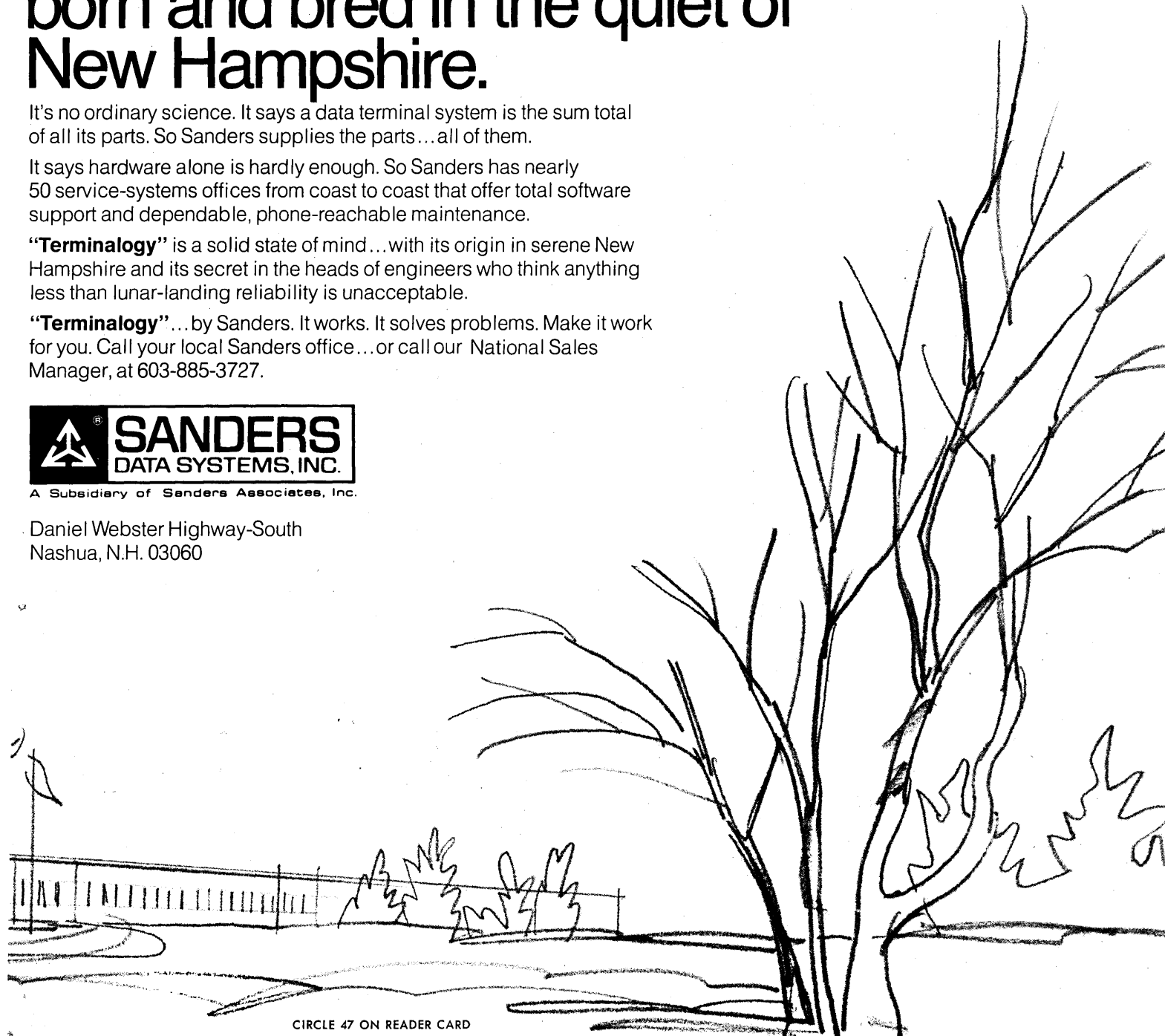
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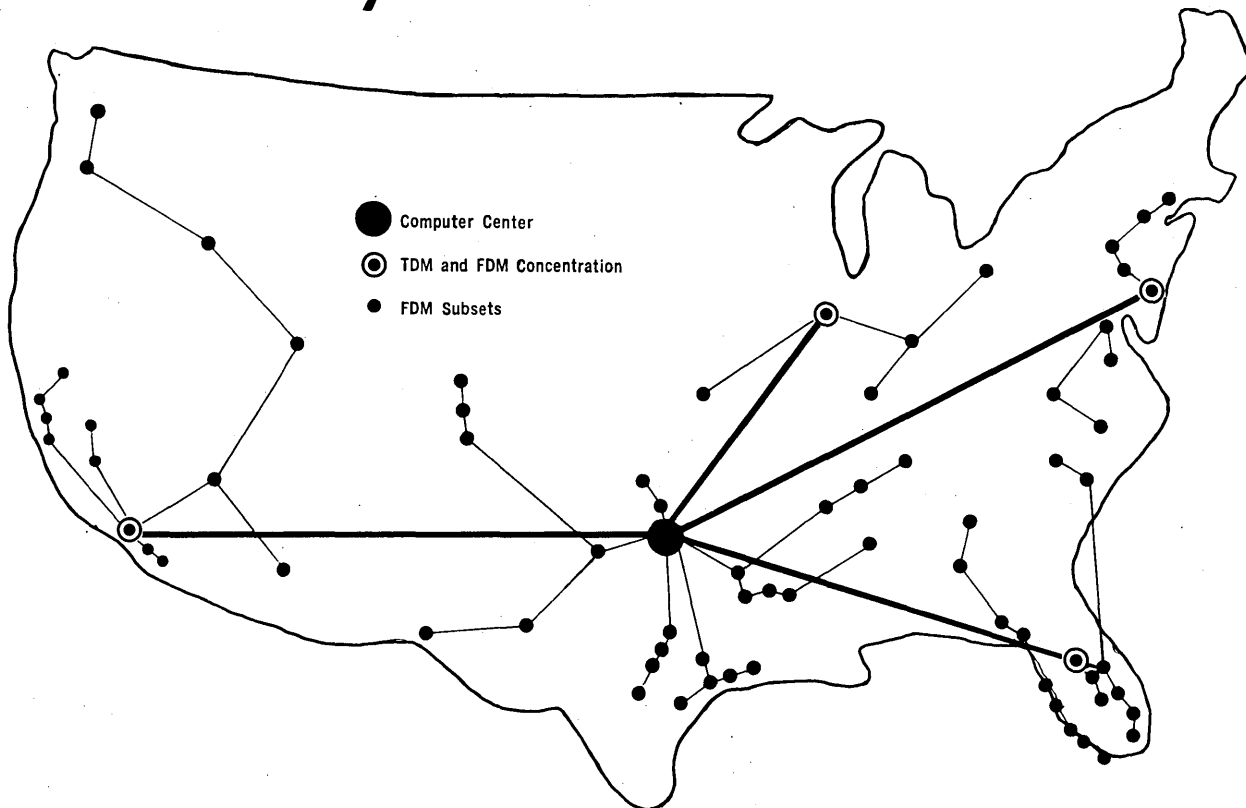
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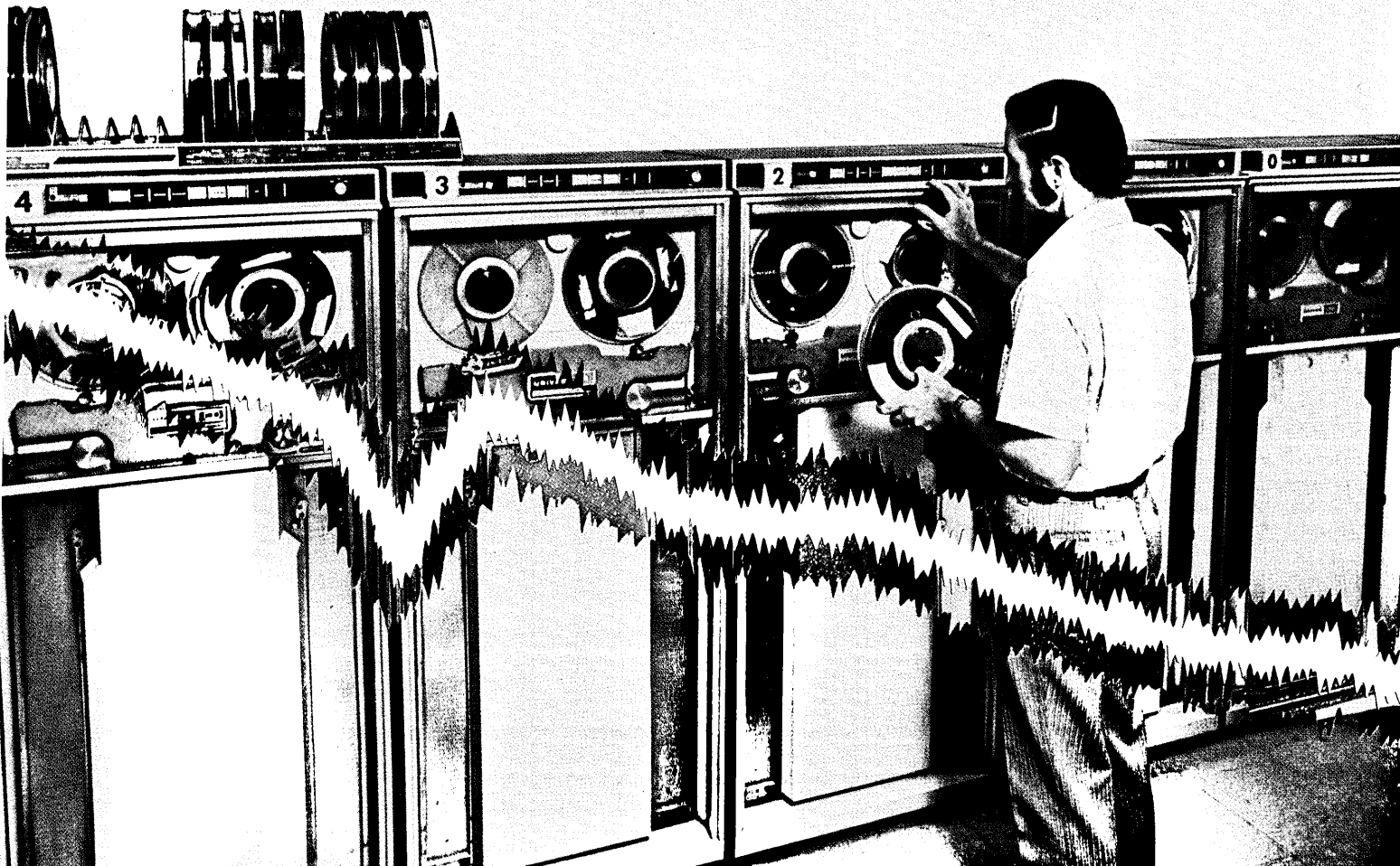


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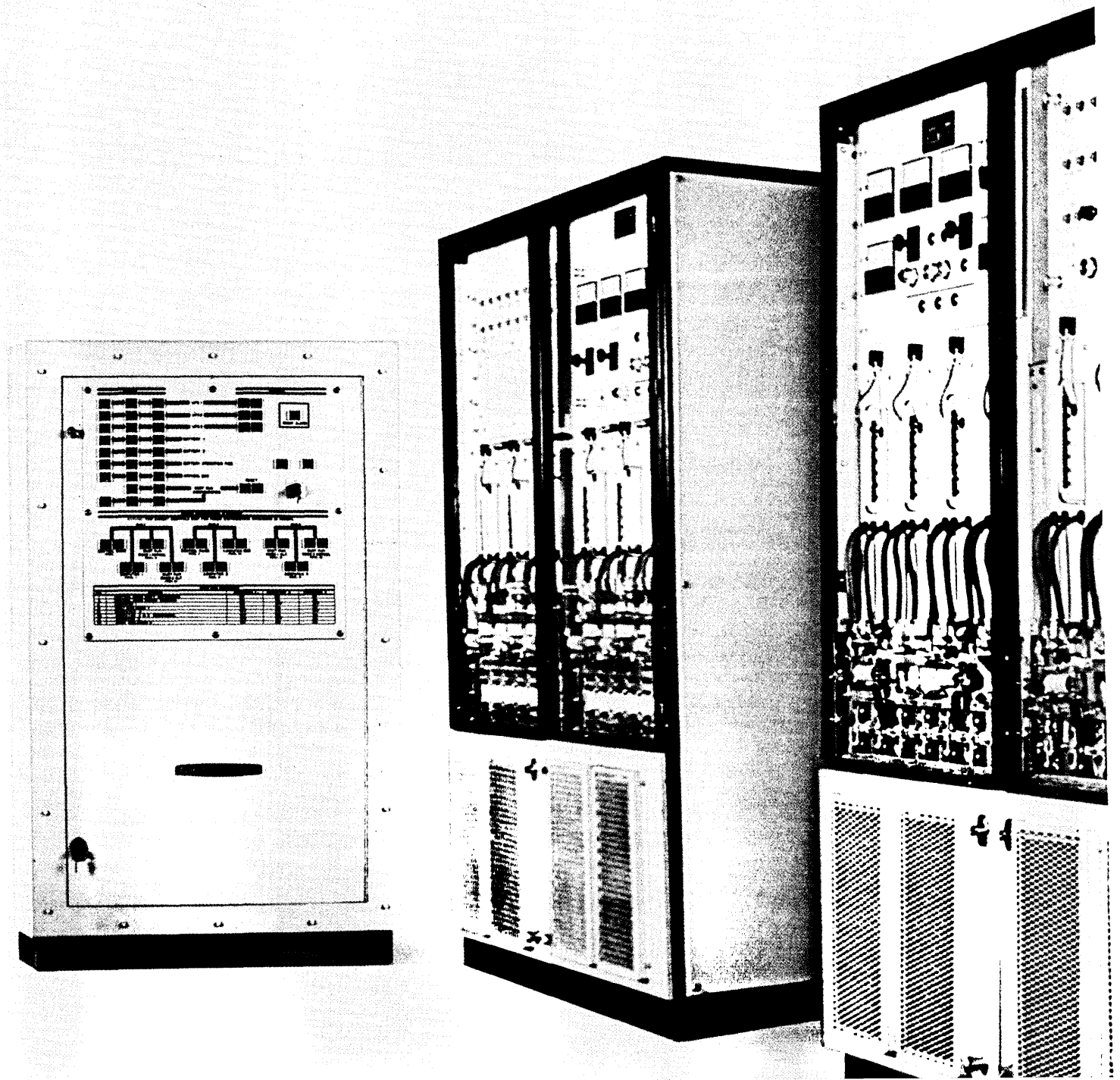
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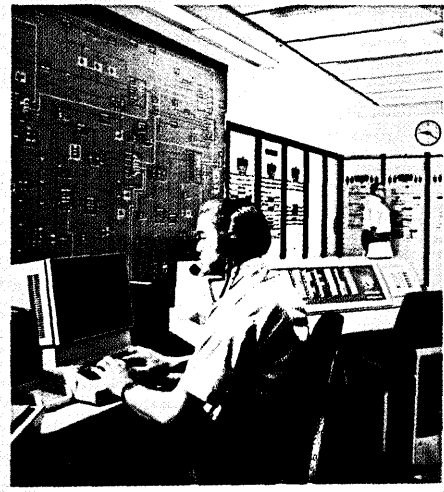
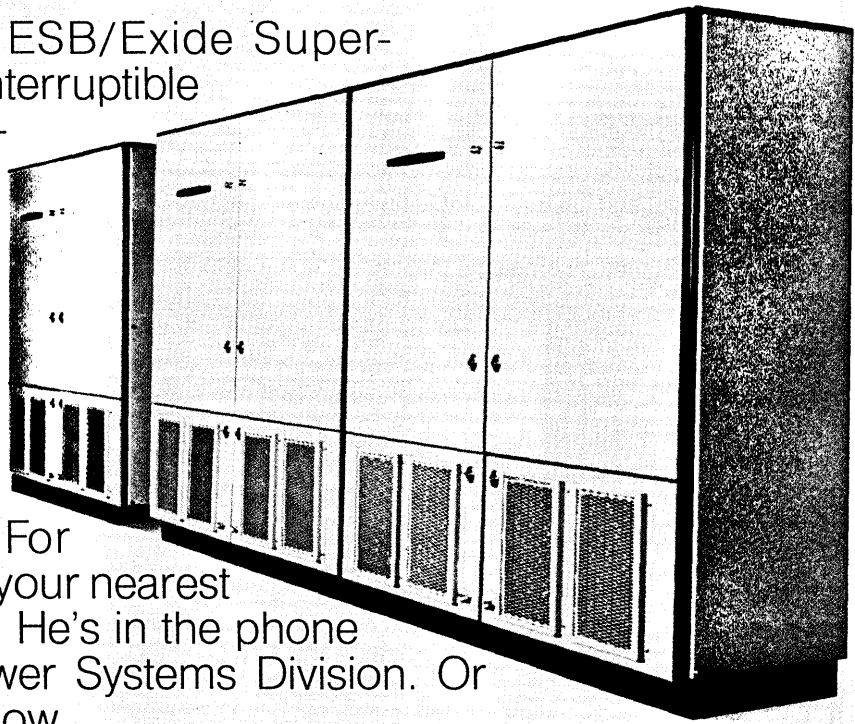


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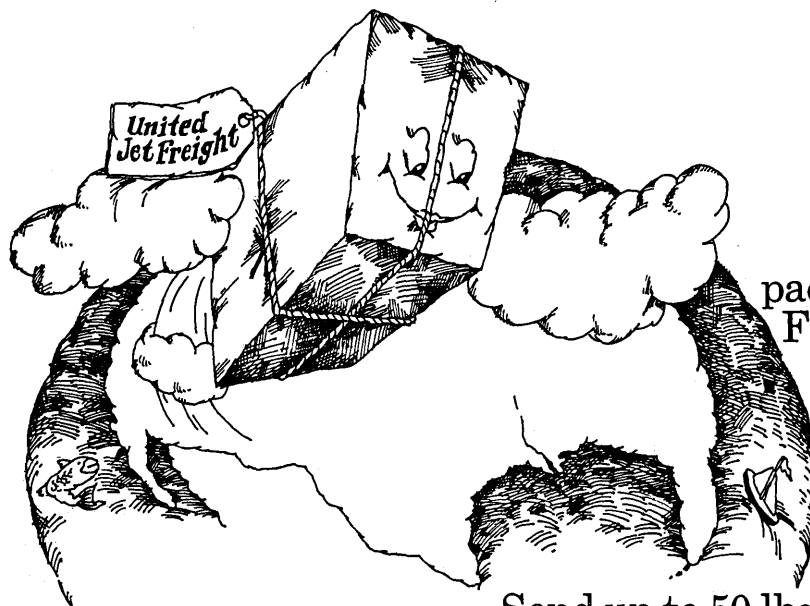
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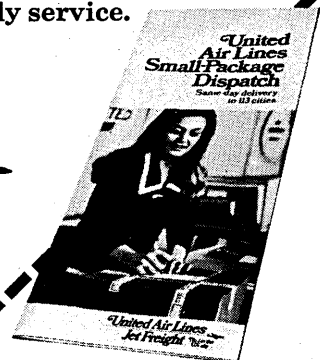
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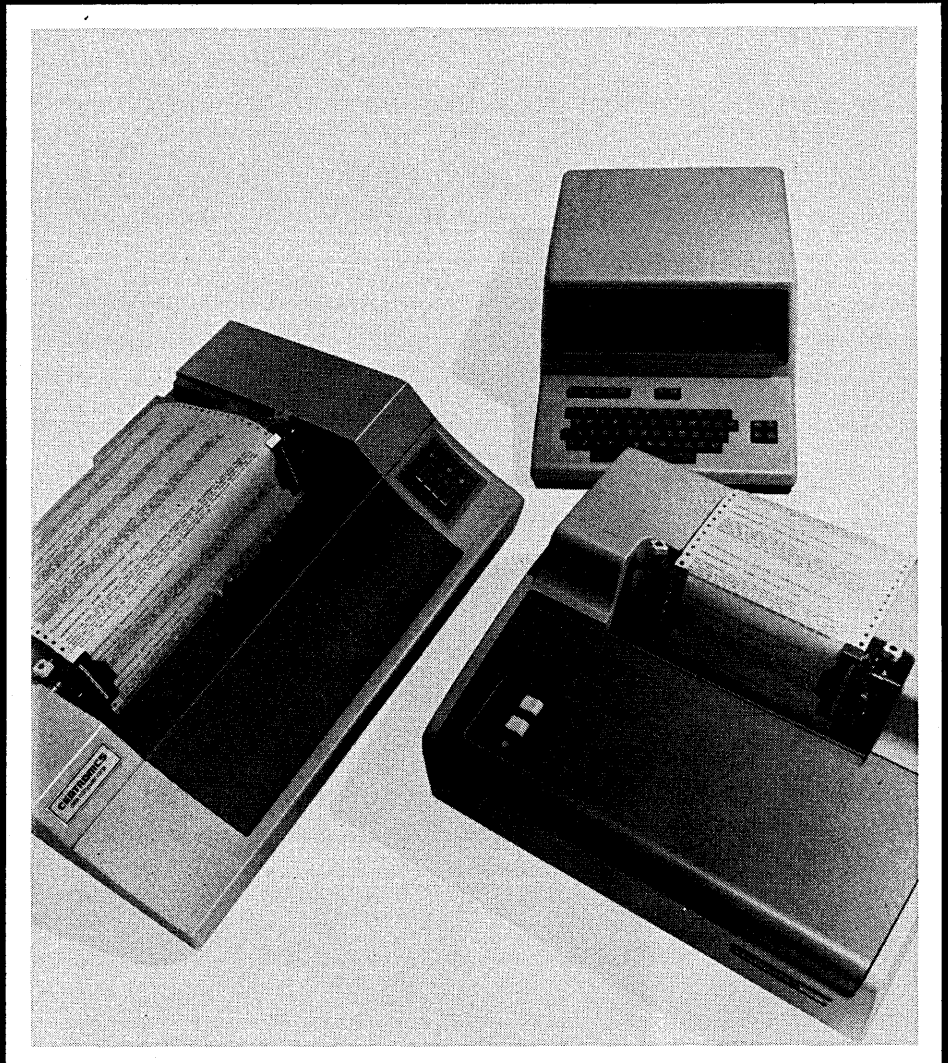
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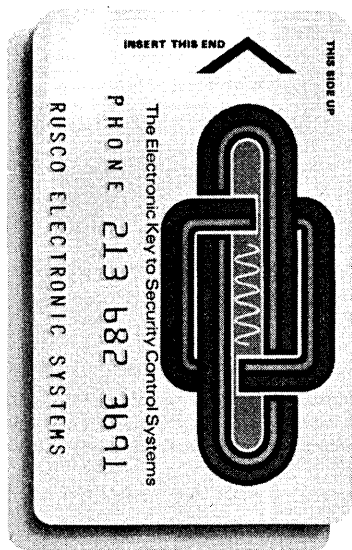
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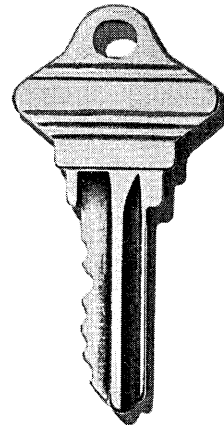


This is a key.



This is a key.

(With a picture!)



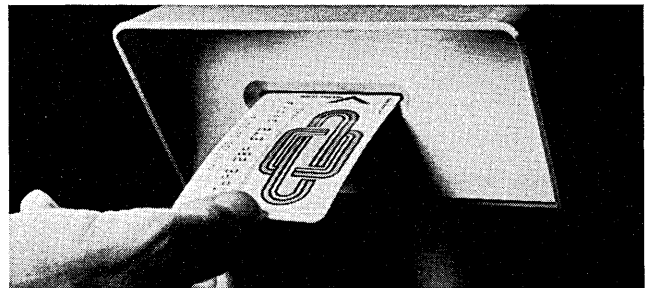
This is a trap!

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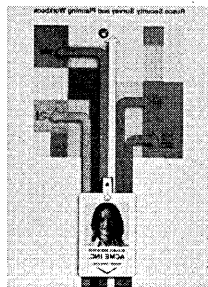
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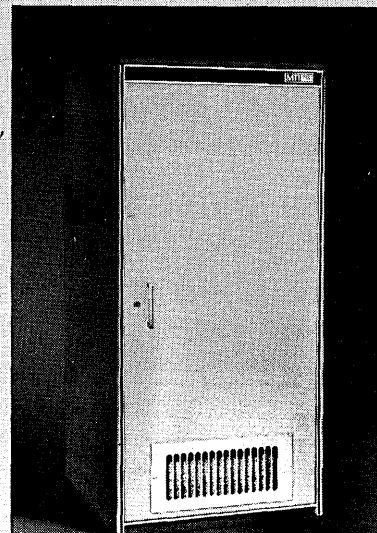
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If you're thinking about replacing or adding to your present 155 memory or evaluating a 158, why not find out how we can help you save money, space, and get new flexibility within your present configuration. Call James Crough, (617) 443-9911, Memory Technology, Inc., 83 Boston Post Road, Sudbury, Massachusetts 01776.



CIRCLE 32 ON READER CARD

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But do you know that DECsystem-10 is the time-sharing computer that first used them all together?

Write for the 90-page DECsystem-10 Technical Summary. DECsystem-10 Group, Digital Equipment Corporation, Maynard, Mass. 01754. (617) 897-5111. European headquarters: 81, route de l'Aire, 1211 Geneva 26. Tel.: 42 79 50.

digital

Based on the authors' experience with virtual storage systems from IBM and other manufacturers, a planning method to avoid the problems and reap the rewards

How to Get Real Benefits From

IBM's virtual storage announcement has confronted already heavily burdened dp managers with a new dimension of very real technical and management complexities. Without careful planning, these complexities and other hidden subtleties can quickly compound to subvert the basic desirability of virtual storage.

The purpose of this article is to bring to the surface some of the not-so-obvious aspects of virtual storage operations. The material is drawn both from several recent assignments where Booz, Allen & Hamilton has assisted larger and medium scale IBM users to plan for virtual operations, and from the firm's prior experiences with virtual systems from other manufacturers. The article begins with a brief review

of the more basic considerations spawned by IBM's recent hardware and software announcements. It then describes the range of possible user benefits, and concludes with an outline of the steps each user should follow to evaluate and to achieve these benefits.

Hardware

IBM's recent announcements focus on hardware designed to support virtual storage processing.

This hardware is described briefly as follows:

The newly announced and smallest S/370, the Model 125, offers virtual storage operation to the *smaller* user. The design principle is to integrate satellite subprocessors into a central processor. Monthly rental for a typical

Model 125 system is comparable to IBM rental prices for a small 360/30 and to third-party leasing company prices for a large 360/30.

Models 135 and 145 provide virtual storage operation to *medium-scale* users. Current users accepting the "free" field upgrade offered by IBM should anticipate no major disruptions to existing operations. New users will find 135 and 145 rentals comparable to smaller 360/40 and 360/50 rentals, although discounting by leasing companies may still make the older systems attractive in some specific cases.

Two new larger machines, the 158 and 168, offer virtual operation to *larger* users. Each system is supplied with faster, lower cost semiconductor main storage and specially designed

CATEGORY	DOS/VS	OS/VS1	OS/VS2
1. Expandability	<ul style="list-style-type: none"> Partition increase—three to five 	<ul style="list-style-type: none"> Up to 15 user partitions 	<ul style="list-style-type: none"> Up to 63 jobs
2. Real Storage Size	<ul style="list-style-type: none"> 2K page 	<ul style="list-style-type: none"> 2K page 	<ul style="list-style-type: none"> 4K page
3. Virtual Storage	<ul style="list-style-type: none"> Minimum 64K partition Partition size and number established at sysgen time 	<ul style="list-style-type: none"> Minimum 64K partition Single partitioned like MFT is organized in real storage Maximum number of partitions established at sysgen time 	<ul style="list-style-type: none"> One size—16 Megabytes Regionalized in 64K segments Each job assigned local system queue segment for job independence
4. Operational Control	<ul style="list-style-type: none"> Change execution priorities for standard partitions 	<ul style="list-style-type: none"> Vary virtual storage size at IPL time Redefine partition number and class 	<ul style="list-style-type: none"> Control number of active initiators in system which controls total number of active regions
5. Job Scheduling and Spooling	<ul style="list-style-type: none"> Spooling included in POWER facility 	<ul style="list-style-type: none"> Job Entry System (JES) with HASP-like features gives better I/O performance Better job scheduling technique 	<ul style="list-style-type: none"> Dynamic dispatcher load balances CPU and I/O bound jobs
6. VSAM Support	<ul style="list-style-type: none"> Yes 	<ul style="list-style-type: none"> Yes 	<ul style="list-style-type: none"> Yes
7. Thrashing Monitor	<ul style="list-style-type: none"> Yes 	<ul style="list-style-type: none"> Yes 	<ul style="list-style-type: none"> Yes
8. Other	<ul style="list-style-type: none"> Cataloged procedure capability Relocating loader 		

Fig. 1. Virtual storage operating systems—comparative feature summary

Virtual Storage

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

hardware (Dynamic Address Translation) to resolve virtual addresses for execution in real storage.

Large users currently renting the not-so-old 155 or 165 will find shifting to these newer faster machines (from 10% to 30% faster) attractive because IBM rental cost curves for cpu and memory are less than 15% apart at one megabyte (1M) and converge at about 2M. Third-party leasing company alternatives can make this switch even more attractive. But users should carefully plan the equipment changeover

to avoid costly disruptions to ongoing operations.

Users who purchased the 155 or 165 and have at least 1M of memory face a costly field upgrade to obtain DAT capability and keep pace with IBM operating system releases. Users should weigh these one-time costs, \$200,000 and \$400,000 respectively, against alternatively expanding their configurations with additional core and peripherals. The enhanced cpu's, called the 155-II and 165-II, will still have the older core memory, which in some cases may not

provide the proper resource balance for efficient virtual storage operation. Also, users should assess the impact of downtime (about one week) required to conduct this retrofit—especially if heavy production schedules must be met.

In mid 1973, the first 158s and 168s should be delivered. At that time, new users planning to move up to a larger machine and not requiring the full power offered by these new machines should first explore the lease market for used 155s and 165s. Users may find attractive savings opportunities through a flexible 155/165 third-party lease.

A cheaper disc controller, called the 3830-II, makes it easier financially for users to switch from 2314s to 3330s, a *must* move if users want minimum acceptable performance from virtual storage operation. Users must consider installing 3330-like devices if they anticipate paging requests to exceed a moderate demand level of 15 pages per second and do not want to suffer a substantial decrease in overall throughput.

Even with these more powerful cpu's and cheaper disc hardware, users should address several important questions that may impact their configurations and result in incremental hardware expansion:

1. Does the new hardware offer sufficient cost/performance advantages to offset the lower and lower prices charged by third-party lessors and computer brokers for comparable 360 equipment?

2. If I do go to 370 virtual operation (and especially knowing what has happened to users who purchased a 155 or 165 at the outset) should I rent or

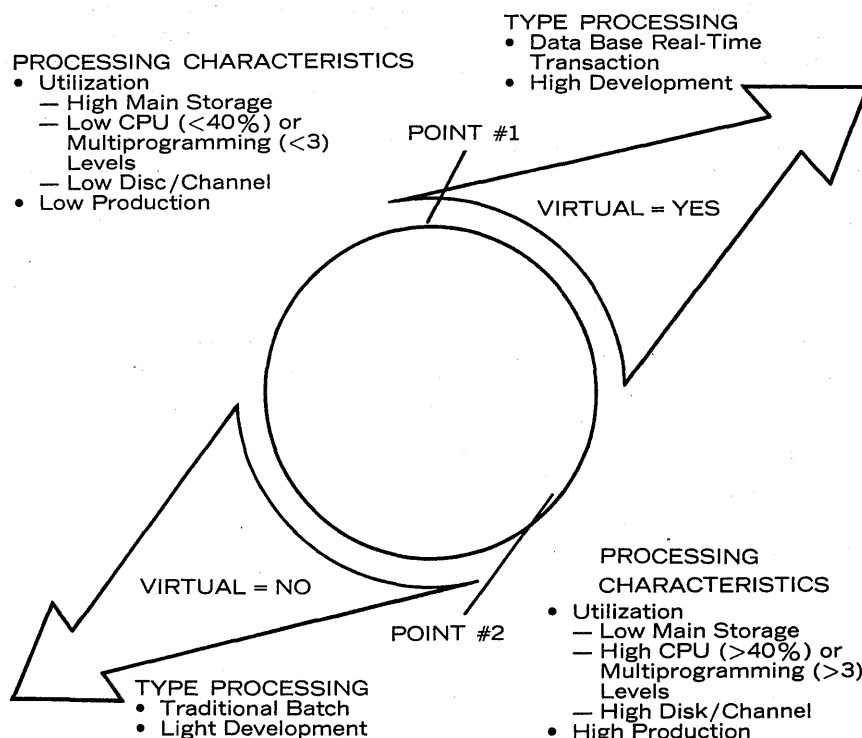


Fig. 2. Virtual storage operation benefit spectrum

Real Benefits

purchase from IBM, or seek a third-party lease and for what term?

3. What balance between *real* and *virtual* storage should I have at my installation?

4. How feasible is virtual storage operation on a small machine like the 125?

5. Will programs running today become less efficient under virtual operation?

6. Do I forever "lock" myself into a single mainframe vendor by going "virtual"?

7. Are 3330s coupled with block multiplexer channels going to provide enough speed to handle expected paging demands, or will I need a 2305 high speed drum or similar equipment?

8. Can I properly distribute virtual storage over available hardware resources at my installation and still avoid paging request bottlenecks?

9. Can data packs be interspersed with virtual storage and yet not degrade total channel throughput?

Software

Three¹ new operating systems, coupled with the new hardware, manage system resources for virtual storage operation.

These new operating systems and their older counterparts are DOS/vs (DOS) os/vs1 (MFT) and os/vs2 (MVT).

Fig. 1 (p. 48) summarizes comparatively significant enhancements for each system. Some important points included in this exhibit common to all systems are discussed as follows:

IBM has continued to provide operating system support for *all* user market segments, but noticeably more major improvements were included in the smaller systems. Rather than drop any future DOS support, IBM has provided DOS/vs with features previously available only from independents' packages such as EDOS, GRASP, ASAP and SPRINT.

Smaller systems, DOS/vs and os/vs1, manage real storage in 2K blocks compared with 4K in os/vs2. These design decisions produce tradeoffs:

1. Smaller pages produce better real storage utilization. More pages can be in real storage at any one time and fewer incomplete pages result.

2. Larger pages enhance total I/O operations. Bigger blocks mean less paging and better channel throughput.

A "thrashing" monitor function is offered in all vs systems, according to IBM. Thrashing results when a program makes excessive page requests to vir-

tual storage to obtain new or previously referenced pages. This internal "churning" severely degrades system performance.

To minimize thrashing, IBM has provided a function in its I/O paging supervisor to monitor program paging demands. If this rate becomes excessively large, the supervisor discontinues task executions on a selective basis. When system paging demands decrease, previously discontinued tasks are recalled for execution.

VSAM is supported under *all* vs systems. This new access method overcomes certain key deficiencies—chaining of overflow records, frequent reorganization, etc.—most users found unacceptable in ISAM, the older indexed sequential access method. Users can easily convert existing ISAM files to VSAM and realize immediate performance improvement. Also, with VSAM users can now transfer data sets across

all vs operating systems.

A recent client experience with RCA's virtual operating system has underscored the critical need to have a thrashing monitor function control total system performance. The CPU utilization at this site was observed to be unusually high (over 90%) although little actual work was being done. Close examination of the virtual storage channel activity revealed that most CPU time was spent trying to satisfy paging demands. Manual job rescheduling measures were applied to correct this unacceptable situation. (Basically, the ratio of demand to supply, virtual to real, was limited to less than 1.5 to 1).

With these enhanced software systems, DP managers should consider these important questions and how they apply at their installation:

1. Why and—if so—when and how should I convert and what's the cost?

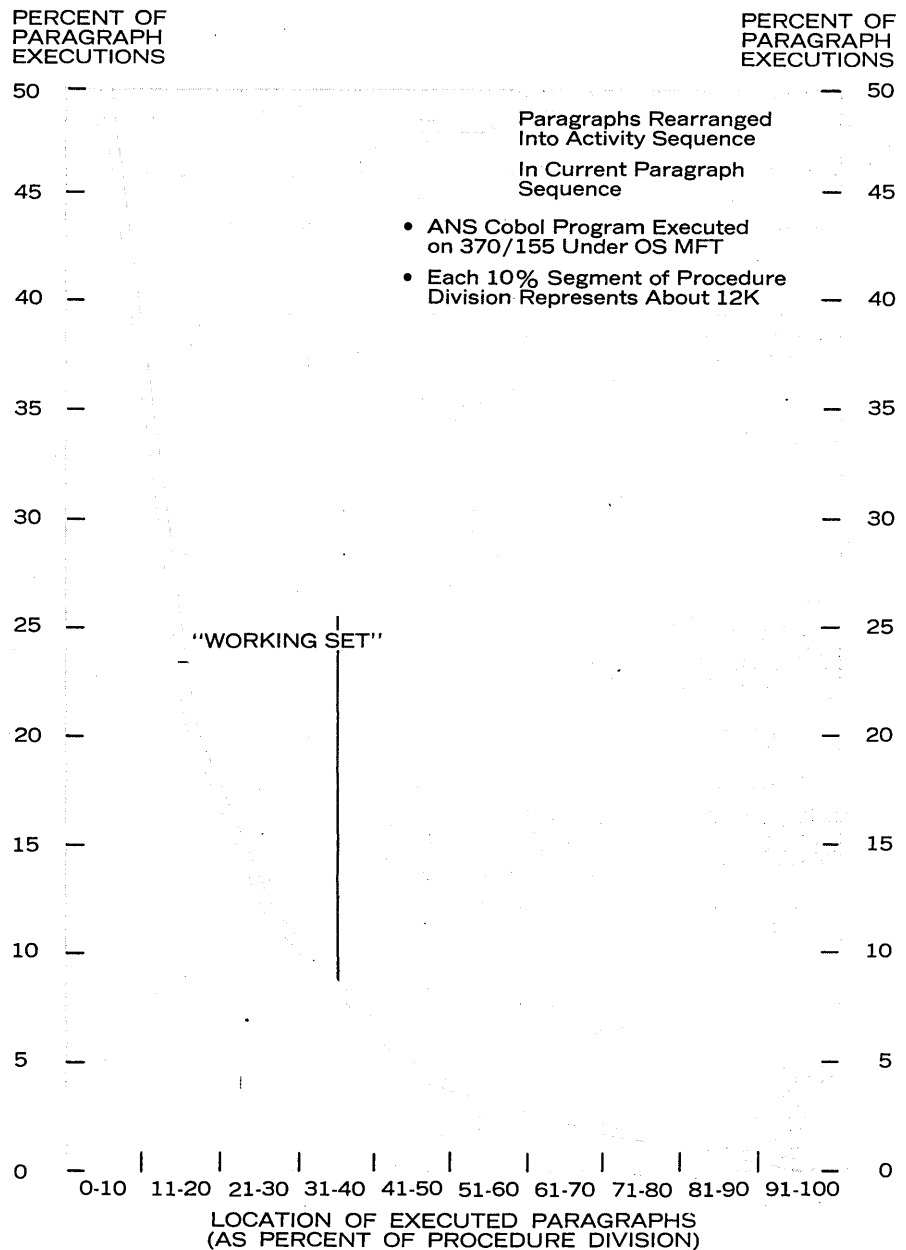


Fig. 3. ANS COBOL program execution analysis

¹ VM/370 has been excluded from this discussion because of the relatively few users currently in a position to work with it.

2. What *real* software benefits should I expect at my installation?
3. For existing dos users, how does dos/vs influence a dos to os conversion decision? How does virtual operation affect dos emulation?
4. What submerged conversion costs or hidden disruptions lie ahead, acknowledging that a move to virtual operation is not easily reversed if not impossible?
5. How many "brand new" functions are included in the new system?
6. Is it likely that all program products will be supported in the future only under virtual operating systems?
7. Will vsam be used in products such as IMS-II that are dependent heavily on ISAM and, if so, when?
8. To what degree will I have to upgrade my systems staff?
9. Will I become technically obsolete and stop attracting good talent if I don't go "virtual"?

Varied benefits

Most users can benefit overall from virtual operations though the nature and extent of specific benefits will vary widely.

Nowadays, more and more dp installations are running communications-based systems in combination with

regular batch-oriented jobs. Also, almost all have a mix of production and development work. The intersection of these dynamic support requirements produces workloads that result in different cpu and main storage utilization levels. Virtual storage operation will have differing impact then, depending on the "tilt" of these variables at user installations.

Fig. 2 (p. 49) illustrates the extent and degree of benefits different user types should realize from a move to virtual storage operations. This exhibit portrays activity levels—user data base real-time versus traditional batch activity levels at either extreme—mapped over varying main storage and cpu utilizations. Users can judge quickly where they stand by pinpointing the spot in this exhibit that corresponds to the relative mix at their installation.

For example, specific user benefits are described by picking two contrasting points in the activity spectrum depicted in Fig. 2.

Users at Point #1 have heavy data base real-time processing causing high main storage utilization. They are likely to benefit most by:

1. *Reducing dedicated main storage* for message processing programs. Large segments of most routines

should be paged-out when idle. Total overall reduction will depend, however, on the type TP support system being used. For example, IMS-II TP users should assign the TP control program and I/O buffers to real storage (V=R, nonpageable storage) to avoid substantial degradation in throughput response. Moderate space saving results considering that, currently, between 300-400K is required to configure a medium sized IMS-II TP support system. Conversely, CICS users should gain larger reductions as most code appears pageable without greatly impacting performance.

2. *Increasing test time* during regular staff working hours. But the amount will vary with each user. Virtual may help users go to TSO which, in turn, can spur programming productivity further.

3. *Extending TP "up" time.* Minimal real storage should be needed to keep TP functions "alive" longer assuming enough remaining storage is available to run concurrent batch operations efficiently.

4. *Expanding communications support* if excess hardware capacity exists.

5. *Reducing costs* for a backup machine. A smaller, less costly machine can be used as backup if the main

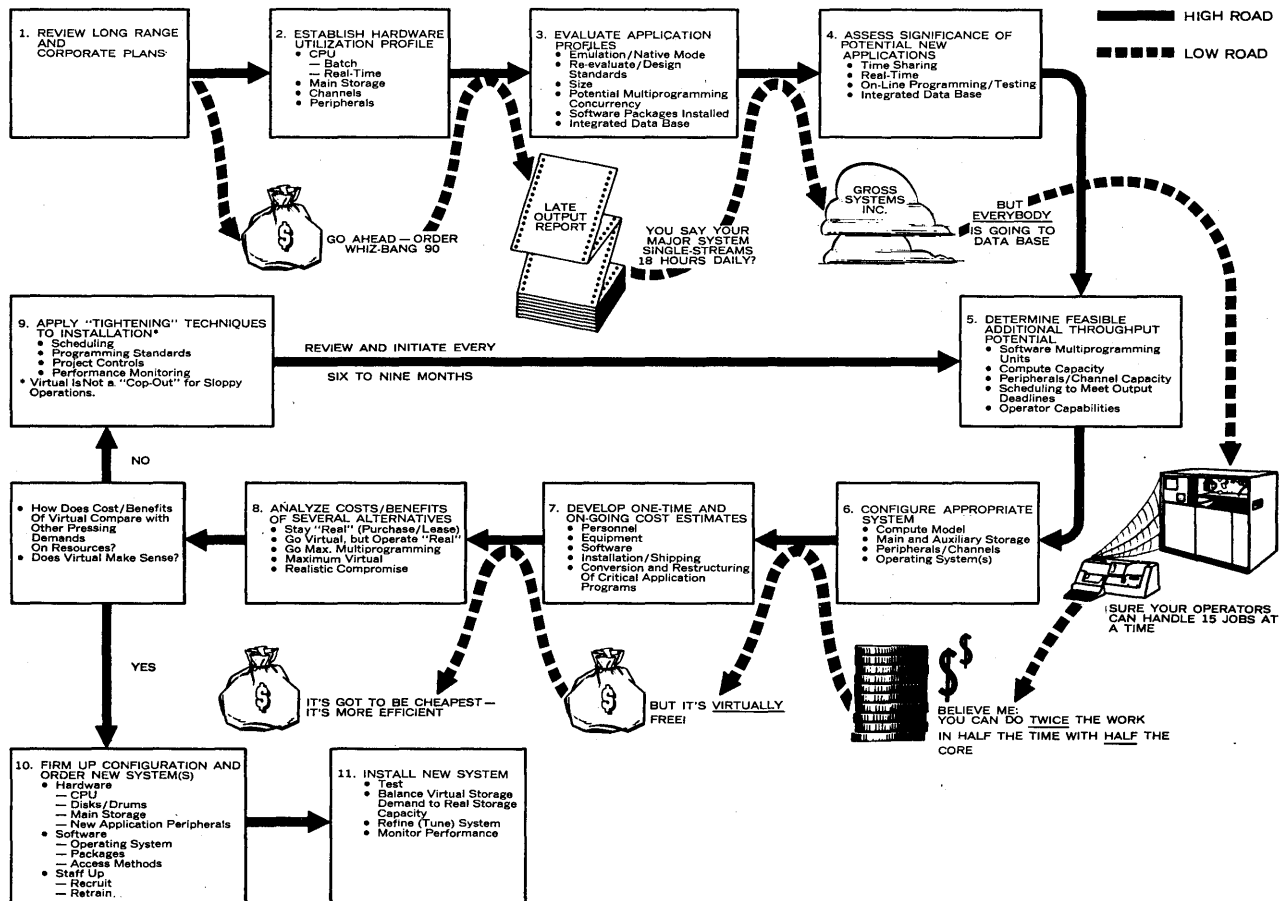


Fig. 4. Avoiding virtual pitfalls

Real Benefits

system fails. Savings should be sizable, especially if the main cpu is a Model 158, 1M system or greater. Also, the increased reliability of MOS memories claimed by IBM may make it less critical to have a backup machine. (More and more of our clients appear to be ready to take this gamble.)

Users at Point #2 have heavy time-dependent batch operations causing high cpu utilization. These users typically have optimized operations and may be experiencing difficulty implementing ongoing changes. Virtual storage operations may not be the answer—an increment in main storage, however, might be. Nevertheless, users might realize marginal benefits from virtual storage by:

1. *Eliminating costly overlay structure* execution to increase throughput. Programs can be restructured and demand paging would cause a more selective overlay resulting in decreased execution time.

2. *Reducing time* required to make changes. Depending on system complexity and maintenance staff experience level, ongoing changes may be difficult to implement and still stick within system size and performance criteria. Changes could be made more easily under virtual storage operation and result in less impact on system and staff.

As an added benefit to development-oriented installations, users can now consider implementing, under virtual storage operation, software systems previously judged to require excessive main storage resources. Several systems that can help dp managers solve problems or expand support services are:

1. TSO, the time-sharing option. A 250-280K main storage requirement under MVT has made TSO less attractive to date. But now, under virtual storage operation, TSO can support interactive packages to help speed program development and, equally as important, program maintenance. Booz, Allen & Hamilton's recent experience with setting up a TSO environment points up that users can cut development and maintenance timetables substantially.

2. IMS-II, TCAM/TCS, CICS and GIS/2 products from IBM and TOTAL, Mark IV, INTERCOMM, SCORE and System 2000 to name a few from independent vendors. These packages can help dp managers increase overall support services.

Most benefits

Users who have implemented project controls and strictly enforced a standards program focused on modular

programming stand to benefit most from virtual storage execution.

Most dp managers have established and tailored standards to fit the needs of their installations. Some have emphasized modular programming design concepts. On-line users usually stress multiple subprogram structures that, when executed, result in minimum main storage occupation. Other more batch-oriented users generally specify that high-level decision logic be included in a mainline module and that remaining details be executed in sub-routine-like fashion. In either case users that have modularly structured programs hold the key to successful execution under virtual storage operation.

To illustrate this point dramatically, the graph in Fig. 3 (p. 50) shows the pattern of execution for a typical ANS COBOL edit program in production at a client site before and after restructuring. The dashed line in this exhibit identifies (1) a linear execution pattern, and (2) modules recently added, and therefore frequently executed, at the tail end of the program (extreme right on graph). The solid line represents execution in activity sequence necessary to obtain a small "working set," a term IBM coined to identify code frequently executed so that once it's paged into real storage it tends to remain there. Because this client stresses modular programming concepts, it was a quick and easy task to rearrange COBOL code so that the program could execute in activity sequences. The restructured program should reduce paging by about 25-40%, depending on the ratio of real to virtual storage, because its working set, 35% of total, contains 80% of all paragraph executions.

Unfortunately, although most users have implemented complete standards programs, few strictly enforce them. If users decide to go virtual and conclude that the dashed line in Fig. 3 represents typical program execution at their installation, they should plan to balance virtual to real storage in a ratio not to exceed 1.3 to 1.5.

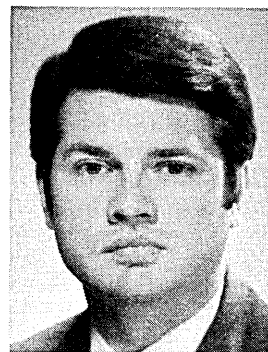
Traditional project controls, the key to any successful project implementation, are just as important under virtual storage operation. Each segment of development or maintenance work must be divided so that it is both manageable and controllable. Most users will acknowledge that COBOL programming tasks taking between 150 and 200K are hardly ever implemented successfully, bug-free and on time. Now, with unlimited virtual storage, dp managers should visualize a maintenance programmer poring over a 500K listing late at night trying to fix a critical problem. Categorically, large unstructured programs are difficult to install successfully and, furthermore,

are worse to maintain.

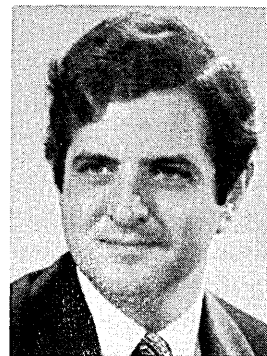
Users should look closely at their *real* standards programs and start *now* either to reemphasize their existing program or initiate one that capitalizes on virtual storage execution.

Users considering an upgrade to virtual storage operation should begin planning now.

Users should not blindly step up to virtual operation. Considering the complexities, subtleties, costs and as yet unrealized benefits, dp managers should not accept "good faith" claims about virtual operations. Each manager should develop and execute a comprehensive planning and analysis program to weigh virtual upgrade alternatives. An example of a step-by-step program designed to avoid pitfalls is outlined in Fig. 4 (p. 51). Only by executing these steps thoroughly will dp managers gain "real" benefits from a move to "virtual" storage operations. □



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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.

IBM was 15 years behind
with the concept but only two years
behind with the name for it

Today IBM Announces Yesterday

by E. J. Gaudion

The recent announcement by IBM of the virtual memory enhancement is certainly interesting and will undoubtedly now lead to wide acceptance of the concept that programs can be written in an unlimited address space and then automatically fragmented, with the resultant pieces being juggled in and out of real memory as the occasion demands. The cognoscenti might prefer to consider that programs were operating in an independent address space which was mapped by hardware or software, or both, into a real memory address space.

It should, however, be borne in mind that very little in this world is for free. To move the pieces in and out of the main store requires that the input/output channel be severely exercised and the other programs that are currently in execution suffer a "hidden" degradation in that the memory has to take time off from the main line operation to digest this rapid exchange of program pieces. The unsophisticated user will be blissfully unaware that this is happening and the more knowledgeable user will probably never receive any satisfaction when he probes this topic.

I imagine that the IBM marketing

plan is based on the strategy that the net result of all this overhead, plus the extra core store occupancy of the virtual memory operating system, will be a very healthy increase in *real* memory sales payable in *real* currency.

How anyone can view this announcement as being the most important since the announcement of System /360 is difficult to understand, unless, of course, you happen to be an IBM shareholder. Perhaps a short historical review will help to clarify how one could possibly hold the opinion that IBM has *not* come out with a historical first, but rather a very delayed historic last.

Some 15 years ago, Ferranti's Atlas machine in England was already running multithread job streams using an automatic fixed size paging structure and achieving operational flexibility without the "benefits" of a complex job control language.

Also 15 years ago, the Gamma 60 in France was already automatically scheduling fully parallel jobs between a number of peripheral processors. Just how well it was behaving was finally realized by the French Railways when they tried, and ultimately succeeded in, transferring the Gamma's workload

onto a Univac 1107 in 1965.

By 1960, the EMIDEC 2400 in England was running up to 24 independent parallel processes. This was a fully asynchronous machine designed by N. Brown and his team who are now part of the ICL group in Britain.

By 1962, Burroughs in the U.S. had successfully installed their 5000 series based on a fixed head disc system and a variable length segment swap. It is an unfortunate fact of life that these in-calcitrant newts called programmers do not yet know how to take any job and write it so that it is of a fixed size, or such that its natural subsets are of a fixed size. Their excuse is that jobs do not come in fixed sizes and there may be some merit in the argument. Anyway, by pure chance or maybe design, Burroughs solved the problem and allowed the job segment to be the size it turned out to be.¹ This is one of the few cases in computing history where the

¹ Information size is an independent variable which varies dynamically within instruction and data sets, between instruction and data sets, and also from application to application. Hence, we derive the law: Any fixed page size is automatically of the wrong value. This law demonstrates the particular problem with the general solution, as opposed to the late Stephen Potter's differential ploy of offering a particular solution to a general problem, one of the pillars of Gamesmanship.

Today IBM Announces Yesterday

long suffering users got something useful from a manufacturer.

Burroughs also slipped up and provided an easy-to-use system. Instead of having to specify to the operating system where the COBOL processor was resident and which scratch tapes were available, their operating system knew these facts and you just said RUN COBOL. Unfortunately no one knew how good this was until the historic announcement of System/360 and the trauma of its Job Control Language became self evident.

The Burroughs concept was designed by King, Glaser, Lonergan, Barton and others. Internally, the B5000 finally got away from the very quick electronic cash register approach, which results in many internal transfers to banks of registers and which is, of course, good for the hardware selling business. (The less efficient you are internally, the sooner the user needs to buy the next model in the series). The B5000 crew stumbled on the fact that it is more economical to change a simple pointer rather than move great rafts of data about, or perhaps they knew what they were doing. For whatever reason, the simple stack and pointer concept emerged, and the first viable and painless multiprogramming system was born. Later on, to accommodate multiprocessing and file sharing, the cactus stack was propagated and has been running successfully on the B6500 series.

By 1963 Univac under Lonergan's aegis had recognized the importance of swapping programs between main core and an external medium, and their operating systems have all featured rapid access drums from that time on. Unfortunately, they too did not coin a catch phrase such as virtual memory to describe this process. They just break their programs into pieces and shuttle them rapidly between drum and main store as required, although this requires user involvement in the initial breaking up process and operating system gyrations in the allocation process.

By 1965 CDC had automated the allocation process by fixed size paging and simplified the initial breaking up process into modules equal to the real core size. DEC also has a similar set-up.

For the sake of completeness, we should mention that a complete system using virtual memory (except in name) was in existence in 1967. This is the GE/Honeywell MULTICS system, fathered by the aforementioned Glaser amongst others.

In about the same timeframe, mother adapted the regular 360 line by the

addition of a swapping mechanism and gave birth to the 360/67. This was also a fixed page system but was not blessed with the name of virtual memory.

But mother cannot even claim the honor of being first with the word, just as the deed clearly eluded her. A horde of mother's children came together at RCA and they were first to commercialize the word in 1970. They took a speeded up Spectra (almost a duplicate of the 360), added a paging drum using fixed size pages and, wonder of wonders, virtual memory was born. Shortly afterwards RCA's computer operation went belly up but its products are being very professionally (and profitably) salvaged by Univac.

So much for Snow White's historic first. It still seems to me to be aimed at selling more core, drums, and discs. Caveat emptor should be the standing order for the user community until proved otherwise. Alternatively, the dwarves, with their established records with this type of operating system, would appear to be the logical choice for the user who wishes to sample the "all new virtual memory concept". He can even try it by renting a terminal, instead of a machine, and dialing up the nearest friendly time-sharing service, thus forgetting about a machine altogether.

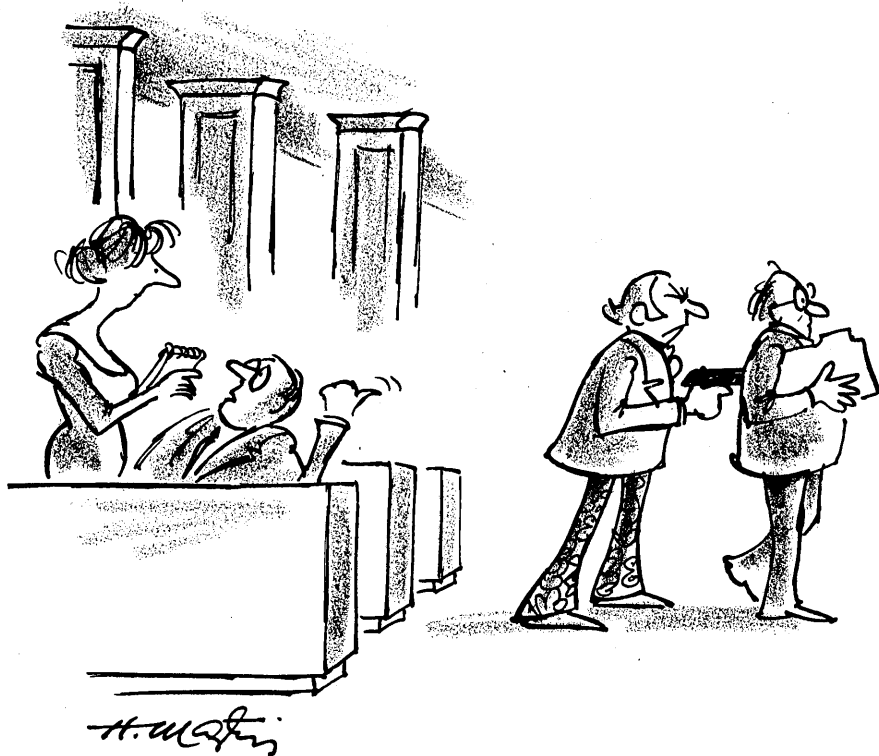
When I am invited to put IBM on the right road, my first order of business will be to get Burroughs to do the

design work, to have Univac or CDC make the mainframes, discs, and drums, but to do nothing, repeat nothing, to the boys in the grey flannel suits who will be telling you how wonderful it all is. In a more serious vein, it would be erroneous to even imply that there is anything but a vast number of dedicated and competent technical people throughout IBM.

It does seem, however, that the corporate ability to market a standard product somehow mitigates against their possibility of having technical excellence adequately represented in the executive superstructure. □



Mr. Gaudion is a graduate of Oxford University. His computer experience includes six years with EMI (now part of ICL) in Britain, four years with Univac in Switzerland, and four years with RCA in the U. S.



"What do you think, Miss Benham? Is that a hold-up or a forced retirement?"

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An IBM view of the advantages of virtual storage, with some practical advice on installation and programming considerations

Virtual Storage Operation

by Richard V. Bergstresser

For the data processing manager, virtual storage can be a valuable tool in increasing his operation's efficiency and effectiveness. It can ease the job of the computer operator and programmer and can make the data processing center's resources more available to the end user.

The key to successful implementation of virtual storage is the achievement of a balance with other elements—cpu power, main storage size, direct access devices and channels, and the user's own application programs.

In planning for the use of virtual storage, therefore, it is valuable to maintain an overall perspective on two main areas: the advantages that virtual storage can provide, and the practical considerations imposed by the computing system. It is the purpose of this article to provide such an overview.

To understand and appreciate the advantages of virtual storage, one need only understand these two characteristics: (1) a large address space is available to hold executing programs and data and (2) the system dynamically allocates real storage to jobs, as required.

Range of users

Announced for IBM System/370 Models 125 through 168, virtual storage brings to small and large user alike the ability to work with his computer as if it has a main storage capacity of up to 16,777,216 bytes—the maximum that can be referenced by System/370's 24-bit addressing scheme. The virtual storage system control programming includes new versions of IBM's disc operating system (DOS) and operating system (OS) that feature general compatibility to allow upward

growth from previous versions of the same operating systems.

Virtual storage capability is, in effect, the transparent linking of direct access storage to main storage. In virtual storage terminology, the direct access space is called *external page storage*, the main storage space is called *real storage*.

To operate with virtual storage, a System/370 must be equipped with a machine facility called dynamic address translation (DAT). The system control programming, interacting with this facility, transfers programs and data—in 2K or 4K pieces called pages—between real storage and external page storage. This operation, termed *demand paging*, takes place to meet the changing demands for real storage space by the applications being run. The division of programs and data into equal sized pages is done by the hardware and software.

A job is given a region or partition somewhere in the 16 megabyte virtual storage.

The job's programs reference all instructions and data by their virtual storage addresses, regardless of where they are physically located. These virtual storage references are intercepted by the DAT facility, as instructions are executed, and translated to real storage references. Translation is based on the contents of tables maintained by the system control programming. These tables also indicate whether a needed page is already in real storage. If this is the case, execution of the program continues. If the page does not exist in real storage, an interrupt occurs and paging takes place. During a paging operation, the system control programming will dispatch other pro-

grams.

If too much paging activity occurs, the system control programming will free additional real storage space by temporarily deactivating the lowest priority partition. This can help ensure that actual processing of programs is not impacted to an unacceptable level by abnormal paging rates.

Advantages

Virtual storage offers a wide range of operational advantages.

For example, in a multiprogramming environment it can allow use of more and larger partitions, despite the constraints of real storage size.

Programmers are essentially freed from coding overlay routines to meet partition size requirements. Also, they benefit from the availability of the computer for immediate program testing through use of a low priority partition which can be set up in virtual storage.

A "hot job" partition can also be used to accommodate high-priority but irregularly scheduled production jobs, helping the operations staff to meet end user demands more quickly and easily.

The example of the "hot job" partition points up one of the key features of virtual storage—improved main storage management. Partitions are set up in terms of virtual—not real—addresses. Since most programs do not reference all of their logic and data during any one short interval of time, only the active portions of a virtual storage partition need occupy real storage. Such a concept more fully utilizes real storage and helps to reduce the amount of "dead code" or wasted inter/intra partition or region space that can exist in conventional multi-

Virtual Storage Operation

programming.

This improvement in storage management can facilitate, for example, the simultaneous running of teleprocessing and batch operations: during periods of low terminal usage, much teleprocessing partition space can be paged out to make room for batch work. The fact that a high priority job can have more real storage allocated to it during its peak loads than would have been practicable in previous operating systems is extremely significant for teleprocessing and data base applications.

Installation considerations

More system resources are needed to handle the functions of virtual storage than are required by a conventional multiprogramming environment. It is in balancing these requirements with the additional functions and benefits offered by virtual storage that the user achieves a system best suited for his needs.

For example, resident control program space in real storage is increased by requirements for virtual storage management routines; additional cpu time is required for such functions as dynamic address translation, processing of paging interrupts and the translation of channel program virtual addresses; and i/o time is needed for paging operations.

Additional control program space requirements are not as significant in a large system where the space needed for the control program can be more easily recovered by means of better storage management. They become more significant as the total real storage size gets smaller.

The amount of real storage that is nonpageable, or *fixed*, in order to accommodate control functions, obviously detracts from the amount available for paging. Fixed real storage requirements fluctuate during processing because, in addition to long-term fixed requirements, varying space is short-term fixed to handle i/o activity. In addition, fixed real storage space is required for *virtual equals real* job steps: those steps that must be entirely in real storage because, for example, they modify channel programs.

The paging rate is directly affected by the ratio of utilized virtual storage to the amount of pageable real storage, and the percentage of active data and program information within this utilized space.

As this ratio increases, so does the paging rate which, if plotted, would produce a gradually rising curve fol-

lowed by a sharp upward sweep. The shallow part of the curve would represent passive paging, in which a large amount of work is accomplished per paging operation. The sharp upward sweep would represent active paging, in which a highly increasing amount of paging is required in order to accomplish any processing. Within this area, the programs are tending to fall below their optimum working sets—the minimum amounts of real storage space they need to perform efficiently.

A typical virtual storage environment would fluctuate between passive and active paging. The user may determine active paging can be tolerated on an exception basis, or even more frequently in order to achieve a function that

does not justify a more powerful system.

Constant active paging, however, will tend to cause deactivation of low-priority jobs by the system control programming. (In the case of programs having the same assigned priority, the first program entered would have the highest priority on a first-in, first-out basis.) A high incidence of job deactivation may point to the need for system configuration changes, including more real storage capacity or higher speed direct access devices for paging.

A history of paging activity can be maintained by recording the paging statistics provided by the virtual storage operating systems. OS/vs1 and OS/vs2 provide job and system-wide

System Control Programming for Virtual Storage

Here is a rundown on the system control programming that provides use of up to 16 million bytes of virtual storage on System/370s equipped with dynamic address translation. Data portability between DOS and OS virtual storage systems can be achieved through use of the new Virtual Storage Access Method.

Disc operating system/virtual storage (DOS/vs)—This extension of DOS provides up to five partitions for multiprogramming, and can run on Models 125 to 158. Multiprogramming is facilitated through use of the optional relocating loader, which makes it possible to load programs automatically at any address in any partition. DOS/vs incorporates the POWER program for automatic spooling and priority scheduling in either batch processing or remote job entry. Virtual storage size can be specified at SYSGEN or IPL time in increments of 2K bytes, starting with the computer's real storage size plus 64K. Partition sizes can be specified in 2K increments, starting with 64K. For external page storage—the direct access space that augments main storage—DOS/vs supports the 2319 disc storage, 2314 direct access storage facility and 3330 disc storage.

Operating system/virtual storage 1 (OS/vs1)—This is a follow-on to OS/MFT (multiprogramming with a fixed number of tasks), and provides up to 52 partitions—15 for problem programs and 37 for system tasks. It runs on Models 135 to 168. A minimum OS/vs1 system requires a computer with main storage capacity of at least 144K bytes. For all standard vs1 features, a main storage capacity of at least 160K bytes is needed. vs1's job entry subsystem (JES) provides spooling and scheduling of input and output streams. JES includes remote entry services (RES) for job processing from remote locations. Virtual storage size can be specified at SYSGEN or IPL time in increments of 64K bytes, starting with the computer's real storage size plus 512K. Partition sizes can be speci-

fied in increments of 64K. For external page storage, vs1 supports the 2319, 2314, 3330 and Model 2 of the 2305 fixed head storage facility.

Operating system/virtual storage 2 (OS/vs2)—An extension of OS/MVT (multiprogramming with a variable number of tasks), vs2 provides up to 63 user regions, of which up to 42 can be for IBM's time-sharing option (TSO). Each of the TSO regions can serve multiple interactive terminal users. TSO offers the full facilities of vs2 to each terminal user in conjunction with interactive program creation and debugging facilities. This combination creates a very powerful tool for application development. It can run on Models 145 to 168 with at least 384K bytes of main storage for a minimum system, 512K for batch and TSO and 768K for batch, TSO and HASP. Job entry and scheduling is performed by readers and writers, or, optionally, HASP or ASP. Virtual storage size is fixed at 16 million bytes. Region sizes can be specified in increments of 64K—4K increments for virtual equals real page 2—and are both read and write protected. vs2 supports the 2319, 2314, 3330 and both Models 1 and 2 of the 2305 for external page storage.

A fourth system control program, *virtual machine facility/370 (VM/370)*, provides new functions for users of typewriter-like terminals attached to a central System/370. It allows each terminal to be operated as the user's "own" computer with his choice of configuration and System/370 operating system and up to 16 million bytes of virtual storage. This function, together with the interactive capability provided by VM/370's conversational monitor system, offers new benefits in such diverse applications as on-line program development, conversational problem solving and complex business computations. VM/370 can be run on any System/370 with at least 240,000 bytes of main storage and the DAT facility. □

page-in and page-out statistics, as part of the system management facilities, while DOS/Vs provides a page fault trace capability.

Throughput can be increased if a higher level of multiprogramming causes more CPU and I/O time to be overlapped. Of course, the potential for such overlapping must exist in a system, and the required hardware resources must be available.

A wide range of system and application factors is involved both in selection of direct access devices for external page storage and in optimizing a system's ability to handle paging.

Device speed is only one factor. Another important consideration is the control program's ability to spread external page storage over multiple devices in order to permit overlapping of paging activity.

Performance can in some cases be improved by use of dedicated paging devices or by reducing the other I/O activity on the channel to which the paging device or devices are attached.

IBM's virtual storage system control programming can be rapidly installed and made productive because of general compatibility with the earlier operating systems.

As mentioned earlier, the system provides 16 megabytes of virtual storage. It is not expected that all installations can effectively utilize this space unless they have sufficient physical resources and have properly designed their applications.

In addition, it has been found with OS/Vs1 that a number of things can be done which will have a positive effect upon its performance. A complete discussion of this subject would be beyond the scope of this article, but a few examples can be mentioned.

For instance, use of larger pageable R SVC (resident supervisor call) and RAM (resident access method) lists has been found effective. Active members will remain in real storage, with the less active in external page storage. A pageable RAM routine permits the sharing of the module between tasks, eliminating multiple copies.

Use of larger I/O buffers can increase performance in most cases by reducing total I/O time and channel program translation time. This technique should be balanced with the fact that larger buffers increase the amount of short-term fixed real storage space.

An interesting situation is created by those programs that use as much of a partition or region as is available in order to achieve best performance. They do not, however, differentiate between virtual and real storage, and could cause abnormally high paging if scheduled in a large virtual storage partition and if a limited amount of real storage is available. A solution is to lim-

it such programs' virtual storage address space by, for example, scheduling them in small partitions or by using input parameters to control the programs' use of real storage. Programs such as the OS sort have an option which can be used to limit use of storage.

Programming considerations

Programs with disciplined flow and data organization—that is, those written so as to conserve storage space—are highly effective in a virtual storage environment because they have relatively small working sets.

But, while virtual storage frees programmers from the need to contend with limited main storage space, it is still a good idea, in many cases, to structure programs to centralize their logic and data references. This consideration, in turn, presents a number of tradeoffs between programmer productivity and program optimization. For example, it could be decided that only the most heavily used programs need be structured in optimum fashion.

Programming for efficient use of virtual storage essentially consists of placing subroutines in the sequence of most probable use so that processing proceeds sequentially, with calls being made to infrequently used subroutines. Infrequently used subroutines that tend to be used at the same time whenever they are executed should be located near each other, as well.

In addition, the data most frequently used by a subroutine should be defined together so that it is placed within the same page—or group of pages if a large amount of data is involved—instead of scattered over many pages. If possible, data should be placed within the same page as the subroutine using it.

When possible, subroutines should be packaged within page boundaries, rather than overlapping them, in order to require as few pages as possible.

Use of self-modifying code should be reduced or eliminated for the following reason: A page is only transferred to external page storage if it has been modified; otherwise it is merely overwritten in real storage, conserving I/O time. Paging of self-modifying programs impacts performance by requiring more actual I/O operations.

Use of *virtual equals real* mode should be limited to those programs actually requiring it, in order to help keep pageable real storage space to a maximum.

Finally, some existing programs can be made more efficient for virtual storage by removing overlay structures and combining job steps that had been created merely to fit a program into limited main storage. Such restructuring is not necessary and can take place, on a selective basis, after the system

control programming is installed and productive.

Properly implemented, virtual storage can help a data processing center meet its application challenges of the '70s.

With greater independence from main storage size limitations, users can employ a single design and operating procedure for applications that are to run on multiple systems. Large program packages can be evaluated and tested without the need to secure additional main storage capacity.

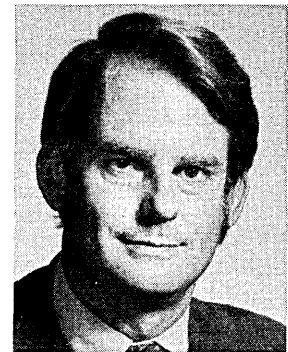
Programmers can benefit from the additional functions of larger compilers and can enlarge existing programs with less concern for partition or region limitations.

Large programs can be tested and debugged on smaller computers in preparation for the installation of larger machines, speeding the development of applications.

Programs whose storage requirements vary widely during their execution, based on transaction volume and complexity, can be justified, designed, installed and run more easily.

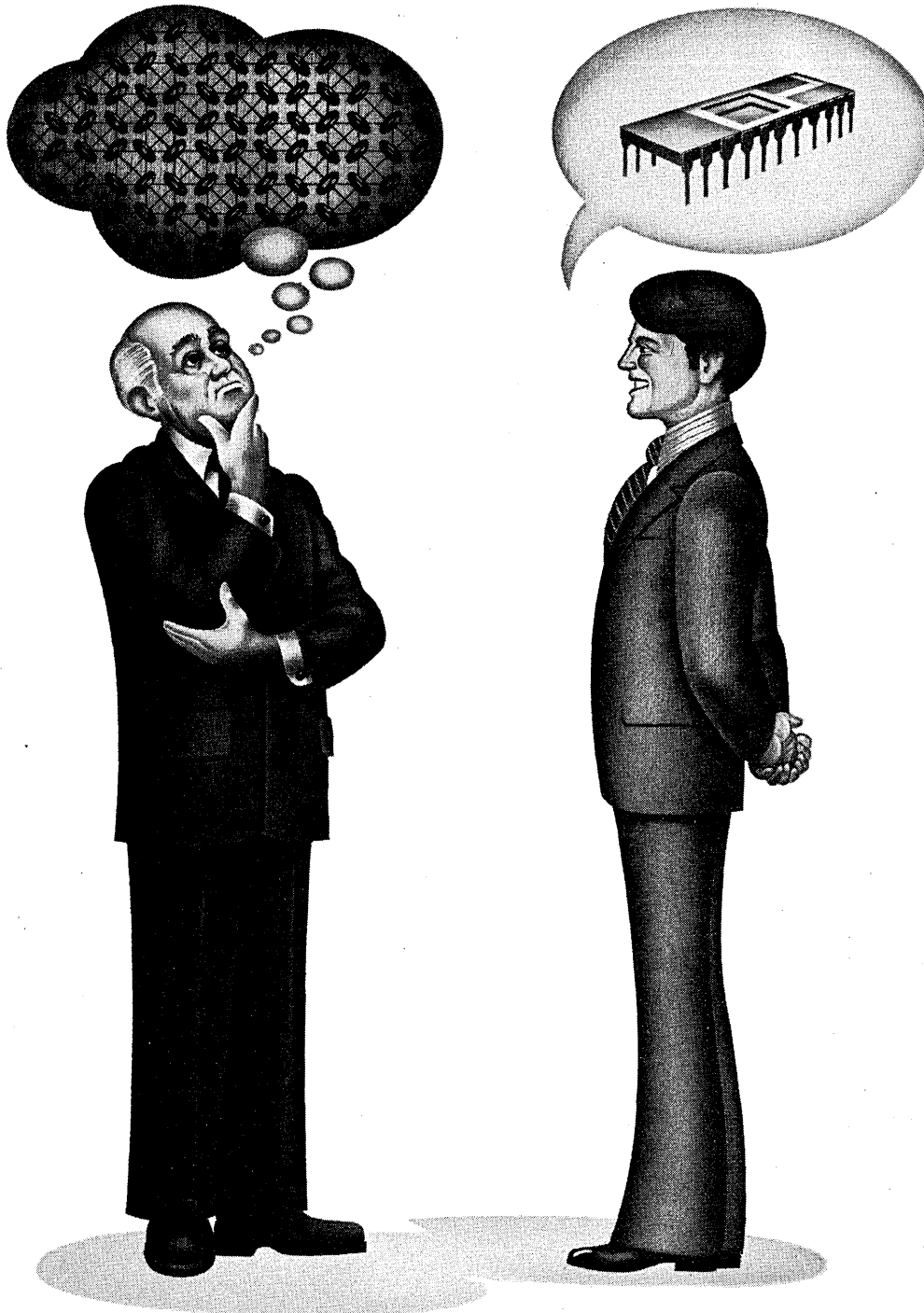
The trend in application programs is toward larger and more variable storage requirements. In addition, it is becoming more desirable to be able to run these applications on a variety of machines. Virtual storage helps fill these needs.

The advent of virtual storage for DOS and OS will have as far-reaching an effect on installations as other efforts to create machine independence have in the past. Its impact may well be comparable to that of such developments as high-level languages, device independence and CPU model independence. □



Mr. Bergstresser is on special assignment to the vice president, marketing, of IBM's Data Processing Div. Since joining IBM in 1956, he has also been director of programming systems marketing, administrative assistant in the office of the division president, and an industry development manager for the division. His responsibilities have included such systems development projects as ASP and the CALL/OS time-sharing system. He has a BA in mathematics from Pomona College.

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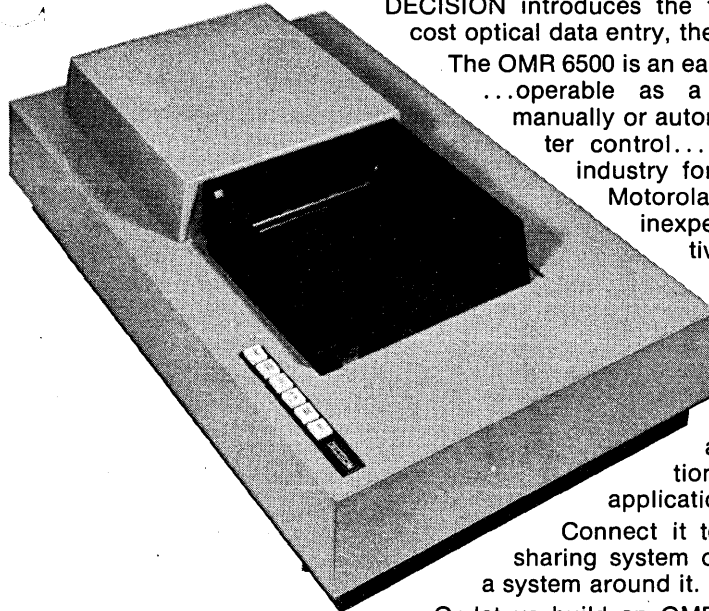


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From a cross section of installations, the actual expenditures for 1972 compared to budgets for 1973, including hardware, software, salaries, and services

A Survey of DP Budgets for 1973

by Richard A. McLaughlin,
Technology Editor

According to a DATAMATION poll of several hundred data processing installations, the dp industry in the U.S. and Canada is healthy and growing stronger at a rate of over 10% per year. It already accounts for well over \$20 billion per annum, and 1973 expansions will take it to nearly \$25 billion.

Actual 1972 edp expenditures and 1973 budgets were supplied to us in confidence by 269 geographically distributed, mixed size dp organizations. Using these figures, we think we can show with reasonable accuracy how

much of an average dp budget is allocated for hardware, software, communications, salaries, and other major expense items. Equally important, we can show how the budgets are changing.

The dollars spent in 1972 by our 269 installations and allocated for 1973 are shown in Table 1, along with the percentage changes. The sample sizes included are significant too, as they trace how many shops have budgeted for those expenditures. Note, for instance, that 98 (about one-third) of the sites budgeted for "Data Communications"

in 1972 while 134 (one-half) did for 1973.

Note that hardware budgets are up almost 14% and salaries up about 7%. Also, the chart suggests that hardware acquisitions for 1973 will most often be purchased. This may reflect government pressure on its contractors to buy rather than rent.

There will be no cause for rejoicing by consultants or contract programmers in these figures. Expenditures for consultants show the smallest gain of all, and contract programming gets the

	1972 \$*	Sample	1973 \$*	Sample	% Change
Hardware	\$ 86,370	269	\$ 98,110	269	+13.6
rented	47,840	203	51,820	201	+ 8.3
purchased	9,940	69	13,490	81	+35.8
leased	28,590	118	32,800	121	+14.9
Software	1,560	87	2,280	98	+46.2
Data					
Communications	11,430	98	14,570	134	+27.5
Supplies	12,900**	269	14,490**	269	+12.3
Consultants	840	48	870	47	+ 3.6
Training	760	135	1,030	146	+35.6
Conference					
Attendance	320	141	400	146	+25.0
Time-Sharing	1,260	45	1,470	46	+16.7
Services					
Batch Processing					
Services	840	24	1,040	22	+23.8
Remote Batch					
Services	390	13	450	13	+15.4
Contract Programming	1,780	45	1,560	42	-12.4
Salaries	102,000***	269	109,200***	269	+ 7.1
TOTALS	220,450		245,470		+11.3

* In thousands of dollars.
** The average of 247 responses multiplied to yield 269 responses.
*** The average of 223 responses multiplied to yield 269 responses.

Table 1. Sample data processing expenditures for the U.S. and Canada.

DP Budgets for 1973

only negative figure on the table.

The table doesn't show what size installations reported the expenditures. But the individual questionnaires suggest the following conclusions:

Software is being purchased by very few installations spending less than \$100K per year on their machines, and by about half the shops that spend over that amount. Except for that break at \$100K, there seems to be no correlation between whether software is purchased and size of installation budget.

A separate budget item for *Data Communications* appeared on a few forms submitted by installations under \$25K/year, then its frequency arithmetically progressed along with budget size. Very few large installations fail to show line items for communications, and some of those indicate that the expense is included under "Hardware."

Consultants are apparently very little used in shops spending less than \$100K/year on hardware items. Somewhere between a quarter and a third of the bigger shops allocate funds for them.

Training appeared in more than half the budgets as a separate item, running about 1% of the hardware costs. There was some overlap with *Conference Attendance*. That is, some installations count conferences as training expenses. Those that count conferences separately generally give them about .5% of their hardware charges. There seemed to be no distinction between different shop sizes and percent of budget allocated for training or conference-going.

Under 20% of the shops in the \$25K to \$100K hardware range spend money on *Services*—outside processing, including batch, remote batch or time-sharing. Not many more shops than that in each higher category buy outside time until machine expenditures go over \$250K/year. Users spending between \$250K and \$500K are twice as likely to buy outside time as those spending under \$250K (almost 40% of them do). Nearly 80% of the installations spending over \$1M/year on hardware use outside processing.

Contract Programming is mentioned by about 20% of the shops in all categories over \$25K/year. Peak usage seems to be in the \$250K to \$500K/year group where it is mentioned by about one-third of the respondents. Big shops, over \$500K/year, don't use contract programming any more than little shops do; probably they have more nearly sufficient in-house expertise.

Supplies generally account for expenditures equivalent to about 15% of those for hardware—slightly more in small shops, slightly less in large shops.

Sources of the Survey Data

The cooperating dp installations are part of DATAMATION's Computer Executive Panel, a carefully selected cross section of dp users. The full panel's 1,100 members were selected to represent accurately the geographical distribution, industry classification, parent company size range (by number of employees), and installation mix (by computer size and make and by dp budgets) of the magazine's readership. We think we can show that it also reflects the U.S. and Canada dp universe.

Two things were obvious from examining the responses from the panel.

First, dp is big business. It may be left to IBM and the Justice Department to officially describe how big our industry is, but our small sample of users turned up over \$200 million in actual expenditures for 1972.

Second, the budgets for individual installations are very different from each other, no matter how they are grouped by expenditures in any category. We soon realized that we could not project the figures by category for a typical \$100K/year installation by averaging a few other \$100K sites. For example, one installation this size might spend \$10K for supplies and another several times that much. This doesn't mean that the averages are not useful—only that, to be statistically relevant, the averages must be taken over the whole sample.

Not all 1,100 panelists returned questionnaires. After rejecting some questionnaire returns because they showed only partial figures or because they were otherwise unclear, we ended up with 269 responses. Of these, 156 (roughly 58%) were for installations

that rented more than half their hardware, 26 (10%) were for sites that had purchased their machines and were depreciating them on their budgets, 81 (30%) were for leased machines, and 6 (2%) were for organizations that spent more on service bureau time than on in-house equipment.

The responses fell into the following categories by hardware expenditure:

Less than \$25K/year	12
\$25K to \$100K	113
\$100K to \$250K	72
\$250K to \$500K	34
\$500K to \$1M	23
Over \$1M	15

The cost categories were not chosen arbitrarily. The "under \$25K" category includes most IBM System/3 Model 6s and such smaller machines. "Under \$100K" handles the bigger System/3 Model 10s and 360/20s. A 360/30 or 40 fits into "under \$250K" most of the time, while "under \$500K" covers the 360/50s. Most single, large machines like 360/65s can be had for "under \$1M," but multiple cpu's and the bigger 370 series configurations run "over \$1M" per year.

Compared to the real world, these figures are biased toward the larger machines, at least to those over \$25K/year. There may be as many as 15,000 sites that spend less than that figure on hardware each year, but at least one source (International Data Corp.) credits all such sites with only 7% of the total dp expenditures. If that is accurate, our total dollar projections may not be off by very much to begin with, and are at the very least accurate for sites spending more than that minimum amount. □

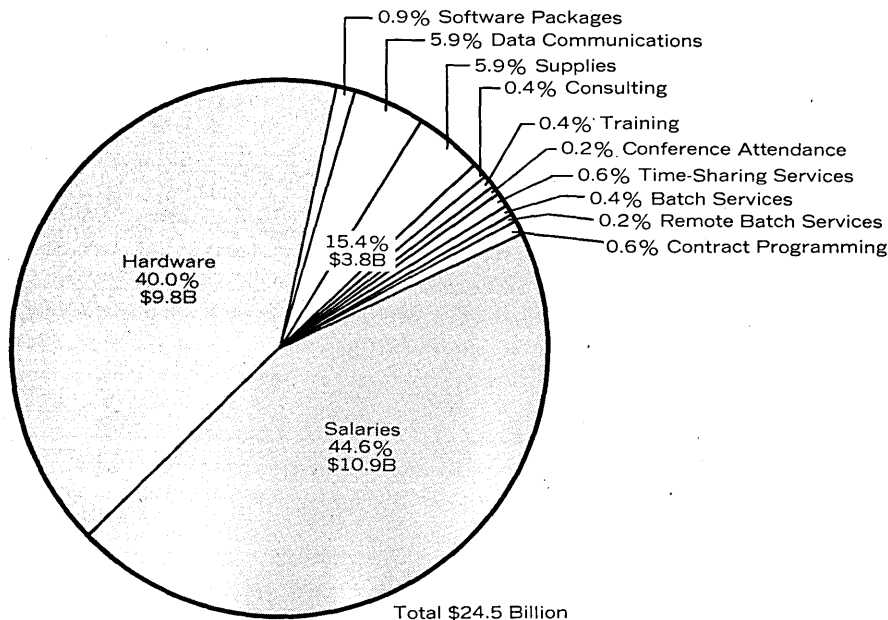


Fig. 1. Major dp budget items for 1973 (U.S. only).

The money spent on *Salaries* kept nearly the same ratio (110-115% of hardware costs) for all shops, no matter what size hardware was used. And our sample showed there would be 457 more jobs at our 269 sites in 1973 (86 operators and clerks, 92 keypunchers, 262 programmers and analysts, and 17 supervisors). Sorry, we can't tell you where they are.

Finally, we polled the panel on *Facilities Management* and found only one user, a big shop spending over \$1M/year on hardware. To date FM has not made significant inroads, though Ross Perot and a few others who have been very successful at it may project big things.

How the expenditures pie will be cut up in 1973 is shown in Fig. 1. A similar figure for 1972 would be so little different that it is not worth including.

Our sample is large enough that the proportions shown in Fig. 1 should be projectable to the U.S. and Canada dp universe as a whole. And we think the dollar figures are projectable, too. Computer censuses published by International Data Corp. indicate that there are about 26,000 computer sites in the U.S. with machines in the "over \$25K/year" range. For rough estimating, that's close enough to 100 times our sample of 269 that dollar figures in Table 1 become 1% of the U.S. total. For instance, hardware charges in 1973 should account for \$9.8 billion, and total dp expenditures, including salaries, for \$24.5 billion. To put that last figure into perspective, IBM grossed something around \$10 billion in 1972 worldwide, and General Motors was the highest grossing company in 1971 at \$28.26 billion.

We gain some confidence in the U.S. projection knowing that 1971 U.S. dp expenditures have been quoted at \$18.6 billion.

The Canadian budget figures are not noticeably different from those of the U.S., so we think we can incorporate them into our sample without biasing the U.S. projection. Unfortunately, we do not have census figures for Canada, so we cannot estimate that country's total expenditures.

Projections are never certainties. We have far more confidence in what the 1971/1972 comparisons suggest for proportions of budgets allocated to major items. What the figures suggest to us are: that the industry is growing at a rate of about 11% overall; that greater emphasis is being placed on communications, on packaged software, and on purchases as opposed to rentals; that the workloads are up (check the *Supplies* figures, which are always a good measure); and that even the job market is opening up. Looks like it will be a good year. □

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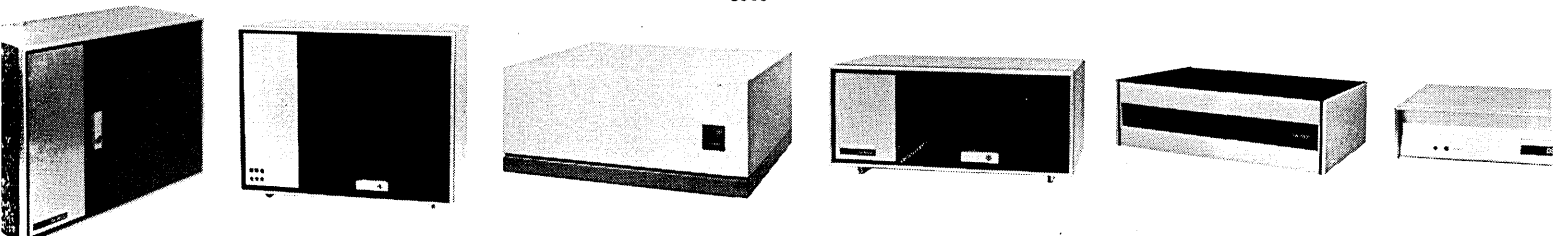
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A worldwide real-time
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Instant Financial Information

by William P. Rogers

One of the world's largest real-time networks is operated by GTE Information Systems, whose automated stock quotations reach brokerages on every major continent after being priced at the source—the floors of dozens of American and foreign securities exchanges.

Although a decade has passed since the company's Ultronic brokerage services division began transmitting on-line quotations, many original design principles still apply in coping with steadily mounting volumes, including routine 20-million-plus share days on the New York Stock Exchange alone.

In fact, 10 years has seen the computer completely rewrite traditional work patterns in both front and back office. Before 1960, many investment firms were using tickers for quotes and blackboards to record selected stocks. The technique was primitively simple: As transactions poured over the ticker, prices were shouted to a clerk who dashed to the board, erased the old quotes, then wrote in the new ones. Change came as trading surged, more companies went public, and the computer took its place as a commonly

accepted business tool.

The original Ultronic brokerage information system featured a desk-top terminal called Stockmaster, a button-operated, three-position Nixie display from which the registered representative could retrieve the latest trading price and bid-ask price on any of hundreds of listed securities. Thus, when a customer phoned and asked, "How's GM doing?", the broker would turn to his terminal, key in GM's code, and reply on the spot.

Although Stockmaster remains an active information tool in many brokerage offices, it has now been succeeded by the more technically advanced Videomaster crt terminals specially designed by GTE Information Systems for this application. These displays not only give last sale and bid-ask prices on over 16,000 securities, but also open, high, low, close, volume, dividends, yield, earnings, and price earnings ratios, among other data. In addition, the latest Videomaster II model offers the broker access to his own computer data base for research reports, buying margins, and similar privileged information, besides every-

thing carried by the network. Impact and thermal printers linked to the videos produce hardcopy and thus contribute to the new system approach.

Design criteria

But before terminals enter the picture, several design criteria must be met for any brokerage information system to be functionally and economically feasible. One is real-time access to current stock prices. In today's high-volume market, news even 15 minutes old is too old to be useful. Prices fluctuate like yo-yos, and the broker must know the exact price at any given moment. The GTE Information Systems network averages one and a half seconds between time of request and receipt of information.

Another important consideration is constant access time for each user. Since competing brokerages share the same data base, it would be unthinkable to prefer one customer over another in accessing information. Equally undesirable would be to have waiting time increase as a result of one brokerage house experiencing heavier activity than another.

Financial Information

Simplicity of operation also weighs heavily, particularly with brokers who care little for the theory or operation of multiprocessing equipment. Studies show that during a busy hour a man may average as many as 40 quotation requests. Videomaster makes it possible for him to depress no more than eight buttons for a quotation—one for mode, one to six to identify the particular security, and one for "go."

The four modes—Quote, Marketminder, Limitminder, and Videoscan—each provide specialized information. In the Quote mode the broker retrieves statistical data and news on one selected stock. Up to 11 different facts may be displayed.

In the Marketminder mode the current last sales price for up to 18 securities is presented. The broker can see at a glance current prices for the securities in which he is particularly interested.

Limitminder automatically monitors changes in last sale price with respect to limits that the broker sets. In this mode, the broker enters a price limit with an up or down arrow alongside the stock symbols he has inserted. The arrow indicates whether he wants to know if a stock climbs above or falls below a particular limit. As soon as the last sale price breaks one of the limits, the arrow is replaced by a flashing plus or minus sign. A red indicator on the keyboard also lights, alerting the broker that one of his limits has been broken. This indicator will light regardless of the mode being used.

Videoscan displays two lines of ticker information and seven lines of financial news wire information. Typically this involves the New York and American last sale tickers and either Dow-Jones or Reuters financial news.

Reliability also figures prominently. Here, two major points concern the broker—accuracy of information and system uptime. If a single bit error occurs in transmitting the least significant digit of last sales price, he may lose approximately \$900 in selling 1,000 shares of a security "at the market." And because he depends on the system every minute during trading hours, equipment reliability and maintainability are essential, including redundancy of lines and hardware and a means of updating the data base following temporary outages.

Finally there is cost. Since no one company monopolizes brokerage quotations, each of the three available vendors must be able to offer comparable information at comparable prices. This, in turn, leads to minimizing op-

erational expenses—which ultimately benefits the customer.

The network

Only the largest brokerage houses can consider creating a dedicated quotation system and none has actually established one. This follows from the high start-up cost as well as the expense of maintaining and distributing the data base. Naturally such financial commitments have tended to discourage additional companies from entering the quotation services market.

Inputs to Ultronic's data bank, which average 200,000 messages a day and a quarter of a million or more on peak days, come from all the leading national, regional, and Canadian exchanges; from the various market makers in the over-the-counter market; and from NASDAQ (National Association of Securities Dealers Automated Quotations). Inputs from the large exchanges are received by Teletype, while the smaller over-the-counter market makers telephone in sales information. A 2400-baud line carries the NASDAQ messages.

Headquarters for the output operation are in Mt. Laurel, N.J. (See Fig. 1.) Here, quotations go out over leased lines to 23 regional data centers in the

English news service and Ultronic's overseas partner. London adds inputs from Western European exchanges and drops American securities of little interest to foreign brokers. Satellites in Johannesburg and Sydney also can input information just as the Mt. Laurel and London masters. Altogether, some 400 cities on every major continent are served by the 100,000-mile network.

Each satellite contains a computer identical to the Mt. Laurel front-end computer for updating the data bank, a card reader for loading programs, and a Teletype for issuing commands and receiving status information from the system. In addition there is a drum memory which dedicates nine memory tracks for the storage of subroutines and for use as a first-in/first-out data buffer.

Data line interfaces to the drums permit the customer to retrieve quotations from his terminal. The network of data lines connecting master computers with satellites is called the backbone network. Retriever loops link masters and satellites, and an average of 50 of these low-speed lines interface to each U.S. data center, although some satellites have as few as 16 lines, while New York has 500. An average of 18 terminals is connected to each

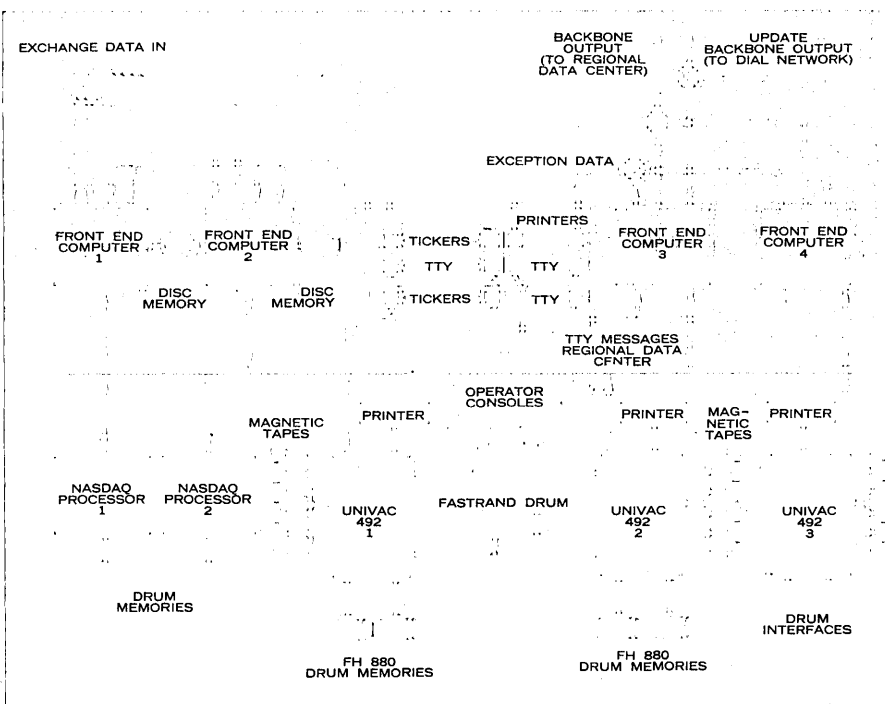


Fig. 1. The Mt. Laurel, N.J., master computer center for the GTE Information Systems, Ultronic Brokerage Services, real-time stock quotation and financial information network.

U.S. and Canada. These centers—or satellites, as they are often called—store information from the master for transmission to nearby customers so that line costs are optimized.

Quotations also are transmitted to London via cable where they are sent around the globe by Reuters, the En-

line.

The Mt. Laurel master contains four front end computers specially designed by GTE Information Systems. These small 16-bit word machines contain 16K of core, have a 1.5-microsecond memory cycle time, and an average instruction execution time of 6 micro-

seconds. The four machines, which handle all switching, basic translating, and formatting of functions, are evenly divided between input and output applications. Linked to the two input processors are small 12-megabit disc memories.

The computers interface by means of a common I/O bus with three Uni-

vac 492 central computers and two NASDAQ processors. The latter are identical to the front-enders, but in place of data line interfaces and disc memories they are interfaced with two 11-megabit drum memories.

Pairs of input, output, and NASDAQ computers process the same data. However, only one of each pair is on-

line at any time, as determined by one of the 492s. The 492s receive formatted input messages, validate the messages, update the files, generate statistical information, and assemble the necessary data for the output messages.

During the market day, the front-end input computers take bit serial data received from the automated exchanges (New York Stock Exchange, American Stock Exchange, etc.) and the operations room, framing them into transaction messages. A conversion to a normalized code is next performed, and exchange identifiers are added to the messages. The messages are then buffered in core for transmission to the 492s. Disc memories on the input computers allow for storing up to 40 minutes of input data should an outage occur.

Two of the three 492s are on-line during the market day, with the third on standby. The standby computer also logs all input data on magnetic tape and performs other nonpriority batch processing required by the center.

Transaction processing

Once a transaction message is received, a series of validity checks is performed. In the case of bids, messages are tested to see that they are less than the corresponding ask prices. Conversely, ask messages are validated on the basis of being greater than the corresponding bid prices. In addition, a last sale transaction is tested to insure that it is less than or equal to the bid price. Changes in bid prices, ask prices, and sale prices are monitored with respect to pre-established limits for each exchange and each class of data.

Should a transaction fail any of these validity checks, an error message is transmitted via one of the front-end output processors to a printer in the operations room. There the transaction is verified. If an error exists, a correction message is entered from a Novar remote terminal. If valid, an override message is sent to the master computer which then allows the transaction to be processed.

The input and output front-end processors are designed to run in parallel. Each computer of the respective pairs receives the same inputs. While one executes all the requirements of the system, the other operates in a recovery mode, constantly monitoring its twin. Thus, if the first computer encounters trouble, the second takes over without operator intervention. At the same time, all system decisions are reported and may be overridden by the operator.

Inputs to the front-end processors and output messages broadcasted to all satellites are not queued. Each input message is recorded on the journal and then processed, following any one of



Board room of GTE Information Systems Mt. Laurel master. Here, latest quotations from North American exchanges are processed and transmitted to customers throughout the world.

MASTER

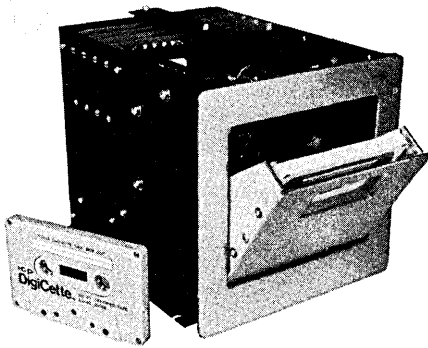
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CIRCLE 81 ON READER CARD

Financial Information

the four parallel processing paths in each computer. The number of processing paths can be modified to meet changes in the system whenever necessary.

At the end of the process, data is forwarded to the front-end output processor. Here broadcast messages are formatted for the satellite centers as well as other required messages. Transmitted messages are retained in auxiliary memory until all satellite centers have acknowledged receipt. If a satellite misses one or more messages, an update for the appropriate record is forwarded from the files.

The satellite centers can update price fields stored on drum at a rate of up to 120 records per second. Because the regional data base is updated each time a transaction takes place rather than only when a price change occurs, cumulative data errors are eliminated.

The data center computers are similar to the Mt. Laurel front-end processors. They have a Novar terminal for issuing commands and receiving status information from the system. The drum memory, which stores all stock information, is arranged as an associative memory. This means the data on a given security can be retrieved using either an absolute binary address or up to a 40-bit address corresponding to the code for the security's stock symbol.

Each security has eight marker bits, six of which identify its particular exchange. Using these marker bits, the computer sequentially searches for and reads all securities by exchange. Another set of 12 temporary marker bits allows the computer to update the price fields.

After market hours, the Mt. Laurel center transmits data to the satellite computers. Routines include adding and deleting listed securities, updating relatively static information (such as price earnings ratio and yield), clearing prices (except close prices), updating programs used in the field, and running diagnostics to check out the network system.

Operating at maximum capacity, a data center theoretically could generate 5,460 messages per second. But if message processing and data lookup are to take place serially for all subscribers, such a response volume cannot be maintained. Obviously some means must be provided to allow simultaneous drum searches for multiple requests. Also, some signaling scheme between the regional center and subscriber's terminal is necessary to minimize the time required to service a terminal.

The signaling or polling scheme devised uses an address field at the beginning of every reply message. The message originates from a regional center and is used to poll a terminal. While the remainder of the reply message is being transmitted, a request message is sent from the terminal just polled. During the transmission of the next reply message, a drum search is performed for the requested information. Then the quotation is directed to the terminal for whom the data has just been accessed. In this manner, with three terminals on a line, terminal No. 1 is polled by and transmits a request message during the reply message transmission for terminal No. 2. A drum search for the data requested by terminal No. 1 takes place during transmission of a reply message for terminal No. 3. The following reply message transmits data back to terminal No. 1.

With last sale information omitted, a 1.3-kilobit baud rate is optimum for this type of signaling. This rate also affords a practical speed for the transmission of data over unconditioned lines using asynchronous modems. In addition, it allows 333 baud for the transmission of last sale ticker information, adequate for current market activity.

The GTE-IS Securities Information System, as it stands, is a valuable tool for the broker, but its evolution is continuing. New systems are under development which will allow him to enter buy and sell orders from his terminal, review customers' portfolios, and communicate with branch offices. And this is only the beginning. More and more of the brokerage industry's practices and routines will be revamped as computer-based communication systems and technologies push it forward into the future. □



Mr. Rogers is director of systems development for GTE Information Systems, Ultronic Brokerage Services. A graduate of Drexel Institute of Technology with a BSEE, he holds several patents for work on video display terminals. The article here is adapted directly from a recent paper delivered at an IEEE seminar in Computers and Communications.

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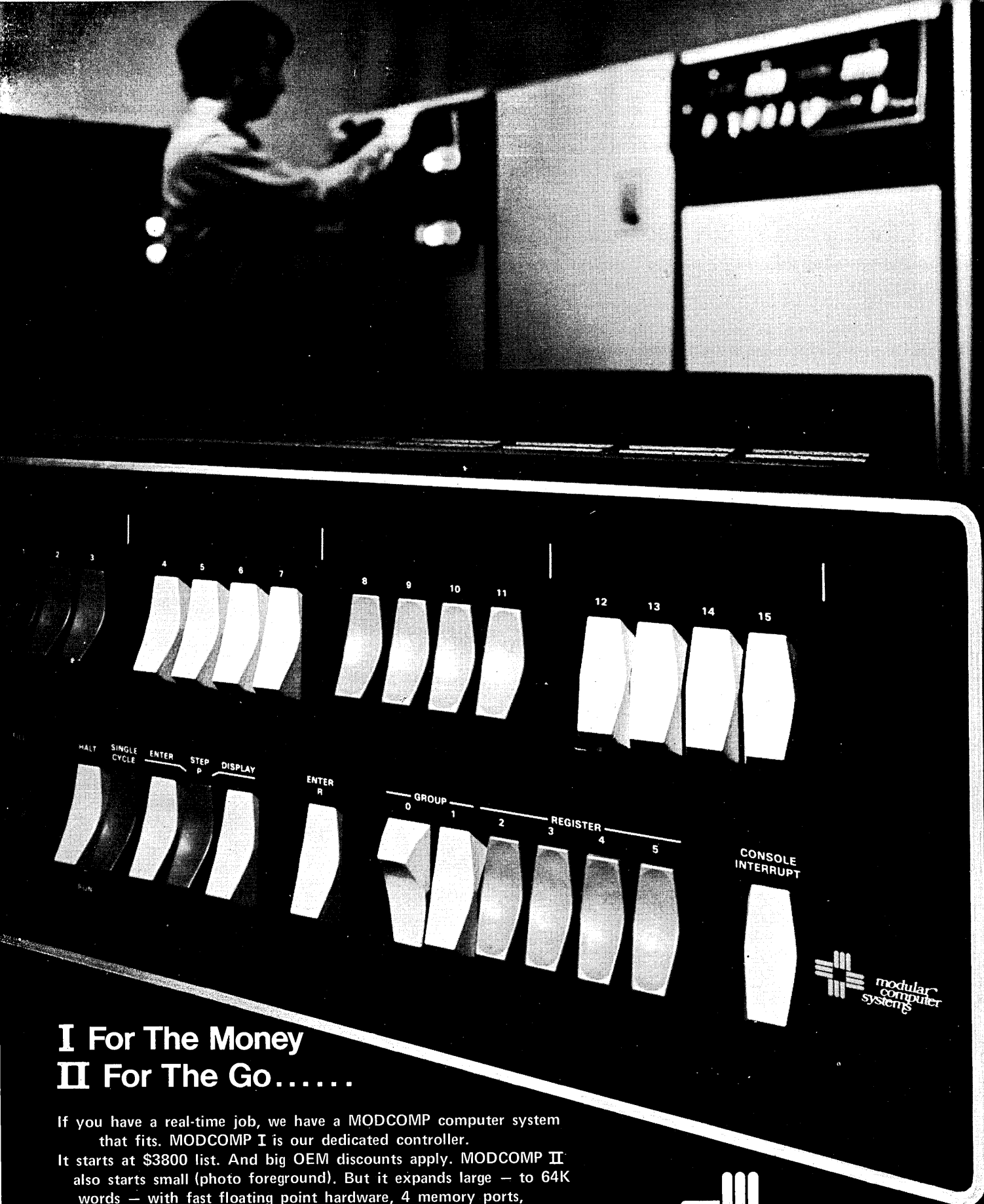
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CIRCLE 31 ON READER CARD

The Potential of Complex-Time Computing

by Jackson Granholm

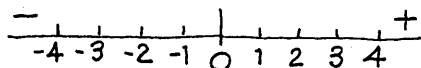
For many years at technical symposia the features of real-time computing have been bandied about. As many quasi-learned words have been uttered on this subject as on any in the industry. The PR and advertising men have picked up where the scientists and engineers paused for breath, and the glories of real-time systems are touted in color lithography on the slick pages of trade journals.

Yet, oddly enough, we do not find the work of Nattkarl,¹ et. al., followed up. Where are the computers working in time domains other than "real"?

The invention of the SCHROMP compiler some years ago at UCRA pointed the way. This compiler worked in number system to the base i . Thus SCHROMP, twice compiled, ran in number system to the base minus one, saving computer time with each execution. How sad that the tightwad budget allotted to SCHROMP development never permitted it actually to run.²

But where pioneers have trod, men of good will may follow. It is thus strange to note that no present development project actually funded by a major company aims at a machine to operate in the complex-time system.

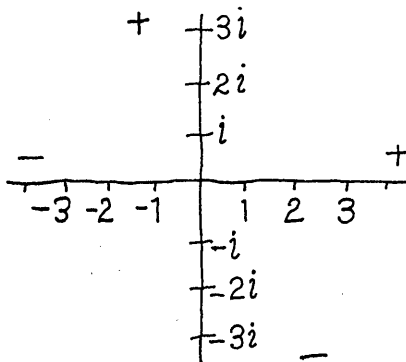
Complex time is simplicity itself. We begin with the idea of real time, represented in the domain of real numbers, and graphed along the linear axis of timespace with origin (time zero) at any point we choose (say the present instant).



Measures to the left of origin represent time past. Those to the right represent future time. The customary

symbolisms of "minus" and "plus" apply.

The concept of real time is extended to that of complex time by the expedient of graphing each time instant as an ordered pair of numbers. The real-time axis remains as before. The imaginary-time axis lies orthogonally to it. Time increments along the imaginary axis are in the scale of i -seconds:



Also relevant is Kraletschevsky's noted hypothesis of the complex-time clock.³ While his model was scaled in sidereal complex time, the approach is variously applicable. To convert to the terminology of the mean solar clock, we picture Kraletschevsky's clock as moving time in a positive direction (counterclockwise)⁴ so that what we used to call "midnight" becomes time 1. Six a.m. is converted to zero plus i . Noon becomes minus one, and 18:00 (six p.m.) is zero minus i .

Whether Kraletschevsky's clock has direct application to design of a digital computing mechanism is a topic debated in the learned journals.⁵ Mote⁶

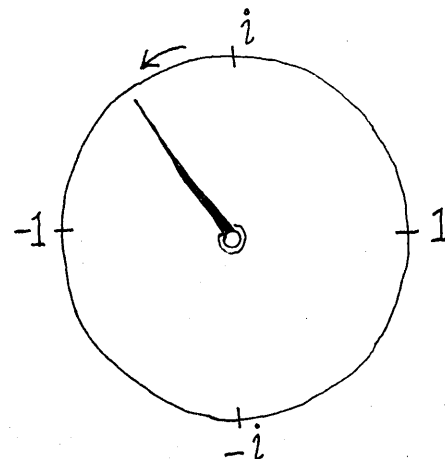
discussed the subject in his well-known treatise on the pragmatic application of IF logic.

An actual approach was taken recently at a not-inconsequential university. It involved building a computer control unit in which each pseudocycle was a function of complex time up to the quadratic level, as, for example:

$$f(t) = at^2 + bt + c$$

where $t = x + iy$

The laboratory unit, built from surplus parts, while operating well, was notable for asynchronousness of cycle times of



Kraletschevsky's complex sidereal time clock*

which, unfortunately, only the real parts could be directly observed.

While real time is essentially linear, and may be thought of as flowing on forever from some indefinite past to some unknown future, complex time is cyclic. The use of the complex domain

¹J. Nattkarl, H. Väckarklocka, and O. Papperskorg, *Gode Kvinnor*, The Swedish Academy of Astrosciences, Stockholm, 1969.

²Caesar Salada, *Remembrance of SCHROMP Past*, Proceedings of the Special Interest Group for Metacomputers, Los Angeles Chapter of the ACCM, August, 1962, p. 214.

³Boris Kraletschevsky (translated from the Russian by T. Knight), *My Life and Hard Times*, Samovar Press, New York, 1965.

⁴*Ibid.*, p. 67.

⁵Igor Moussorgsky, *Strictures at an Inhibition*, Proceedings of the American Society of Raconteurs, Vol. xxiv, No. 3, Fall, 1967.

⁶Enoch Mote, Judas Iscariot Professor of Heresies, The General Theological Seminary.

*Author's note: The diagram of Kraletschevsky's clock, contrary to uninformed opinion, is correct. As those who did not sleep through their Cartesian geometry know, the origin of polar coordinates (theta equals zero) always lies on the X axis (the three-o'clock position), and the positive direction of rotation is counterclockwise.

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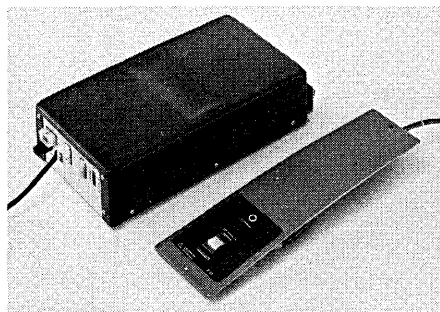
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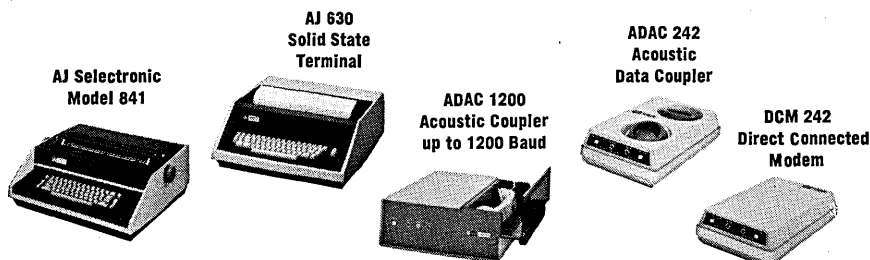
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Complex-Time

in representing cyclic phenomena is well-known. In particular, this is shown in the representation due to De Moivre,⁷ frequently presented as:
 $(\cos \phi + i \sin \phi)^n = \cos n \phi + i \sin n \phi.$

Thus in a computer with a complex time clock any particular cycle is indistinguishable from any other cycle. All considerations of mundane things such as device speeds become irrelevant. It is not necessary, for instance, to fetch an operand during the cycle in which an operation takes place. It could as well be fetched during any previous cycle, or, more to the point, *at any future cycle.*

Could there be a more cogent illustration of the power of imaginary time in the inner operations of a computer?

The proof of this capability is readily found in the integral of a function of complex time, simply stated as:

$$\int_C f(t) dt = \int_C (u dx - v dy) + i \int_C (v dx + u dy)$$

where: $f(t) = u(x, y) + i v(x, y)$

According to the well-known theorem of Cauchy,⁸ if we take any closed path through complex time, we have:

$$\int_C f(t) dt = 0.$$

amply demonstrating the premise as set forth.

It might be well to list as Campylos⁹ has done the probable characteristics of a computer operating in complex time: the independence of device speed, the freedom from programming (since the operation performed at any given cycle time is irrelevant), the accomplishing of problems involving cyclic phenomena with a single DO loop, etc.; but the present constraints of time and space preclude this.

This is unfortunate.¹⁰ Complex-time computing deserves a firm and clarion apologia which the world can well note.

We may take comfort in the knowledge, however, that in spite of the current lack of vision of the world's self-appointed decision makers, good sense will doubtless, in time, prevail. ☐

⁷ Fred De Moivre, *Cycling in Idaho*, Bunn and Blum, New York, 1966.

⁸ John Cauchy, *Down to the C in Shifts*, Carper and Hoe Publishers, New York, 1938, p. 323.

⁹ Lucy Campylos, *Comments on the Design Notes of N. G. R. Sanders During Preliminary Design of the FRED (Fiendishly Rapid Electronic Device) Project*, Journal of the accm, Vol. XVII, No. 2, June, 1964.

¹⁰ Kraletschevsky, op. cit., p. 287.

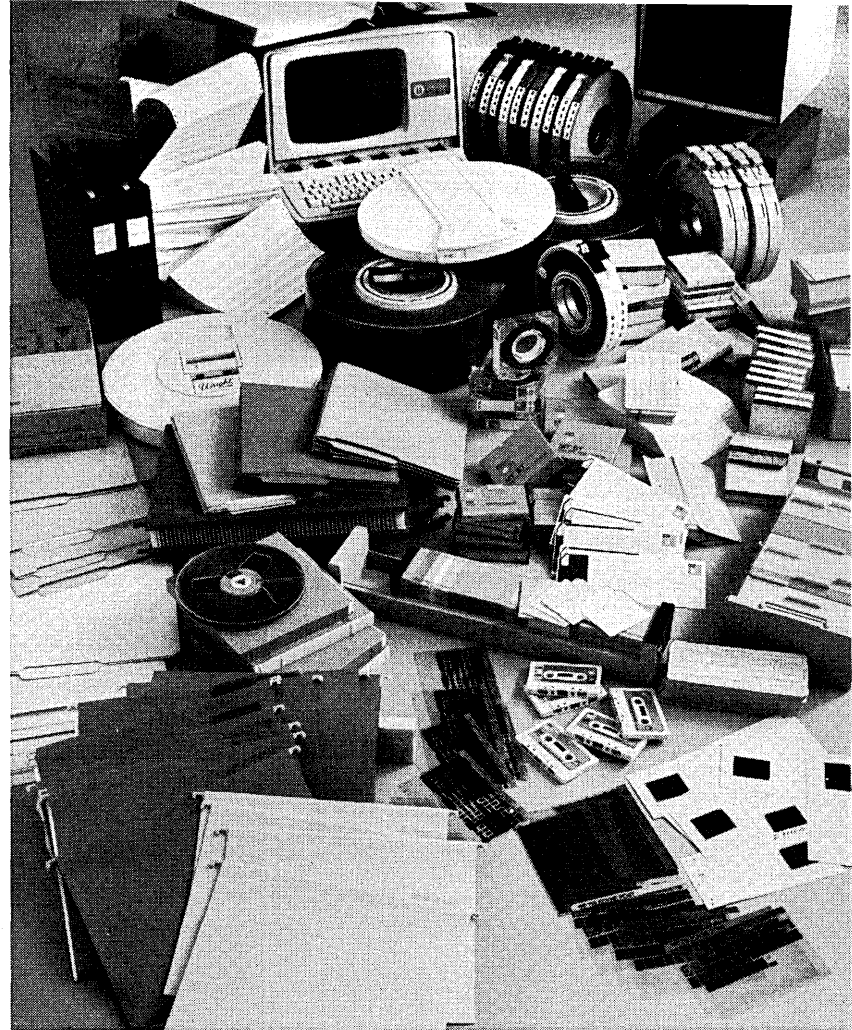
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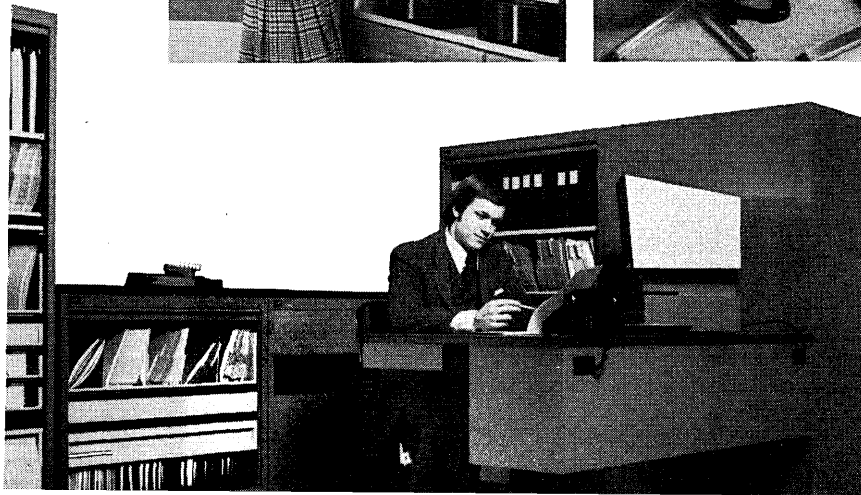
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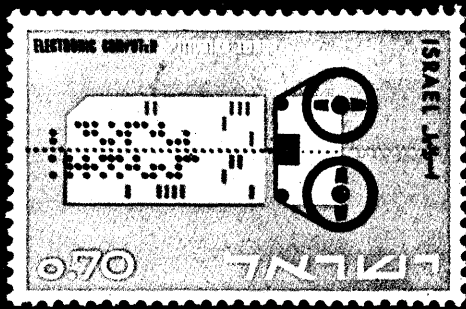


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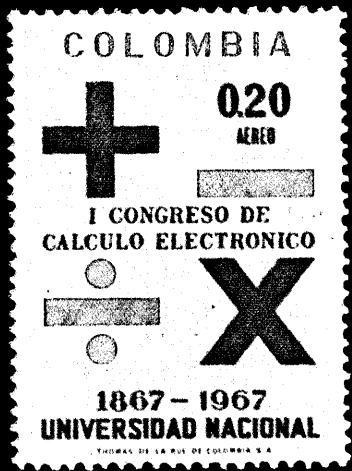
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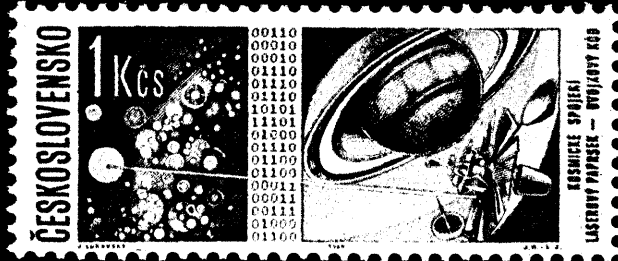
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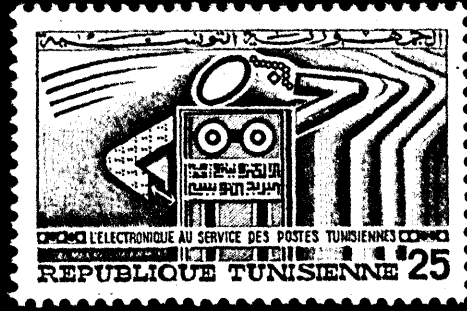
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4

A Gallery of

A POSTAGE STAMP featuring a computer has not been seen by many edp practitioners—and with good reason: out of some 75,000 pictorial stamps issued around the world in the past 20 years only a handful picture computer equipment as part of the design.

There are a number of stamps depicting automation in various applications—mostly manufacture and communications, but they do not show any edp equipment, though it is obvious that without it most automation processes shown would not exist.

“True” edp stamps—those directly related to the computers or depicting some aspect of edp in their designs—

number only 23. They have been issued by 14 countries on 16 different occasions. The U.S., where the modern computer was invented, has not yet issued a stamp for our industry—it is long overdue.

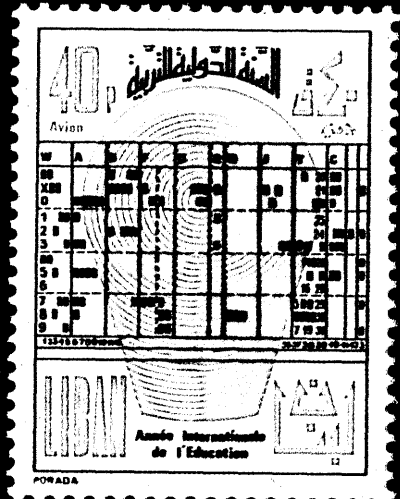
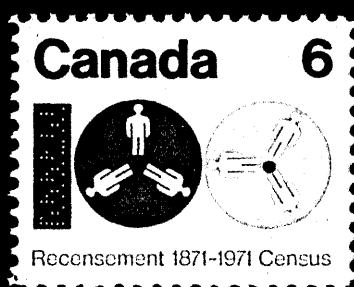
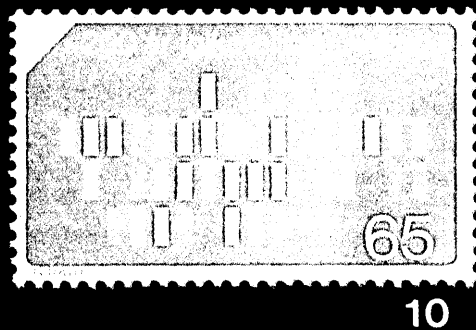
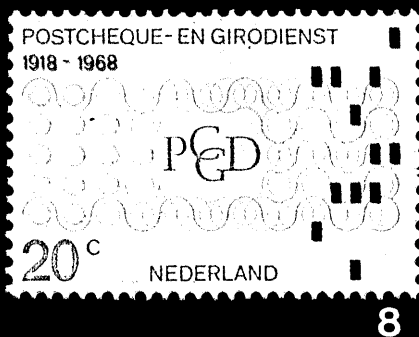
Some of these postal miniatures honoring our industry are presented here, with short histories of their issues.

The first computer stamp was issued in 1964 [1] as part of a set issued to publicize Israel's contributions to science. In 1966, a computer appeared on an East German stamp issued in February to publicize the 1966 Leipzig Spring Fair [2]. Later that year, a space conquest set of Czechoslovakia

included a stamp showing the binary code [3].

Russia entered computer philately in 1967 with this stamp issued to commemorate industrial progress [4]. “Computer tape” is included in the official description of the design.

1968 saw several computer stamps issued. A “humanized” computer appeared on three Tunisian stamps issued to publicize the introduction of electronic equipment into the postal service [5]. Colombia issued an air mail to commemorate the First Data Processing Congress in 1967 held in conjunction with the centenary of the National University [6]. The official designation of the design is “computer



Computer Postal Art

by M. W. Martin

symbols." The 1968 Australian set issued to commemorate the 9th International Congress of Soil Science includes a stamp whose design represents "soil testing through chemistry and by computer" [7]. Punched cards on stamps first appeared in 1968, from the Netherlands—the leader in number of "computer" stamps issued. One of them [8] appeared to commemorate the 50th anniversary of postal checking service. In 1971, the Netherlands issued another punched card stamp [9], to commemorate the 14th national census.

Norway issued a stamp with a punched card in 1969 [10] to commemorate the 200th anniversary of the first Norwegian census. The 1969

UAR (Egypt) issue to publicize the International Congress for Scientific Accounting, Cairo, was a stamp depicting ancient arithmetic and a computer card [11].

Only one set of computer stamps appeared in 1970. It came from the Netherlands and it shows various designs made by a computer. The designs include: isometric projection from circle to square [12], parallel planes in a cube, two overlapping scales, transition phases of concentric circles with increasing diameters, four spirals.

Three countries joined the computer stamp club in 1971. Canada issued a census commemorative depicting a punched card as part of the design

[13]; Poland honored the 6th Congress of Polish Technicians with a stamp depicting punched paper tape [14], and Lebanon issued two air mails (same designs but different values and colors) depicting punched cards as its commemoratives of the International Education Year [15].

In June, 1972, the Republic of Ivory Coast issued a stamp dedicated to *Informatique-Development*, which might mean it is intended to publicize the development of information techniques. The design shows a girl operating a key punch, with other edp paraphernalia in the background, but the stamp had not yet arrived in this country when this article was prepared. □

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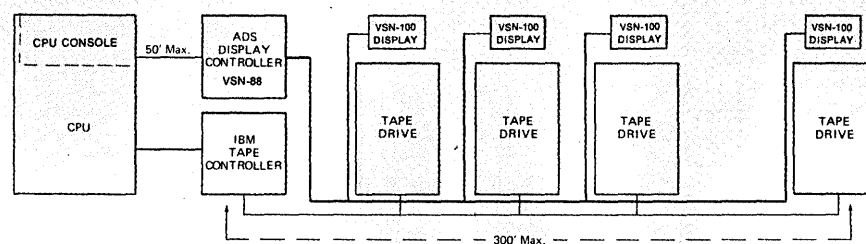
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There are several good reasons for users disliking the manager of data processing services—and some ways of changing their attitude

Why Are DP Managers So Unpopular?

by John N. Petroff

"Can't you just push a couple of buttons and come up with the list by Friday?", asked my colleague from accounting. "Isn't that your job—doing our clerical work?"

That particular job would have taken our programmer longer to code than an accounting clerk would need to complete it. I sent him packing, but he was grumbling on the way out about how it used to be, when you could rig up a plugboard and shuffle a deck of data cards.

We run more than two shifts on our computer, sometimes three. We compute suggested customer orders, bills of lading, invoices, payroll, purchasing requirements, financial reports, departmental expenses, and a poor man's version of "time-sharing" for marketing information. The company couldn't run for a week without the services we provide.

This is typical of many companies, I believe. And yet, why are so many people moderately sore at the data processing manager half the time? I perceive several bases for this undercurrent of dissatisfaction: fright; disruption and difficulty; cost; reaction time; and what've you done for me lately?

Fright

Many a middle or first-level manager is scared of computing. And rightly so, because the computer can replace some jobs and allow combination of others through simplification and summarization. Also, he's scared that

fast, accurate computer reports are somehow going to shine a spotlight on his inadequacies and shortcomings, real or imagined. He's now recognizing that the fantastic computational power of our third-generation computers makes fast, accurate exception reporting possible. This means that top management can monitor performance of various functions against any criteria desired. Reports showing totals, ratios, and events falling outside of accurately defined parameters, outlandish to try for in a manual environment, now are easily and frequently available for the cost of a short computer run. These exception reports can be as long or as short as the various levels of higher management desire, and have the effect of increasing the visibility of all levels to their respective bosses. The view downward into the succeeding levels of the organizational hierarchy thereby becomes clear and bright.

This is a bone-chilling vision to a supervisor or manager who might be just a little unsure of himself anyhow, or naturally a bit paranoid.

Beyond that, many departments depend heavily on computerized data for their continuing life, while the managers affected have little authority over the processing. They have nightmares that a computer "screw-up" or downtime will someday prevent getting the monthly statements out.

It's obvious that a guy who's scared of you is not going to be a truly cooperating and contributing user, either during development of a new system or

in support of an installed one.

I won't waste your time with platitudes about "massaging his soul," "pumping up his ego," etc. We've all seen books and articles on the psychic needs of people at work. But demonstrating that your department has mature, professional abilities—and delivering high-quality, user-oriented service—will help a lot. Talking to the user in English about his problems could also help make him trust you a little more.

Disruption

A conversion of any scope is a horribly disruptive event in any department. Cleaning up manual files for conversion always overburdens the work force and spoils their dispositions. Running parallel during change-over is fraught with problems. Worse still is that the old, comfortable work patterns no longer are appropriate, and people's habits have to be changed. I've noticed a direct relation between longevity on the job and tenacious affection for the old habits.

In short, bringing computing into a function just about turns the world upside down for the people affected, because seen through the eyes of an office worker, his job really is an important part of his total world. You may look on his function as an element of an integrated system. He looks on it as his entire work-world. And you, you outsider, are talking about a totally new approach!

One of our staff recently came back

DP Managers

from an AMA seminar with an extreme example of this syndrome. One of the participants told the story of an attempted accounts payable system. The trouble was, though, that Matilda, who had been doing the job manually for 14 years, was determined that the computerized system wouldn't work. So, she sabotaged the system whenever she could, and bad-mouthed it to management to the point that it was abandoned after a year, in favor of the old manual method. In this case the clerk was entrenched so strongly that management was reluctant to remove her. It looks like top management wasn't sold in the first place, either.

People don't really like change, and when a profound disruption of work habits and methods is involved, small wonder that the dp manager is one to be feared, avoided, and possibly torpedoed.

Cost

The data processing function is incredibly expensive, both in terms of dollars and human endeavor. Computing equipment is so expensive that it just about has to be run three shifts a day to pay off. Other office machines aren't surrounded by this urgency. Beyond that, dp personnel costs have already surpassed machine rental, not including input support costs borne by the users. And with ever-increasing "bang for the buck" in hardware, this trend will continue.

Computer professionals are highly paid, making the fruits of their labor the more expensive. Particularly with third-generation equipment, all this makes it really hard to justify a new application on the basis of clerks replaced. Much tedious clerk-work has already been displaced anyhow.

In spite of continuing developmental effort, clerical costs and other costs continue to rise. Management often asks: "Just what does computing really contribute?" It surely isn't reduced costs! The high cost of data processing must be justified in terms of management quality. Our contribution must be to help managers at all levels achieve a higher level of excellence.

This is a difficult concept to sell. And it's still harder to calculate a return on investment for decision-fueling computer output. Until we can achieve the maturity that industrial engineering has with respect to analyzing and justifying capital expenditures, we will continue to be criticized for the high cost of our function by management at all levels.

Who gets the benefit of the high-cost data processing service? As long as

its cost is charged entirely to the dp manager's budget, it's going to be the squeaky wheel getting the grease. No matter how formal and orderly the selection of new applications is, as long as the user doesn't have to pay for the service he's going to ask for everything. This puts the dp manager in the bad position of turning down requests because he thinks that they are not as economically justified as others. Small wonder that so many fellow managers are sore at the dp manager.

Reaction time

Our company recently introduced a new product into a new region. Although we knew it was in the offing, our department wasn't given exact details until shortly before the first shipping date. Some of our computer programs were limited as to number of regions and wholesalers. We instituted a round-the-clock crash test of the system, and corrected all programs that failed. Luckily for us, we were able to add the new requirements to our system on time. But what would have happened if we hadn't? We could have found the dp department in the spot of preventing the introduction of our new product.

It's sad, but true, that for most of us our reaction time is long. We are taken for granted when we can react quickly with some sort of "college try" and reproached when we can't. And the more often we stave off disaster with such a crash program, the more difficult it becomes to preach proper lead time for excellent system design and implementation.

What have you done for me lately?

The more we succeed in our mission to establish smooth-flowing systems, with painless inputs and timely and accurate outputs, the less visible becomes the wondrous work of the department—to the point that users don't notice it any more, at least until we make some kind of error, resulting in incorrect processing. Our third-shift operator recently entered a bad date code on the console and our general ledger was computed with no activity for the month. I had about half of the managers of the accounting department in my office a half hour before the start of the next business day, using language customarily reserved for describing an earthquake or a prison riot. Now, we compute that report every month, and have for years. Does a six-man delegation meet me in my office when it comes out right? Hardly. Just when it blows.

Equally visible and irritating to the users are the projects that get turned down. It's easy for them to get the feeling that they are not getting service

from the data processing department because half of their requests get turned down. I got the accusation recently from one of our vp's that we aren't doing anything for his area. The fact turned out to be that about one quarter of our monthly computer output goes to his department. Quantity, yes; quality, yes; visibility, no.

Low visibility of ongoing production is an admirable goal, I think, but not one that earns many points for data processing.

Observations

It has become increasingly apparent to me that the normal state of the dp function leads to user dissatisfaction.

This happens because our truly excellent work goes unnoticed while our failures and shortcomings, real and imagined, are painfully evident and magnified by their contrast, size, and drama.

I won't repeat the usual eyewash about communication, user involvement, etc. Not to deprecate these devices—it's truly important to establish good communication with users, and to educate them in some of the black arts of our trade so they can understand us better. Similarly, we need to turn our faces outward, away from our friendly in-group, toward our clientele; and to understand their views and pains.

Two remedies

Beyond these conventional public relations measures, I can recommend two specific techniques that I believe have merit, and which help remove the negative factors mentioned above. One is the institution of a dp steering committee; the other is to convert the department from the usual cost center concept, to a profit center charging fees for the dp services rendered.

The dp steering committee must be instituted by the president of the company. Otherwise, forget it. The membership has to be the top decision makers of the company. The dp manager, naturally, is on the committee, and acts as executive secretary.

The purpose of the dp steering committee is to allocate the scarce resource represented by the dp department. It is called on to queue up all new applications beyond a certain size. Smaller projects would be accepted by the dp manager, or his boss, who should be a vice president. The limits of discretion for these two can easily be set in terms of man-months of dp professional time, according to each company's situation. Let's say the dp manager approves projects requiring up to 30 man-days of professional time, and his boss up to 90 man-days. Anything beyond that has to go to the dp steering committee for acceptance

and positioning in the queue—or rejection.

Having a steering committee puts the decisions where they belong. It is improper to allow the dp manager to make the decisions on future applications on behalf of the company. He almost never is in full possession of the facts concerning the company's plans. Beyond that, since he usually doesn't report to the president, there is a natural tendency to favor his own home group, even if his boss is circumspect about not influencing him.

The dp steering committee also supplies clout. Any new application big enough to be referred to it is bound to be a major one. All major new computer systems wreak a profound change on at least one department in the company, usually several. Once the top executives understand and support the new system—and this will be widely known throughout the company—many of the usual roadblocks and passive resistance just don't materialize.

Closely linked to the concept of clout is the function of progress monitoring. I won't get into the topic of project management here, but surveillance by the dp steering committee keeps the project team's collective feet in the fire. This also facilitates re-emphasis or restructuring during the project, as appropriate. If some project participant starts dragging his heels, or just can't seem to get around to doing his assignment, you can cause the heat to be put on by the top man in his function. Or if more resources are needed by data processing, the steering committee can help get them.

An added benefit is that the dp manager is excused from being the dirty guy when projects are to be rejected, because the steering committee does this for him.

I also believe strongly in a fee-for-service basis for the dp function, the other technique I recommend. This fee includes operations and development, plus a surcharge to cover overhead.

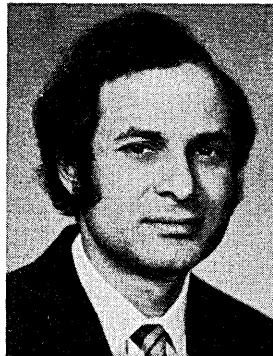
The prices charged should be reasonable, to avoid discouraging legitimate use of computing. The computer charge should cover operators, as well as the machinery. Key punching should include the cost of the supervisor as well as the machines and operators. I even suggest that paper be charged for separately with preprinted forms going directly on the user's budget. Systems and programming should be charged at nearly the hourly rate of the pay grades involved. Obviously, this forces dp management to keep a sharp eye on idle time in the development staff. This also means, really, that the dp department has to have a small budget to cover these idle moments and the use of its own services. Granted, this amounts to a subsidy by the company

to the departments benefiting from systems and programming work. I think that this is desirable, because department managers have a tendency to restrict their thinking to the confines of their own department, and also to the time span encompassed by the current budget, plus maybe next year's. A modest subsidy in the development of dp applications is the price the company pays for a wider and longer perspective than this.

When you send a bill out every month, each user will be reminded, sometimes forcefully, that the dp department has in fact done something for him lately. Moreover, charging fees helps the company put the costs of the dp service in the same department as the benefits. The requestor himself can often decide whether his request is economically defensible. He will be much more receptive to system improvements, toward summary and exception reporting versus runs of all detail, to the elimination of some reports, to weekly instead of daily, monthly instead of weekly, etc. Careless input will cost him more in data conversion. User-caused reruns are charged to his account.

When a fee for service is involved, the whole image of the contribution of the dp department changes, allowing this resource to be evaluated and bought by the beneficiary. With the dp steering committee, resource allocation becomes much more rational. Moreover, a user who pays for the service involves himself much more with his systems than one who gets this powerful support for nothing.

Finally, being monitored by the dp steering committee and charging for services creates a new set of attitudes in the dp department, powerfully biased toward efficiency and high-quality service. □



Mr. Petroff is the manager of management information services for a consumer products firm. He has a varied background in data processing, having worked for a computer manufacturer and a consulting firm, here and in Europe, as well as a major retailer. He has a BBA degree in general business and an MBA in management.

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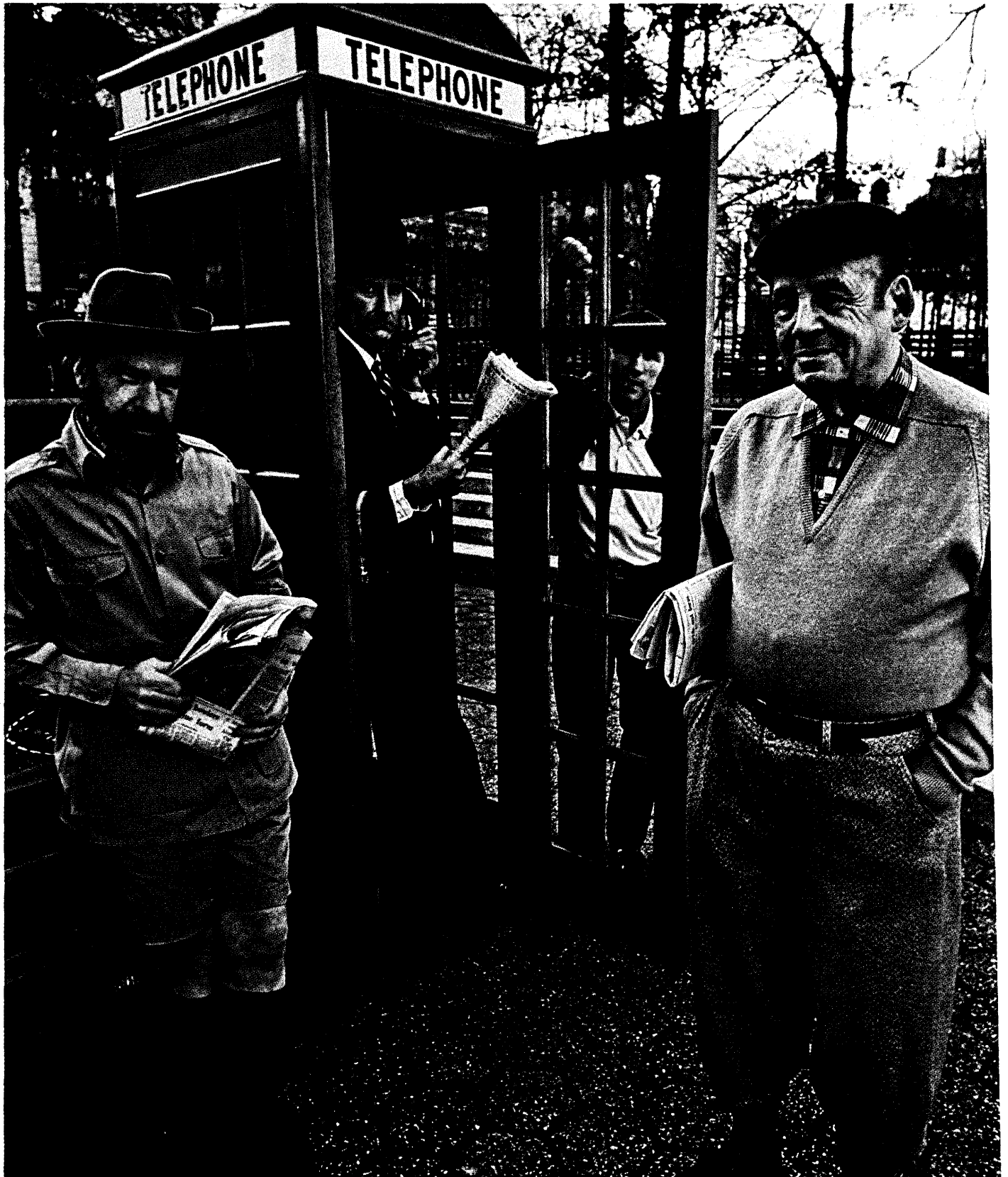
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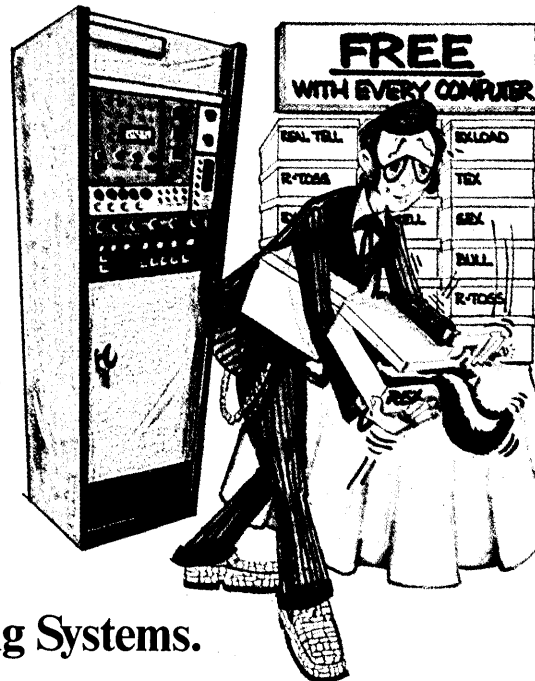
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Vendors have warned their customers not to clean disc packs, with good reason, but new techniques may eliminate the risk of damage

Disc Packs: The Cleaning Debate

by Joseph M. Ludka

Almost since its inception, the removable disc pack has been accorded a unique, but unenviable position in the computer room. . . . it is about the only product in regular use which does not enjoy the benefits of a preventive maintenance program. At a time when 7 to 10% of the annual dp budget goes for maintenance, the disc pack is completely ignored. The anomaly of this situation is that the entire installation is dedicated to generating, processing and storing data in machine-recognizable form, yet little if any concern is shown for its expensive end product, data, which is stored on the pack.

Data processing management has been involved in the "To clean or not to clean" controversy for several years. "Should we clean our packs, or have them cleaned? And if they are cleaned, what benefits will result?"

"Is there a risk involved in cleaning packs? Can packs be harmed by cleaning? Will data stored on packs be affected or damaged by cleaning?"

"What do disc pack and disc drive manufacturers have to say about cleaning packs, and why?"

Nearly all pack and drive manufacturers are agreed that they do not want the customer to clean his packs. They have so advised their customers, when asked. But during repeated tellings, the statement has been inadvertently twisted, until the customer is now often advised that, not only should he not clean his packs, but that packs do not need cleaning. Whether a customer is told not to clean his packs, or that they do not require cleaning, the end result is the same: he keeps away from his packs.

The position of pack and drive man-

ufacturers regarding customer pack cleaning is understandable. The manufacturers have known from the start that pack cleaning, when performed by someone not thoroughly trained in proper cleaning procedures, often does more harm than good. They feel that tongue depressors, tissues and alcohol bottles are potential lethal weapons when put in the wrong hands. In short, the evils of contaminated packs are less than those of damaged disc packs.

Manual pack cleaning also has not proven to be particularly effective. A contamination-caused data check can sometimes be removed, albeit temporarily, by manual cleaning, which is good. However, there is an equal chance that the contaminants will be spread over a wider area, compounding the problem, or worse yet, discs can be bent while the tongue depressor is being inserted between the surfaces, with catastrophic damage resulting to pack, drive and data. Is there any wonder then that manufacturers advise their customers not to clean packs?

In actual practice, whenever re-tries, reassignments, read-write errors and data checks are experienced, the customer engineer attacks the problem, armed with the self-same tongue depressors, swabs, tissues and alcohol bottles. His number one rule is to try to alleviate the problem by cleaning the pack. His actions are completely contrary to his earlier statement that packs should not be cleaned, or do not require cleaning.

The logical conclusion is that disc pack and disc drive performance is definitely enhanced by cleaning, but that manual cleaning is far from satisfactory, even when done by trained

personnel, and potentially disastrous when performed by untrained people.

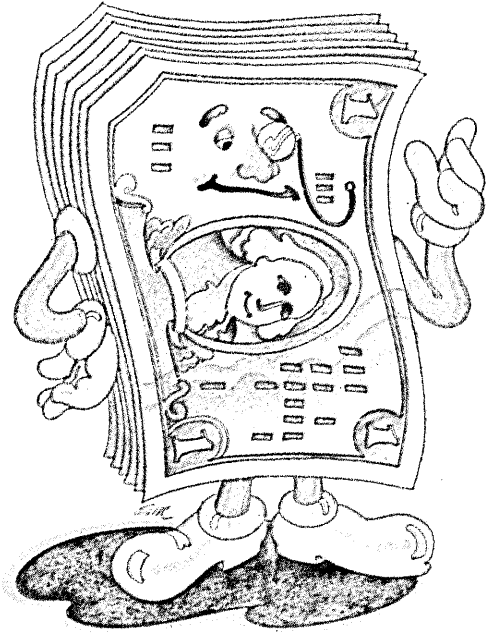
On the positive side, computer industry history reveals that periodic cleaning of magnetic tape, a sister storage device, has long been recognized as beneficial. However, it was not always so. Tape cleaning proponents fought long and hard to achieve their current respected status. Their most important asset was a cleaning device which was completely automatic, which cleaned tape with a minimum of human involvement. The automatic tape cleaner eliminated the swab jockeys from the scene.

Similarly, disc pack cleaning has become far more sophisticated since its introduction in 1969. The user now has available devices which are completely automatic in all functions. The operator has only to mount the pack, as he does on a standard disc drive, and touch a button. Nothing is left to chance. The automatic cleaner will remove virtually every bit of contamination from the pack, but will not damage the stored information, so it need not be removed before cleaning. In fact, an automatic cleaner is most dramatic and beneficial at times when a pack will not run because of a contamination problem. Cleaning will generally restore the pack to perfect operating condition, enabling the user to recover data. Consider some actual case histories:

Lou Gaghan, operations supervisor at Continental Airlines in Los Angeles, had a 2316 type pack which had been delivered to Continental with three factory-flagged tracks. Alternate tracks were assigned at the factory. In the first two years Continental used the

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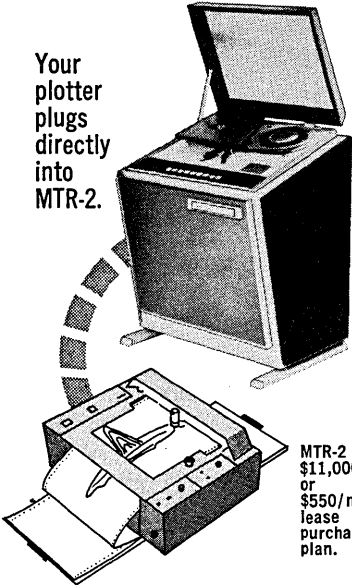
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Disc Packs:

pack, it developed six additional bad tracks, and alternates were assigned. Subsequently one of the alternate tracks also went bad, and a seventh alternate was assigned, bringing the total of re-assigned tracks on the pack to ten.

The pack was cleaned on an automatic pack cleaner, then was re-initialized and proved to be error-free. Cleaning had removed not only the seven contamination-caused flagged tracks, but had also removed the original three factory-flagged tracks. It was re-installed in the system, and more than a half year later was still performing perfectly.

Berry Bearing Co. of Chicago had four or five packs sitting around gathering dust because dp manager Gene Lewis found them unreliable. After automatic cleaning, they were re-installed in the system and are working perfectly.

Val Decker of Interstate Restaurant Supply in Los Angeles reported that Interstate eliminated about 95% of their re-tries through automatic pack cleaning. Read-write errors and data checks have been almost nonexistent since the pack cleaning program was instituted.

Fasco Industries in Rochester, N.Y., had an interesting experience. Manager Tony Mineo reports that they had three packs cleaned in a test demonstration. The packs selected were worst-case packs. Two had been removed from service because of recurrent data checks and resulting unreliability, and the third could not be brought up for a job over the preceding week end. The packs were cleaned, the pack which would not come up ran perfectly, and the job was completed without incident. The other two were reinitialized and put back into service, and have been performing reliably since.

At Marine Midland Services Corp., Syracuse, N.Y., some unusual disc problems occurred. Marine Midland was in the process of changing pack suppliers. New packs were initialized and then data was transferred from the packs being replaced. Because of new packs used, errors encountered were quite surprising. All packs were then cleaned on an automatic cleaner and found to perform much more efficiently. Readability on both new and old packs improved 85% with the automatic cleaning.

Last spring, Corning Glass Works in Corning, N.Y., was flooded. Their disc packs were under eight feet of muddy water for close to 48 hours and were completely caked with mud after re-

covery. They were brought to Marine Midland's Syracuse computer center and cleaned on an automatic cleaner. As a result, over 80% of the information was recoverable.

Jim Renze, manager of the unit test department at disc drive maker Marshall Data Systems in Torrance, Calif., credits automatic pack cleaning with elimination of nagging problems due to dirty packs.

At Xerox in Rochester, N.Y., manager George Schmutz had a 2316-type pack which he could not use because of frequent data checks. He said that he would become a believer in automatic pack cleaning if this pack could be restored to reliable operating condition. The pack was cleaned, re-installed, and is performing perfectly.

The immediate benefits of automatic pack cleaning, as detailed here, are readily apparent. There are also numerous continuous long-range benefits accruing, such as improved total system performance, elimination of down time because of data checks, elimination of delays for alternate track seeks, and elimination of the costly replacement of packs which "suddenly" go bad.

Automatic disc pack cleaning has progressed rapidly, and a user now may purchase or lease his own cleaner, or subscribe to competent cleaning services, where qualified people, equipped with automatic equipment, come into the user's facility to clean his packs as required. It remains for the user to sample the benefits of automatic disc pack cleaning, and perhaps to discover that many problems that have been diagnosed as technical may, in reality, be nothing more than contamination buildup on his packs. The computer industry appears finally to have found an effective way to provide preventive maintenance for its most important product, data. □



Mr. Ludka is president of Randomex, Inc., Palos Verdes Peninsula, Calif. He has been engaged in disc pack manufacturing and marketing since 1968 as director of marketing for Datatron Disc and CFI Memories and as president of Athana Corp. He has a BS from the Univ. of Houston.

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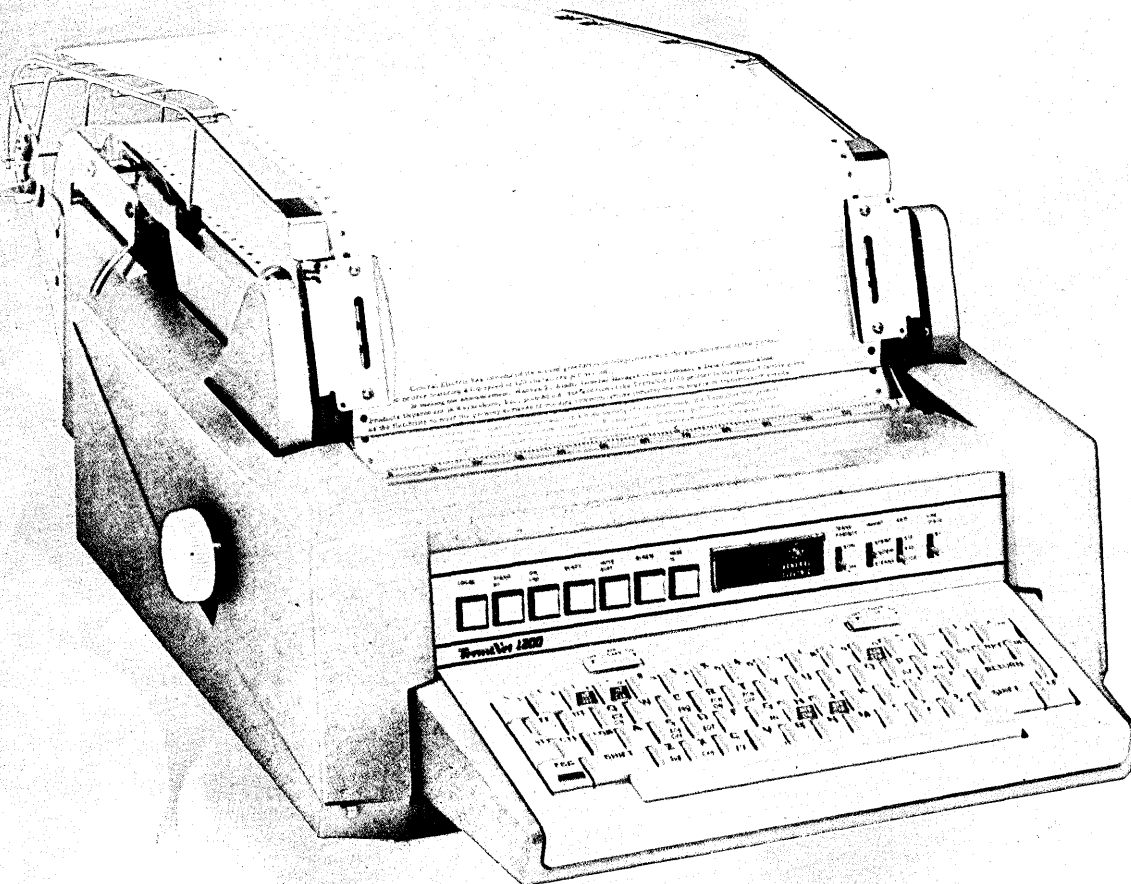


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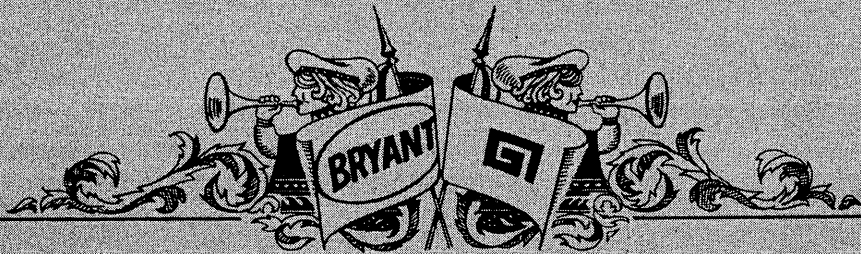
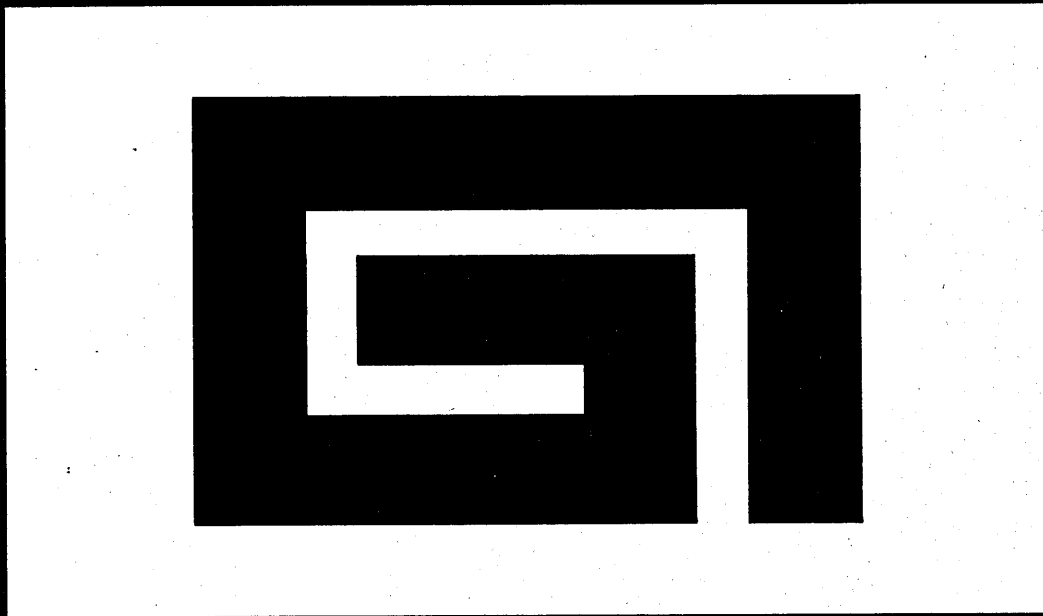
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CAI Techniques for Information Retrieval

by Peter H. Huyck

Judging from the trade press, information systems are inevitable: an idea which has come into its time. To make these systems more accessible, a method of communicating with them will be required which is radically different from the programming languages we have today. Further, the general expectations people have from such systems go beyond what can be provided by the current state of the art. This article discusses some aspects of improving the user interface and enhancing system usefulness in the light of current and projected technology. It is contended that Computer Aided Instruction (CAI), insofar as it has progressed beyond merely electronically turning the pages of a programmed instruction booklet, provides an indication of the direction information systems will take.

The following revealing passage, which appeared in an article on the Japanese computer industry in the late *Information Week*, makes an essential point clear:

"Probably the most important obstacle to the growth of the software industry [in Japan] is the general inability of the Japanese to recognize value in 'invisible' things. The Japanese appreciate computer hardware, but do not have the same appreciation for software. A change in attitude will take time."

The information systems of the future will indeed be built of invisible things and, of the programming languages that we are familiar with today, those of the Coursewriter® type most closely resemble the tools with which they will be built. When CAI technology is extended to information systems, data base creation and administration will resemble the role of the teacher, and the data base user that of the student. Just what such systems will do is a little hard to say. Today "information retrieval" really means "document retrieval"; the information wanted is in the document, and a human is required to abstract it from the document. Current retrieval systems are based on a computer architecture which was designed primarily for computation, an architecture that is being severely

strained by the new demands of information.

The notion of information is not well defined; no generally accepted definition is available. What information is depends on what question is being asked. For example, if we ask a management information system "What is the median draft lottery ranking of our draft age employees?" and we get back "187," we have information. If, on the other hand, we get back 200 personnel records, or even 200 individual lottery rankings, we have data, which must be further reduced to produce the information we want. The purpose of a computation system is, of course, to develop information, which involves the reduction of data. However, a computation system works only by algorithm, which should not be the case with a more general information system.

A computation system has data to be found in the future embedded in logic prepared in the past; an information system has logic to be found in the future embedded in data prepared in the past.¹ There is a further difference between the two types of system which parallels the difference between mathematics and natural language. The primary characteristic of natural language is metaphor. Dr. Johnson defines metaphor as: "gives you two ideas for one." Actually, it gives you two or more ideas for one. In modern terminology this is called sort-crossing. In mathematics, the axioms are the primitives of a carefully analyzed metaphor, and in the deductive process there is no sort-crossing as there is when language is used naturally.

Because their operation is discrete and deductive, digital computer systems have no sort-crossing. Approximation fitting or inexact matching is the closest thing to metaphor in digital computers. They can do close approximation by comparing sub- and supersets of an argument bit string with members of an information universe of similarly constructed bit strings. The state of the art of analog computing is so primitive that it is difficult to specu-

late what might be forthcoming from that direction.

An information system must be able to perform induction as well as deduction; such a system is not currently available. A deductive system can only marshal for you what is implicit in its coded logic. In this framework, there are two possible senses of machine induction. If you have a model A, to recognize that this model also fits to some degree B is one act of induction. Further, to now adjust model A so that it more nearly fits B is a second act of induction. Both of these acts are statistical in nature, and both can be done in a digital computer using the technique of inexact matching with a scale-of-relevance procedure attached to it. A human mind can take the "best" fit because it has much stored experience and intuition and it also may not be a digital machine at all. An ideal information system will limit the inexactness of the fit to be tolerated by including a human being in the loop via CAI technology to make the final resolution.

True induction, on the other hand, may be wholly a matter of loosely fitting one's preconceptions onto things by metaphorical sort-crossing. To quote Margaret Masterman: "This . . . process also is a form of inference in a wider sense of 'inference'—in the sense in which 'inference' is literally any kind of permission to pass from one unit or sequence of units or states of affairs to another unit or sequence of units or states of affairs—but it is intuitive; it does not go by rules." If this is the case, including a human mind in the loop is essential.

In a digital computer, the approximation fitting is straightforward and is, in fact, algorithmic. However, it need not be algorithmic, and in the information systems of the future it probably will not be. How does one get non-algorithmic behavior from a computer? Random number generators are an attempt to do this. But with the current state of the art, the best way to generate meaningful, nonalgorithmic sort-crossing with a digital computer is to establish a mixed-initiative dialogue between the computer and a human

¹ See "De Ludi Natura Liber Secundus," *Datamation*, Dec. 1, 1971.

being.

Current implementations of high level languages which attempt to look like natural languages lack completely the essential property of natural language, which is metaphorical extension or sort-crossing. When Shakespeare said "the seamy side of life" his audience was very much aware of the sort-crossing between the inside of garments and some aspects of life; this will never happen with the phrase "TIME__CARD (JOB__CODE)." Yet there is a way that men can relate to machines in natural language, and computer-aided instruction technology, insofar as it is capable of handling unanticipated and ambiguous input, offers the key.

No matter which of the memory technologies currently being investigated proves to be most economical, one can anticipate that the truly large storage units of the future will be used in the following way. A user will select a storage unit of appropriate size and peripheral devices suitable to his application. He can then shape his information universe by selecting an organization for the storage unit. He will further select the purely computational operations which are necessary to reduce his data to information relative to his application. These could range from the simplest logical operation to the most complex algebraic function. He will also have at his disposal a dialogue program generator similar to those used in CAI. The dialogue program generator will produce dialogues which require no knowledge of computers to use. Persons conversant with the particular information universe will write dialogues which will allow users to do two things: obtain information from the data bank, and modify the indexes dynamically employing their inductive grasp of the subject matter. These dialogues when compiled will result in programs which conduct mixed-initiative, interactive, informational conversations with the user on one hand, and interface to the computational operations which reduce the data on the other. Remember that the technology may permit such dialogues to take place in full two-way audio between man and machine.

For example, a lawyer might have many uses for information from a data bank, such as checking precedents on a case. The lawyer would interface with the data bank through a series of interactive dialogues written not by a programmer but by another lawyer who is familiar with the requirements of checking precedents. Thus, the original logic of the subject matter is added by a lawyer, while the subsequent logic of

the data organization is controlled by an interpreter (not a compiler) which becomes a tracking model of the data bank, based on the intuitions of the user. The end user of the system, as well as the designer of the dialogues, is aware only of the logic of the subject matter. If this scenario is accurate, one of the mistakes of the past is clear: in the future we must try to build people into the system rather than try to exclude them. The direction suggested here offers an application-tailored approach which, at the user interface, is both nonprocedural and presented in natural language.

It has frequently been said that programming must become more of a science and less of an art. Those who say this usually mean that they would like to see more sense of history within programming; the concretions of generations are the daily business of professionals working within the idiom of their discipline. What is really required in programming goes much deeper: there is a need to enrich the metaphor and broaden the presuppositions of the discipline. Any metaphor, whether scientific, poetic, or otherwise, springs from the culture. Our culture is now heavy with talk of "information" and perhaps we are on the verge of forging new metaphors. Models for information science which will do as much for programming as the atom did for physics are an exciting possibility. However, sadly, there is some truth in the wry observation that while scientists stand on each other's shoulders, programmers stand on one another's toes.

Some sort of dualism seems to hold in the world. This is variously characterized as analog vs. digital or continuous vs. discrete. We live in both worlds, while digital machines live in only one. Language is appropriate to us, but only mathematics to them. The attempt so far has been to design an information system in the discrete world of indexes and addresses. CAI technology holds out the possibility of building a hybrid system using the computational powers of machines and the metaphorical power of man.

It is incorrect to make something unique of science; science springs from the same source as all other human intellectual pursuits. Science is aesthetic and science is pragmatic. Further, all fields of human endeavor are inter-related. It is narrow to think of Plank's constant independently of Duchamp's "Nude Descending a Staircase." Before programming can advance in an informational direction, it must have an enriched metaphor to deal with the consequences of dualism. Of course, it is wise to be aware that metaphor itself is a metaphor. Still, interesting similarities between information and energy

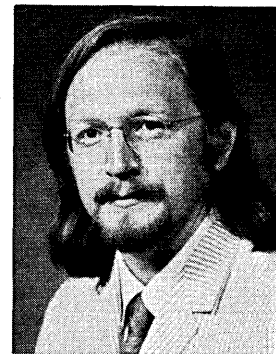
and between the classical laws of logic and of thermodynamics can be seen.

That man cannot know things, but only images of things, led ages ago to a belief in sympathetic magic: that things can be manipulated by manipulating their representations. Programmers are enabling mankind to achieve its childhood dream of making things obey its words. However, as programmers paint the continuous world into the discrete, they must learn more about the relationship of their models to reality. The three basic tenets of the Cubist movement in painting were formalism, realism, and the realization that canvas was flat. In programming we have no lack of art for art's sake; realism will be forced upon us as users more and more demand that their computers be useful as well as ornamental; but the important realization that the medium is discrete and the world is continuous has not yet come to programming.

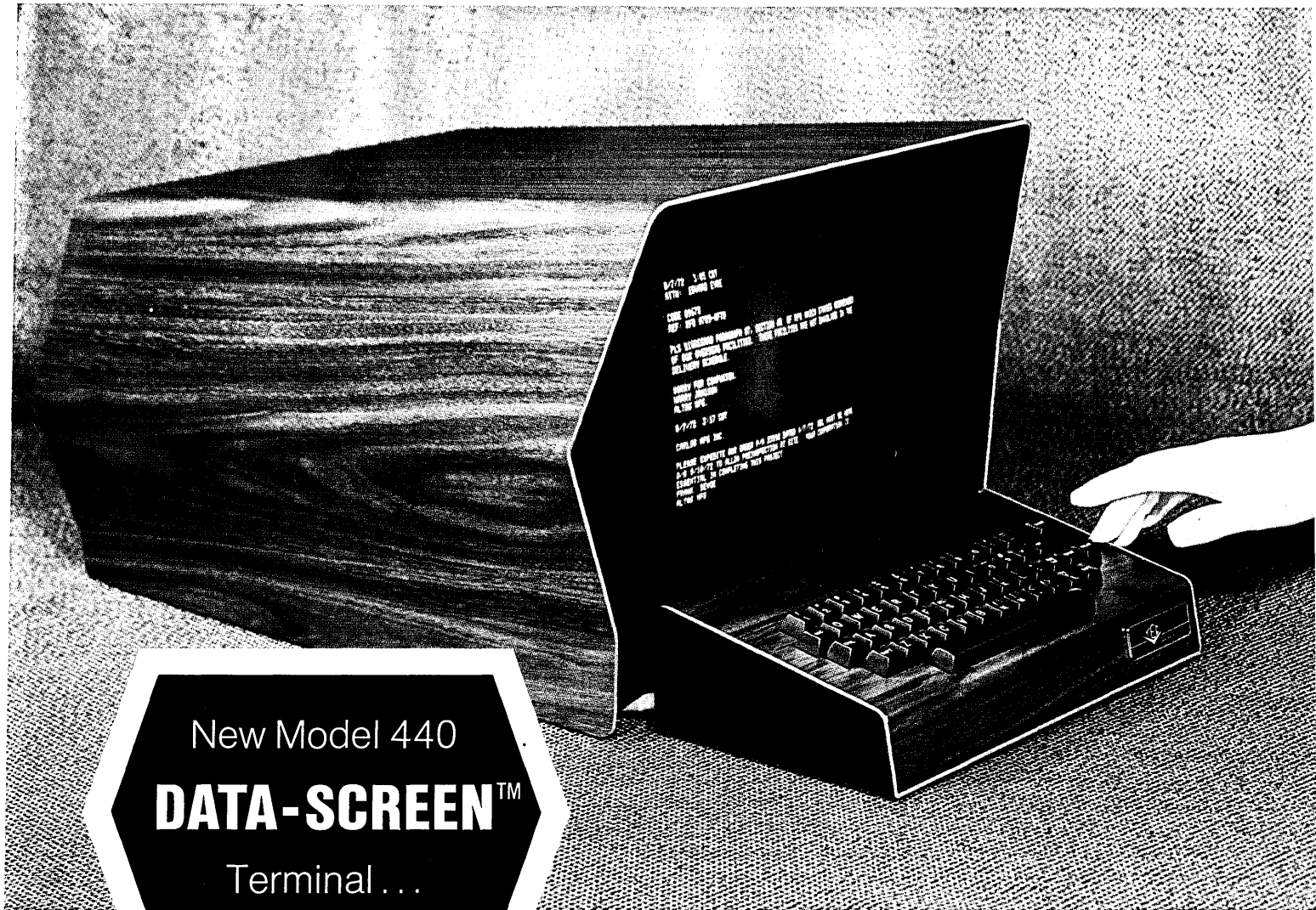
Acknowledgment. Most of the notions presented here were developed in correspondence and conversations with Lucian J. Endicott, Jr., of the IBM Corp.

Suggestions for Further Reading

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Mr. Huyck is a systems analyst with the Measurement Research Center, a division of Westinghouse Learning Corp. He was formerly with IBM and is a graduate of the University of Iowa.



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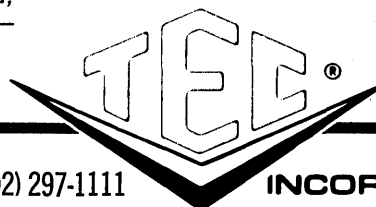
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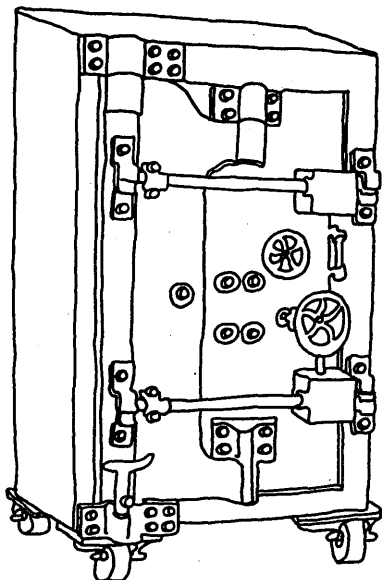
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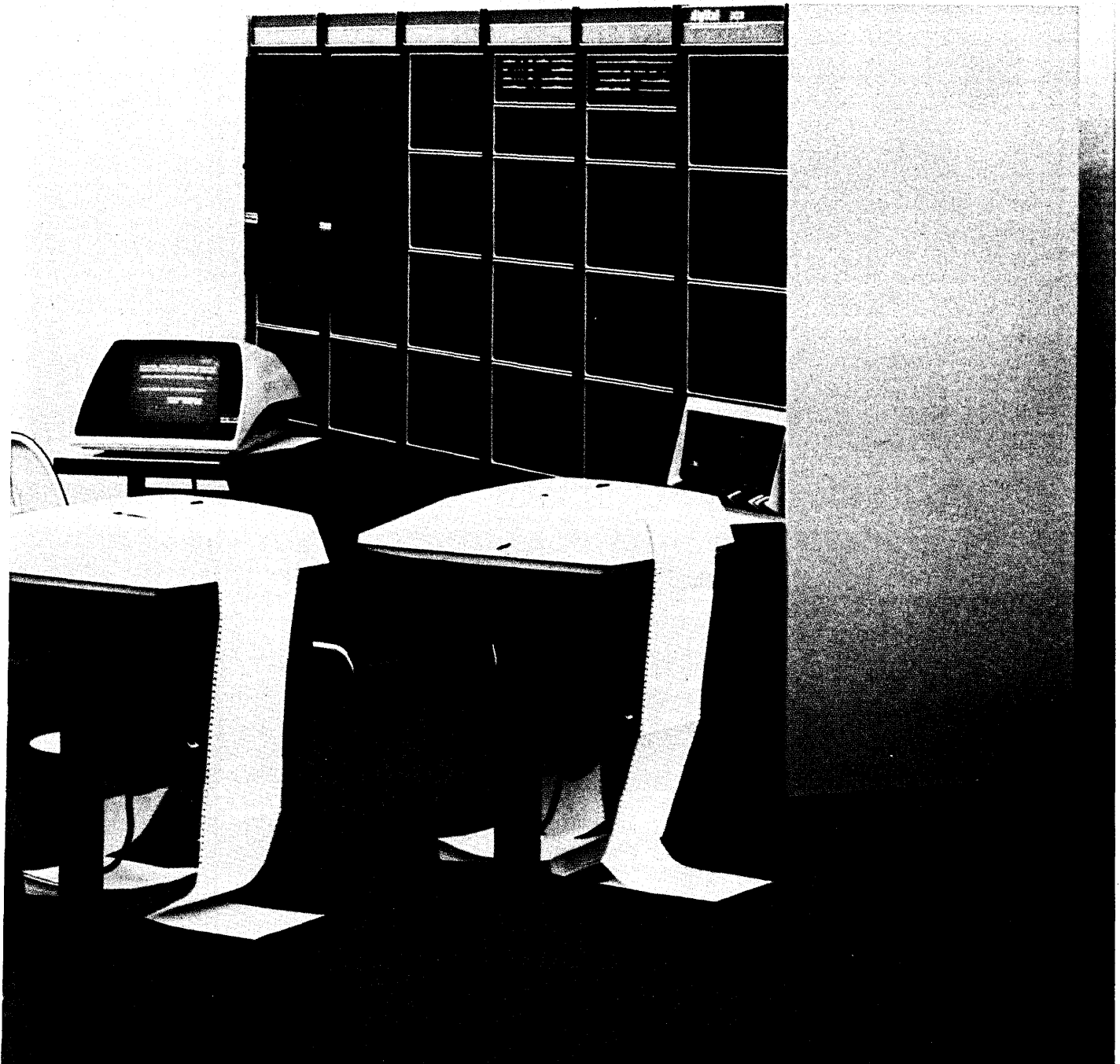
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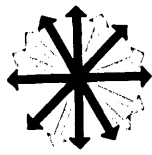
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News in Perspective

Itel Corp. has some success in its court efforts to keep its add-on memories installed on IBM machines overseas. A West German court granted a preliminary injunction stopping IBM from removing a 360/30 from a customer with Itel memory. And Itel will prosecute a similar case in a French court, page 103...

Can West Germany's Nixdorf Computer compete with established U.S. concerns? On page 106, the question is studied as the Nixdorf organization prepares to step up marketing and assembly efforts in the U.S.

How do you centralize regional data centers and still maintain credibility with users? In the case of California's State University and Colleges network, everything that could go wrong, did, page 114. But there's a happy ending...

How did Jerry Schneider successfully steal \$1 million worth of supplies from the phone company and then form his own firm to sell them? Schneider, who tells of his exploit on page 121, has formed a new company, EDP Security, Inc....

AT&T is under pressure to ease its rigid policy against foreign attachments. On page 123, a major confrontation between Ma Bell and the FCC is predicted.

Antitrust

IBM-CDC Settlement Cripples Justice Discovery Mechanism

When IBM reached its legal settlement in the Control Data antitrust suit, it may well have settled the Justice Dept.'s case, too, although not precisely in a legal sense.

The Justice Dept., hampered by a thin staff in its pursuit of its antitrust case against IBM, was relying heavily upon Control Data for its discovery mechanism for the production of pertinent documents in the case. The number of documents and papers that IBM has produced in the case has been overwhelming—millions upon millions of papers, estimated to weigh nearly 90 tons.

"There are only two sources in the world that could handle this kind of documentation in the way it has been handled, and they are IBM and Control Data," said the Justice Dept.'s top man on the case, Raymond M. Carlson, in late November when he referred to the gargantuan task of sifting through the IBM documents.

The burning question now is: How can the Justice Dept. prepare an adequate case now that it can no longer count on the assistance of Control Data? At the November proceedings in the Justice case against IBM, Carlson elaborated further about his dilemma: "At the state of the case that we are in, the data automation process and the expert handling of data is in itself such a highly specialized field that the handling of bulk documents in the 25 million range is one that takes specialist approach."

Technically, of course, most of the IBM documents are available to the Justice Dept. It is simply the problem of sorting through the millions of documents and arranging them in a manner so as to be useful to the Justice case that is mind-boggling.

When Control Data asked for IBM documents and papers, the Minneapolis company was stunned when IBM produced more than 27 million documents. Control Data's attorneys quickly found that the case was 20 times as complicated as they had originally estimated.

The key is an index and automated information retrieval system that Control Data had prepared to access the data base it had developed from the IBM documents. Neither the index nor

the retrieval system will be available to the Justice Dept. In addition, IBM has been successful in protecting many of the documents from use by Justice by alleging they are confidential.

No comment from justice

A spokesman at the Justice Dept. said there will be no comments on any aspect of the case. As a reason, he cited a court order that restricts Justice and IBM officials from discussing the Justice Dept.'s suit against IBM with the press. The press gag order was initiated by IBM.

Although IBM and Control Data had been talking settlement for several months, the out-of-court settlement—when it was announced on Jan. 15—nevertheless caught the industry by surprise. Control Data achieved satisfaction on few of its initial legal complaints against IBM, but it won several attractive business concessions in the deal. CDC's stock spurted upon announcement of the settlement.

The bare bones of the settlement are as follows:

1. CDC purchased IBM's Service Bureau Corp., which had revenues of \$63 million in 1972 and earned \$1.5 million after taxes. IBM also agreed to provide for reimbursement of \$2.6 million a year for 10 years for retirement and other fringe benefits of current Service Bureau employees. IBM also agreed to leave its equipment installed in some 40 SBC offices without rental charges—a measure that represents an estimated \$5 million subsidy. CDC acquisition of the Service Bureau Corp. probably makes CDC number one in revenues in the data processing services business with an estimated 6% of worldwide revenues in that industry.

2. IBM granted CDC research and development contracts totaling some \$30 million over a five-year period for work in the areas of magnetic storage, terminals, transaction-oriented software, and data service networks. CDC's annual budget for R&D and product improvement has been running between \$40 and \$50 million.

3. The two companies also extended a worldwide trust licensing agreement until June 30, 1978. This measure did not carry any monetary value, but

many believed CDC came out one-up in the deal, since it had been expected that IBM would charge CDC between \$4 and \$6 million for the patent rights.

4. IBM also agreed to reimburse Control Data "for expenses including legal fees in the amount of \$15 million." It is understood that this amount included CDC's costs for developing the index and automated information retrieval system for the data base of IBM documents.

5. IBM also agreed to drop antitrust charges against CDC. In its suits, IBM had asked that CDC divest itself of its Commercial Credit subsidiary and charged that CDC had lessened competition in the data processing industry by acquiring over 50 companies in that field. Few, however, felt that this

charge could have held up anyway in view of IBM's willingness to sell its SBC to Control Data.

A joint release

The settlement was announced in a joint release by William C. Norris, president and chairman of the board of CDC, and Frank T. Cary, chairman and chief executive officer of IBM. CDC had filed the suit in December of 1968. The Justice Dept.'s suit was filed the following month.

The removal of Control Data as an opponent to IBM in the antitrust arena is expected to have little effect on two other active antitrust suits against IBM—one instituted by Telex, the other by Greyhound Leasing Corp. The Telex suit is scheduled to go to trial in Tulsa

April 16, and Greyhound's is under appeal in San Francisco following dismissal of the initial charges against IBM last year. Both cases focus on narrow areas of the computer industry—Greyhound on leasing, and Telex primarily on attachment of peripheral equipment to IBM equipment.

The Control Data case, however, represented a sweeping and broad suit against IBM. The continuation of a broad spectrum case now remains in the hands of the Justice Dept., and—with Control Data out of the picture—it is not clear whether Justice can continue effectively.

According to Richard G. Lareau, CDC's general counsel and a director of that company, CDC began receiving IBM documents in the summer of 1970

CDC's Norris: Lack of Persistence Pays Off?

The King was in his counting house counting all his money last month, and undoubtedly grinning his tight, wrinkled Nebraska farmer grin.

But hardnosed Bill Norris, chairman and president of Control Data Corp., probably didn't take much time to savor what he undoubtedly classified as a triumph over arch-enemy IBM.

He was undoubtedly working, walking, swimming, or reading. The top executive and father of eight reportedly takes home two briefcases full of work each night after getting an early start at the office (often before eight). He walks two to four miles a day, swims daily in his indoor swimming pool, and reads voraciously.

A lot of the reading is devoted to company memoranda. "He reads memos even his vice presidents don't read," said one former CDC executive, who adds that such practices give Norris a detailed knowledge of minutiae that he is "constantly tracking. Nothing goes on in Control Data of any significance that he doesn't have an intimate knowledge of."

Such intimacy suggests a control unusual at that level in a company as large as CDC. Indeed, say some former CDC executives, Norris runs the firm almost single-handedly, surrounding himself with yes men and refusing to tolerate disagreement. According to one former colleague, Norris refuses also to confront those who question his final word, walking out of the office instead . . . "out of his own office."

Another ex-cohort agrees and says that Norris "has trouble with

people. He runs roughshod over people, chews them up. But he gets a fair amount of loyalty . . . he's not all that unlikeable."

The view of Norris from within CDC is predictably different. Asked if Norris surrounds himself with yes men, vp Norbert Berg says,



WILLIAM C. NORRIS
Did he give up?

"When Bill Norris says 'no,' I say 'no.'" Then he hastens to make sure you know this is a gag that Norris has already enjoyed. Berg says he has probably worked closer longer with Norris than anyone there and—because he has no aspirations to the presidency—has what he describes as an "easy, friendly relationship" with the blunt, earthy top executive.

Norris *does* delegate, claims Berg, who offers as proof the fact that Norris signed a corporate delegation policy developed by executives to show him what they needed to run their own shows.

Berg says that Norris was impressed by Vince Lombardi and distributed to management team members copies of a book about the late, great football coach. Maybe, suggests Berg, he was trying to show them he's like Lombardi "when he chews our butts." And, he adds, "he's never chewed me out. He's intolerant of incompetents, and we know it."

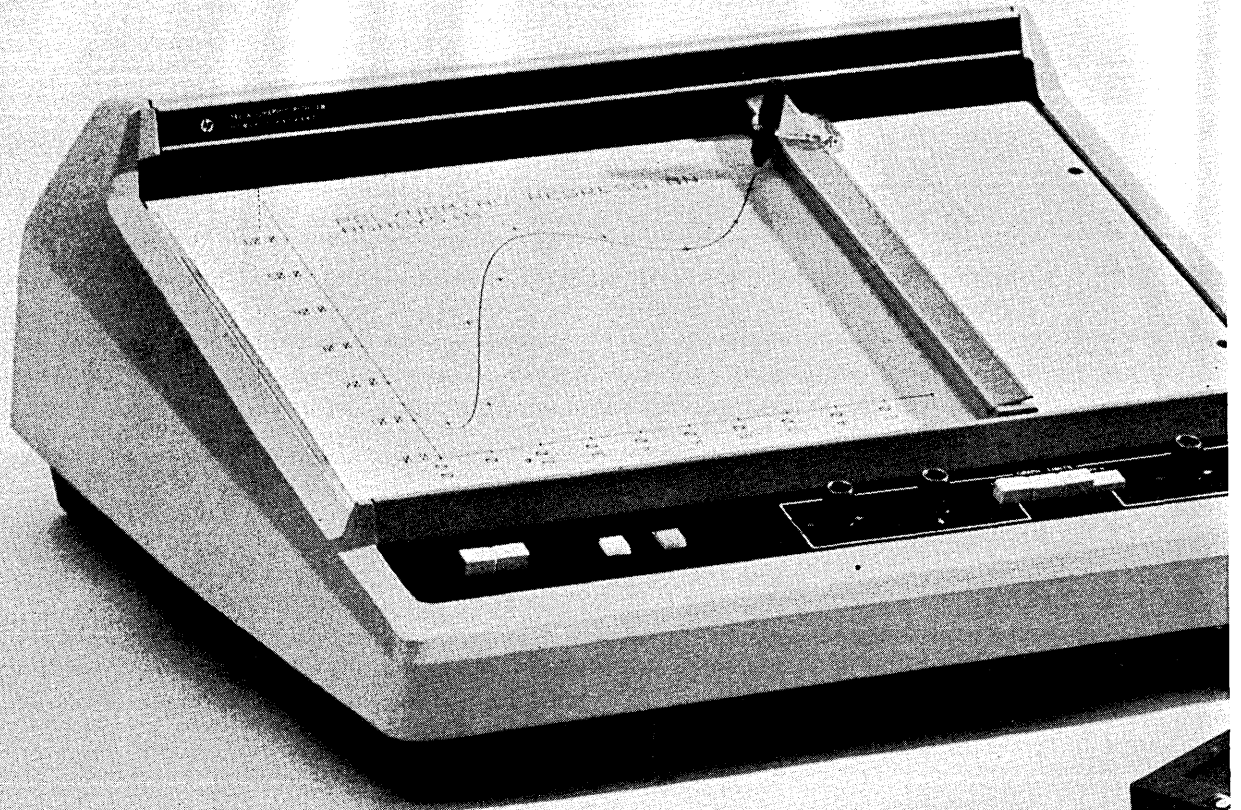
Even detractors admit the wiry, tight-faced chief is something special. "One of his special strengths—it's a weakness too—is his tremendous persistence," says one. The persistence, however, seems to have worn thin in the case of the IBM lawsuit. That fact mystifies those who know Norris well, and who predicted that he would go down with the ship if necessary rather than settle out of court. Control Data executives we interviewed gave no specific reasons for the settlement, and Norris was unavailable at press time.

Another strength, says one executive who has known Norris for a long time, is that ". . . he has a hell of a good nose for some aspects of the market, for strategy. He's always taken a lot of interest in the market."

That interest is likely to continue for some time. Although he's 61, there are no signs of slackening in the awesome Norris pace. "He's awfully healthy," says Berg. "And he likes to work."

Neither are there any signs of an heir apparent among the top management ranks of CDC. If there is one, the King ain't saying who it is.

—R.B.F.



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MDS

The Peripheral Power

and began culling through them right away. He added that "a selected number" were microfilmed and copied and that a computer index was prepared for retrieval purposes.

"There's nothing mystical about the index," he said. "It's really just an index." Lareau pointed out that the government attorneys have many of the IBM documents already and have attended many of the depositions. (One deposition that is unlikely now to get on the record is that of T. Vincent Learson, IBM's former chairman, taken by CDC late last year.)

Lareau said that the index and the automated retrieval system will not be turned over to the Justice Dept. He explained that the index and the information retrieval system are regarded by CDC as private attorney work projects in the case and not as part of the official record.

To the shredder

In fact, a prerequisite of the agreement was that the work project documents be destroyed. In Minneapolis, a hand-picked group of CDC and IBM representatives worked from late Friday until 4 a.m. Saturday on the weekend preceding the Jan. 15 announcement, loading the "work product" onto a huge van destined for the shredder. The load consisted of 10 tons of documents (including some 600 rolls of microfilm and 250 reels of magnetic tape. It was understood the same procedure took place at IBM's Armonk, N.Y., headquarters where CDC documents were kept.

The vast storage of original documents, from which the work product was built, remained locked up in a Minneapolis warehouse, however, awaiting "disposal by IBM."

At least one party expressed public displeasure that the index will not be available to the Justice Dept. J. L. Dreyer, executive vice president of the Assn. of Data Processing Service Organizations (ADAPSO), said: "If CDC and IBM agreed to deny access to documents, a search mechanism upon which the government had been relying, then the implications are shocking. I find it hard to believe that two giant American corporations would have agreed to put road blocks in the path of the government antitrust case."

In a letter to CDC's stockholders, Mr. Norris said: "Since we have settled our case, we have, as is customary, discontinued our efforts toward preparing for trial, and our attorneys have disposed of their work products. While we will no longer be providing assistance to the government in bring-

ing its case to trial, we will continue to advocate the relief which we believe should be obtained for all segments of the industry by the government's case . . . There have been significant benefits resulting from the filing of our suit against IBM, not only to Control Data but to the computer industry. In addition to possibly inducing the government to take action against IBM and to providing substantial assistance to the government in its lawsuit, we found that IBM marketing pressures that we have challenged lessened considerably."

In a statement, Mr. Cary of IBM said: "I'm gratified with the settlement reached with CDC. This suit has gone on for over four years and has represented a significant and growing expenditure of management time and legal expense. This settlement is timely and conclusive, and it gives fair value to both sides."

The justice staff?

The settlement and the fact that the Justice Dept.'s discovery mechanism has been crippled spurred renewed interest in whether the judge in the Justice case—Federal Court judge David N. Edelstein—would press Justice to beef up its staff. As recently as November, the judge had shown concern in the area, stating:

" . . . I think it is also time for the (Justice) department to consider augmenting its staff by bringing in more lawyers to add to the team in charge of this case so that we won't have any problems of not having enough manpower to proceed according to the schedule that I hope to lay out in somewhat greater detail in the very near future."

Since the press gag order forbids communication with the press in this area, there was no one in the Justice Dept. who could comment on its internal staffing situation in the IBM case. However, there have been unconfirmed reports that the Justice Dept. has declined to beef up its IBM staff significantly.

In another area, CDC's Lareau said there had been no contact with the Justice Dept. concerning CDC's acquisition of the Service Bureau Corp. "We felt there was no requirement that we do it," he said. "This is a big industry with a number of small companies in it. It's very fragmented."

As to the settlement talks, Lareau said they had been going on for several months. He added that they were generally exploratory in nature and that many "avenues" were pursued and that they often led to "dead ends."

IBM had been hopeful, if not confident, right along that a settlement could be reached, as evidenced by the fact that it set aside an "appropriate provision" for the settlement in its 1972 earnings statement.

Control Data's new R&D agreement with IBM is the second cooperative venture that the Minnesota firm has entered into with another large computer mainframe company in a year. CDC and The National Cash Register Co. have formed a jointly owned company for the manufacture of computer peripherals.

—W. David Gardner

IBM's Policies Tested Abroad

IBM World Trade Corp.'s refusal to maintain 360/30s with independents' add-on memories is being tested in the German and French courts. The plaintiff is IBM's nemesis from the U.S. courts, Itel Corp.

In a preliminary injunction Jan. 5, the Stuttgart, Germany, court opined that IBM Deutschland was abusing its position as a dominant company in refusing to maintain a 30 with an Itel add-on at publishing house Ernst Klett Verlag in Stuttgart. Further, according to Itel's German subsidiary, the judge stated verbally he planned to encourage antitrust action against the IBM company.

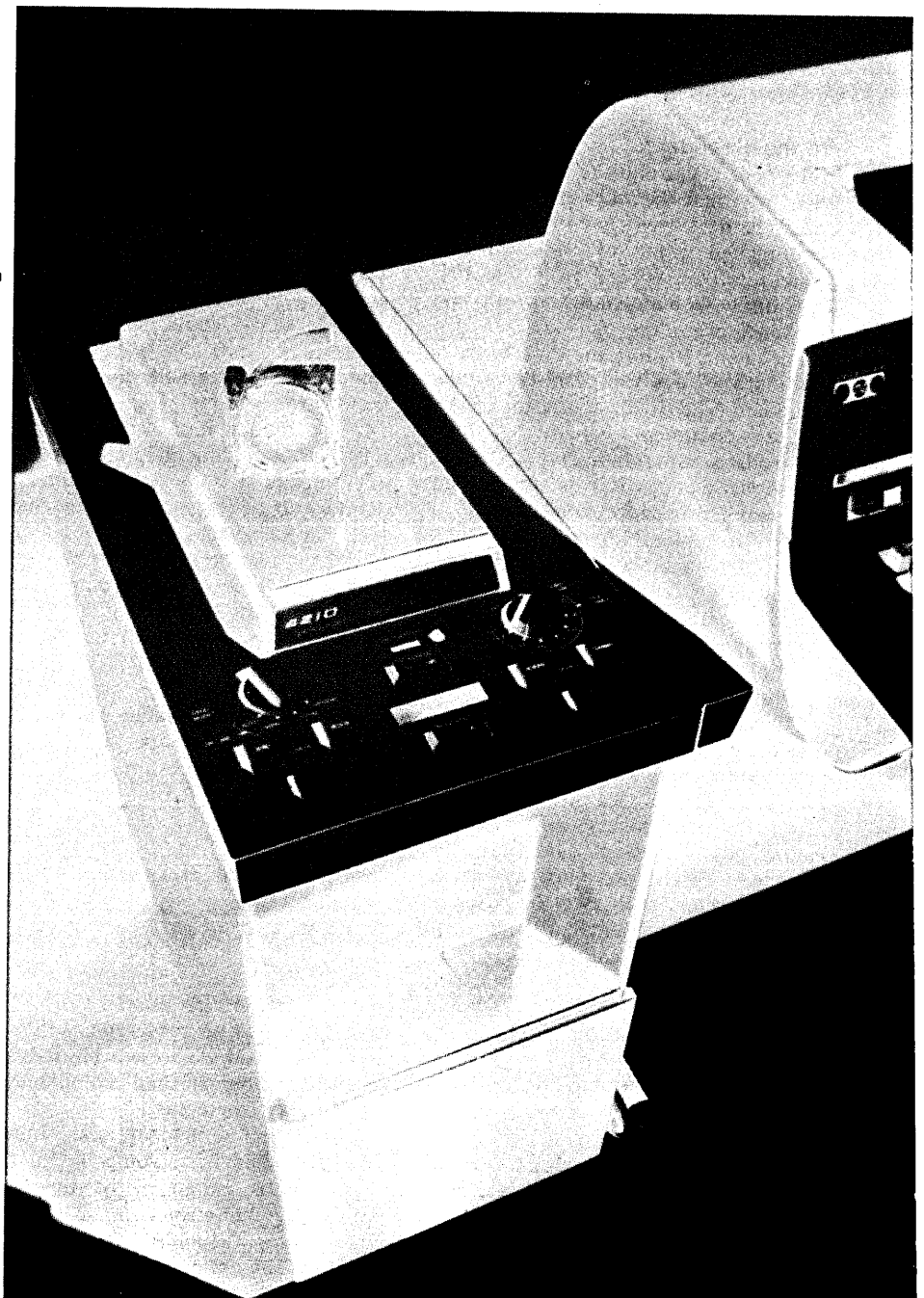
IBM World Trade would not comment at the time, but its subsidiary was not present at the hearing, and an appeal reportedly was to have been heard Jan. 31. As the ruling stated: "because of the urgency and the considerable damage that was imminent, this court had to decide . . . without a prior hearing, pursuant to Section 944" of the German code of civil procedure.

IBM Deutschland, the ruling said, had told Verlag to remove the add-on memory by Jan. 16 or it would remove the 30. The court, according to evidence given, found no "technical or economic obstacles" were posed by the add-on to IBM's maintenance of the system. Further, in "each case of violation" of the order, IBM would pay a \$150,000 fine and court costs.

If the Stuttgart judge succeeds in encouraging antitrust action, it will, it is said, be the first test of European dominant concern laws in the computer industry.

Essentially, a dominant concern is one powerful enough to take action without regard to either customer or competitor. Abuse of this position does not require the extensive proof of market share necessary in a U.S.

**When we
designed the
4210, we didn't
stop with
speed, economy
and control.**



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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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Teletype is a trademark registered in the United States Patent Office.

monopoly case.

According to Itel, its French company and user Société Gachot will have taken a similar complaint to a Paris court by the time this is published. Previously a Paris court refused to rule on an Itel complaint because it did not understand the situation fully enough to do so.

Companies

Nixdorf Entry to U.S. Worth Watching

If a foreign computer manufacturer is to survive through the 1970s, it must enter the U.S. computer market, say many international analysts. Germany's Nixdorf Computer A.G. is doing quite nicely, but its chieftain Heinz Nixdorf feels that its continued profitability demands entry into this "most dynamic" of all markets. That's one big reason his firm bought Victor Computer Corp.'s computer division late last year.

Although Victor's sales only grossed over \$11 million in 1972, its base and

Nixdorf's plans should make Nixdorf-watching an international pastime for the next several years. The signs for success are strikingly positive, but the yet-unanswered questions are just as interesting.

The little giant of Europe's small business computer and intelligent terminal markets isn't starting from scratch. Victor has been marketing Nixdorf's basic 820 line since 1968, although not wholeheartedly enough for Nixdorf. (Most put the marketed versions in the class of terminals and programmable accounting machines because of peripheral limitations.) It has 1,000 installations, mostly one- and two-system sales, a tenuous backlog of 600 orders, a staff of about 470, and 26 sales and/or service outlets. Add to that an order for 1,000 terminals from Control Data for its Cyberloan service, an order that actually was cinched by Nixdorf and played a part in his decision to buy the Victor operation.

A profitable operation

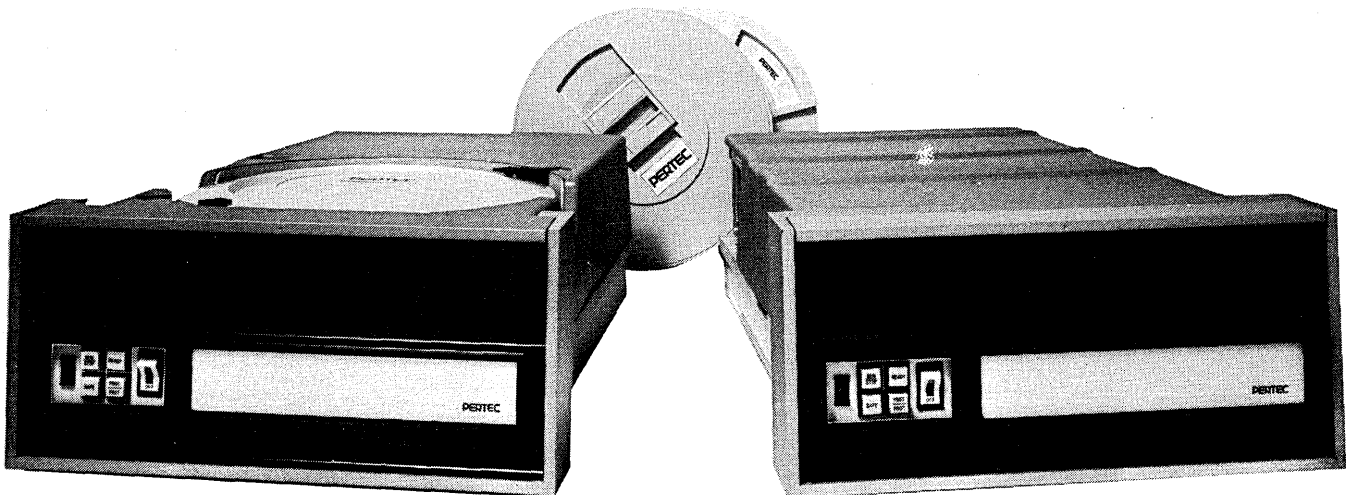
Nixdorf Computer A.G. has profitability, garnering \$136 million in 1971 and a 9% after-tax net—"the only profitable computer company in Europe," says Nixdorf. It has a huge base

of 29,000 systems installed, mostly in that 820 line and mostly (20,000) in Germany. But excluding the U.S., it has subsidiaries and affiliates in 19 countries and a force of 7,700.

It has money, dipping into its own pocket for the rather minimal \$10 million in cash it is paying Victor, and easily obtained \$100 million in credit to invest in the U.S. operation—Nixdorf Computer Inc.—over the next seven years. It has a general plan: to expand Nixdorf Computer Inc. to 800 people by the end of 1973 and to 4,000 within five years or so; to establish production, at least assembly, in the United States and answer both the problems of import duties and a growing economic nationalism here; and to ultimately make U.S. sales surpass those of the rest of its operation. Nixdorf will preside over NCI, but James Daly, coming from Victor, heads marketing.

Nixdorf has much more in its product line than Victor has marketed here. The U.S. has seen the 820 invoicing and visible record systems, with magnetic ledger card feeder, selectric printer, punched card and paper tape units, and cassette units. More peripherals, including crt and ocr reader, are being added here. Terminals in the 820 line with numerical and alphanumeric I/O, automatic forms and

The new Pertec D3000-Series Disk Drives.



passbook feed are also offered. The system also comes in communications control versions. The 820 can have 256 to 32K 12-bit words of core memory and 12-24K words of read-only memory (a hardwired plastic rod cell memory). Average price was \$30K, with a \$10-100K range.

The upgraded version coming this year to the U.S. is the 840, with a 50-cps needle printer and added peripherals, including disc and crt displays. The 880/55 and 65 can handle multiple disc drives, up to 32K of core (12-bit), and most peripherals. The 900 is a system ranging in memory from 8-256K bytes, has a cycle time of 1.4 usec, handles (theoretically) up to 156 terminals, does foreground and background processing, and has a one-megabyte transfer rate. No price lists, U.S., are available for anything but the 820 line yet. The 900 runs about \$300,000, however.

Nixdorf also has the 700 point-of-sale terminal, in a stand-alone system or integrated, with 11 stations handled by an 820 and concentrator. It has options of an optical label reading pen, journal printer, and eight-digit customer indicator. The POS system, which runs about \$3,000 to \$7,000 in Europe, has 4K of core. Nixdorf claims 1,000 orders for the 700 so far in Europe, and "one customer who

wants to buy 12,000 of these terminals."

Nixdorf's plans for production here won't be too painful, as CDC and Centronics provide printers, Potter supplies tape drives, TI and others provide



HEINZ NIXDORF
Resists change, but that's not bad.

semiconductors, and Century Data makes the discs. Although Nixdorf makes the electronics and packages for the peripherals, 25% of its reve-

nue dollar goes to outside suppliers.

Currently, Nixdorf sees its line spanning four U.S. markets as presented in the chart, plus intelligent terminals.

The company personified

Among all its considered advantages, the company has Heinz Nixdorf. Nixdorf started his business life in 1952 on an \$8,000 loan, and eventually amassed what he says are a series of world's firsts: the first electromechanical accounting machine, the first to connect electronic gear to sorting, the first to produce an electronic printing desk calculator. As he watched the U.S. computer business develop, he says he could not understand "why American manufacturers were not giving their customers the small computer system" for use in their offices, but instead "forced him into a centralized operation . . . Business is a decentralized life! Our philosophy for 20 years is to make for \$10,000, \$20,000, \$70,000 a nearly universal tool to put all things near the customer's needs."

He evolved the programmable book-keeping and calculating system into a floor model 820 in 1965 and, according to the firm, "clearly defined the philosophy of modular construction . . . practically designing computer model obsolescence out of existence." (An

They'll give your system a competitive edge that will sharpen your profits.

Pertec D3000-Series Disk Drives have advanced operational and physical features that can sharpen your system's competitive edge and trim the fat from your design and development costs.

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CIRCLE 71 ON READER CARD

news in perspective

apocryphal story says modularity came to him while trudging home after surrender in WWII and finding a cast-off GI shoe whose only fault was a worn-down heel.)

Nixdorf is both an engineer's and marketer's executive. Showing a contingent of U.S. press through his Paderborn plant, he enthusiastically discussed his equipment down to the details of design and manufacture—and dismantled one piece and another to show its modularity and ease of assembly. "See, we do not use any screws," he chortled, pulling out the top of a printer. "They are too expensive." It was evident that he still firmly controls all design.

Service, like the Nixdorf system, must be "near the customer's needs." He boasts a support-to-sales ratio of 2 and 3:1, and maintaining that ex-

1,000-terminal order which will go into the offices of CDC subsidiary Commercial Credit. When CDC begins active marketing of Cyberloan to the banking and financial industries, more orders should come to Nixdorf. And speculators think more such oem-like deals will be made between the two in other industries.

Victor did not do very well in computers when it came to profits, posting a \$2 million loss in 1972. Peter Ehrlich, director of foreign marketing, explained that part of this was due to an old inventory that was not written off until last year. And perhaps it was also due to Victor's overzealousness in committing to large fixed-price contracts on one hand, and to the high costs of serving the small one- and two-unit customers who make up most of its base.

tem that was quickly implementable. Victor was in with a demonstration program in a week and landed a contract for what is now 87 systems in three applications. Essentially, in claims payment, the operator takes the approver's work sheet, types on a scratch sheet on the dual-tractor 820, and the hardwired program spews the data out on a form and a check draft and also files it on a cassette to be mailed to the home office for reconciliation on its central computer files.

Equitable is now thinking that it doesn't really have to put its offices on-line and is interested in avoiding the problems of large machines. It needs access to a beneficiaries file and is considering the idea of putting a small disc in each office. As Nixdorf will introduce a disc capability, it is in the running, although the Genesis I system is also being considered.

Says Baker: "We're looking for vendors who'll carry part of the load, helping detail proposals to management and willing to offer programming services." The major minimakers are not as willing as the likes of Victor/Nixdorf.

The Mennen Corp. brought four 820 terminals in to replace IBM 1050s because of the 820's flexibility in printing, programmable storage, and communications interface with other vendors' equipment. They are used in cassette-to-cassette transmission of processed orders to warehouses, and ultimately Mennen will go directly from the computer to the warehouse 820. Mennen compared its installed terminal to IBM's 3735 for this one-line operation, but found it more expensive (\$330-\$340 vs. \$285) and it required a \$500/month control unit, while the 820 interfaces with a CDC control unit Mennen uses now.

Simple, reliable systems

Bill Nassif, head of CDC's Financial Data Services group, says that the Cyberloan order means "1,000 terminals for 1,000 county seats." While it gives Nixdorf geographical dispersion, it also brings the problem of scattered support needs. Nassif isn't worried. One reason is that the system is reliable, he claims, pointing out that they have had 11 terminals in for over a year and have logged 80 machine months without calling a Victor repairman. CDC was able to handle the few "small failures," he says, and anyone can learn to maintain the units. He notes that CDC "really beat them up," putting them through rigorous tests.

Furthermore, Nassif said he could teach this reporter to assemble the 50-100 pieces of the terminal in two hours, a mighty feat. He claimed that at a recent Nixdorf demonstration in

	Units	Million \$
Electro-mechanical accounting machines	12,400	75
Electronic billing machines	57,000	325
Small business computers	27,700	600
Disc-oriented business computers	10,000	1,000

The 1973 U.S. market according to Nixdorf.

plains why Nixdorf insists on a goal of 4,000 people to handle the nationwide U.S. market and why Victor's sluggish expansion rate was unpalatable to him.

Cooperating with competitors

As a profitable company, Nixdorf is attractive to many major manufacturers around the world who would like to combine its terminals and small systems with their larger central computers. Heinz Nixdorf has been amply courted, but seems to prefer playing the field. Last spring he told DATAMATION: "We would like to have a full line with other manufacturers' computers at the upper end. Why not do this with ICL, CDC, NCR? You should make cooperation with your competitor. You shouldn't say 'I'm your enemy.'" He said this winter that someday he would like to offer a range from the 820 to the large system of Telefunken Computer, of which he owns half. But he really seems to have an attachment for anyone's system, so to speak.

Talks with ICL, heralded in '71, have bogged down due to ICL's own problems of reorganization. Perhaps Nixdorf's most intimate ally to date is Control Data. CDC sells line printers to the German firm, and Nixdorf has the

But if the dollar performance was red, the performance of the Victor personnel was golden, at least according to the users we talked to.

Most scored support as "excellent" and were awed by the hungry, fast response to sales inquiries and delivery dates, especially in comparison to "major business equipment vendors" and "big minicomputer companies."

Connecticut General Life Insurance had contracted with another vendor for a \$40,000 magnetic ledger card system for claims payments, but that firm couldn't meet the I/O requirements and had slipped delivery by four months. Victor dashed in and offered to do it in six weeks, and did, for about \$30,000 per system. Thirty of those 820s are now installed, but CG is going to an on-line crt payment system within a year. Because Nixdorf hasn't brought crt-based systems into the U.S. yet, CG will shift to another vendor and move the owned 820s into other applications.

Score one for the off-line approach at Equitable Life Assurance Society, which had originally thought about an elaborate on-line system for group claims payment. According to Equitable's Jerry Baker, pending changes in national health programs made the firm look for an interim off-line sys-

DP DIALOG

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

DP DIALOG makes its debut with this issue and will appear 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.



Norm Vaughan (left), ASP program manager for IBM, discusses a GUIDE requirement with Bill Curley of Cities Service Oil, the GUIDE ASP project manager.

“IBM ought to do something about it!”

Do something about *what*?
“About priority scheduling of programs running under ASP.”
What’s wrong?

“Look, at our place we may have as many as 150 different jobs waiting to be scheduled and run. Let’s say that 30 of them have different deadlines sometime in the next twenty-four hours, O.K.? Instead of the operator having to interrupt the system and manually re-

schedule programs to try to make deadlines, ASP itself ought to have that capability. IBM ought to program ASP to keep bumping up jobs so the high-priority ones stay on top.”

If you’d been at the GUIDE convention in Denver in March, 1970, you might have heard something along these lines. GUIDE is an IBM user group of 1150 members representing IBM customers in industry, govern-

ment and education. One of its purposes is to meet with IBM people to discuss IBM equipment and programs, express criticisms and ask for changes and improvements. Two other major IBM user groups are SHARE, representing larger-system users, and COMMON, for smaller-system users.

The request for a priority-adjusting capability for ASP (the Asymmetric Multiprocessing system) was voiced at a convention meeting of the GUIDE ASP Project, a permanent committee of 70 members. It was then approved by a vote of the entire Project membership.

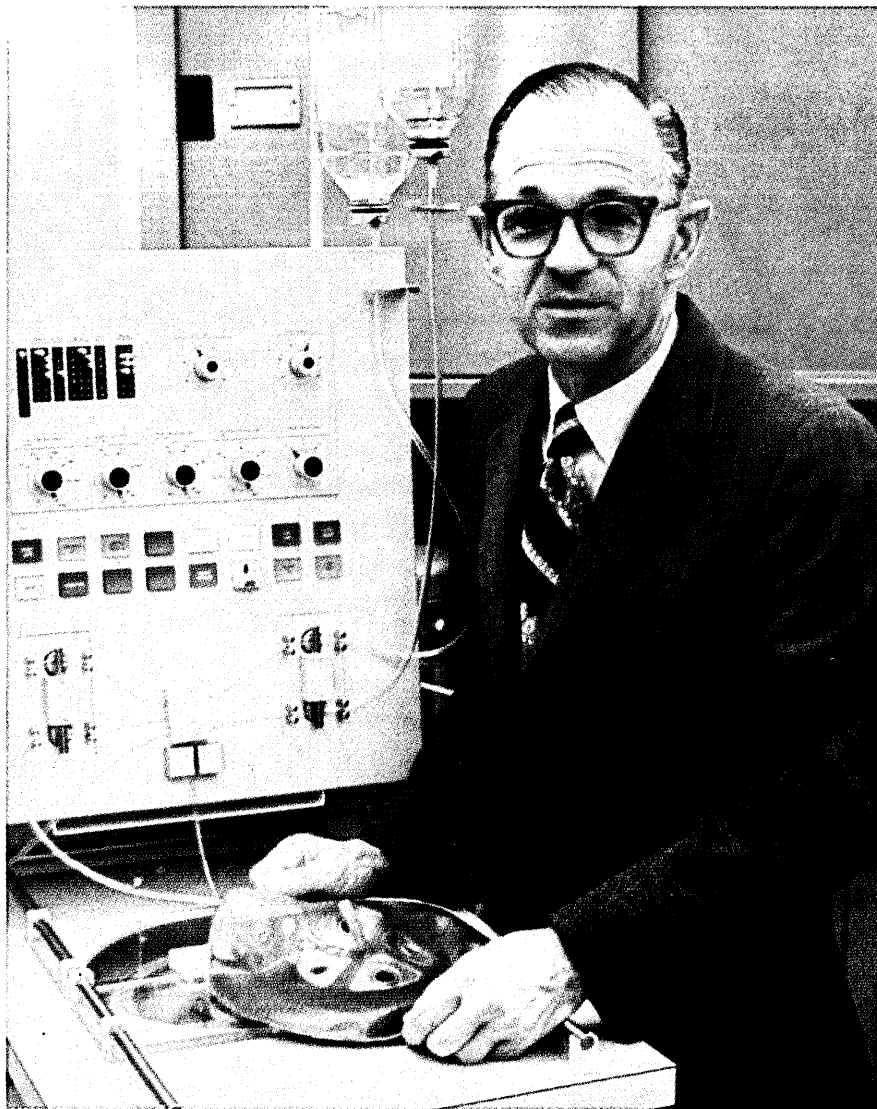
Having passed, the requirement was submitted to IBM for evaluation and response. At IBM, it was assigned to the ASP Project, a development team at the Los Angeles Technical Center. After two months of study, the team concluded that “deadline scheduling” was something that could be achieved.

On three occasions during the next year, IBM system programmers met with GUIDE ASP Project members to check out ideas and get suggestions. Finally in April, 1972, IBM informed

(Continued on next page)

Also in this issue...

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1973: The Year of the Optical Character 3rd page
Virtual Storage Is Working for F. W. Woolworth 3rd page
Toward a Better Knee? 4th page



IBM Fellow Judson with the IBM 2991 Blood Cell Processor.

The CPU that processes blood

George Judson has been an IBM engineer since 1952. Working at the IBM Development Laboratory at Endicott, N.Y., he has contributed to the design of card readers, printers and other peripheral equipment. Yet during his last ten years with IBM he has been engaged in a highly personal project—medical research.

The story begins back in 1962 when Judson's son became a victim of leukemia, the cancerous disease characterized by an excess of white cells in the blood. When his son was transferred for treatment to the National Cancer Institute at Bethesda, Maryland, Judson accompanied him. There he met Dr. E. J. Freireich, who was engaged in leukemia research.

One of the requirements in the treatment of leukemia is the regular removal of the diseased white cells from the

blood stream. In 1962 this was a painstakingly slow process. In their common concern for finding a better way, Judson and Dr. Freireich started exchanging ideas, one as an engineer, the other as a medical man. Out of their discussions a new concept emerged.

The specific gravity of the white blood cells is slightly lower than that of the red ones—1.086 to 1.093 respectively. But it is higher than that of the other components of blood. Could not the white cells be physically separated by the proper kind of centrifugal action? Although there were many problems to be overcome, Judson and Dr. Freireich demonstrated that such a solution was indeed practicable and that it could accomplish in less than two hours what had formerly required an entire day.

The National Cancer Institute was

greatly interested. So was IBM. To allow Judson complete freedom to work with Dr. Freireich in the development of their device, IBM granted him a year's leave of absence with salary and expenses paid. At Bethesda a prototype machine slowly took shape and in 1963 was functional. The promise was being fulfilled.

At this point IBM made a commitment. The company signed a contract with the Federal Government, which operates the National Cancer Institute, to develop the new machine to completion. A special engineering group was formed at Endicott with Judson in charge and Dr. Freireich as an outside consultant. In 1965 the basic production model was finalized and in 1967 the first shipments were made of the IBM 2990 Blood Cell Separator.

That same year, 1967, George Judson became an IBM Fellow. This meant that he was free to pursue, on his own, a special project of interest to him and to the company. He would continue to receive his salary, plus expenses connected with his project. Judson's project was to follow through on the many possibilities opened up by the development of the blood cell separator.

Some of those possibilities are realities today. Chief among them is the IBM 2991 Blood Cell Processor. Employing the same centrifugal principal as the separator, it was developed at Endicott under Judson's guidance to meet the needs of blood banks using frozen blood. When the blood is thawed prior to use, preservatives and unwanted components must be removed from it. The 2991 washes the blood cleanly and safely and may reduce processing costs by up to 50%. It was announced by IBM last summer.

Thus, as a result of his concern and resourcefulness, George Judson has put IBM into an entirely new field of endeavor. **IBM**

“IBM ought to...”

(Continued from preceding page)

GUIDE that ASP had been successfully modified to include the priority-adjusting capability, and that it would be part of ASP Version 3 scheduled for March, 1973 delivery.

But that's not the end of the matter. Both IBM and GUIDE know that the proof of the program is in the running and that any change put into use may continue to evolve for two, three or four years after it first goes into service.

As for the dialogue between the user groups and IBM, that never ends. IBM wouldn't want it any other way. **IBM**

1973: Year of the Optical Character

Many people have been struck by the difference in speeds between data processing (a Model 168 with twelve channels can handle data in excess of 8 million bytes per second) and data entry (a typical keypunching speed is 200 bytes a minute). It has long seemed clear that a systematized method of data entry was inevitable and that it would take the form of optical character recognition.

But OCR and its companion OMR (optical mark recognition) have been slow to gain acceptance, partly because costs have been relatively high. This year, however, with the advent of two new IBM machines, a breakthrough may be at hand.

The machines are the IBM 3886 Optical Character Reader and the IBM 3881 Optical Mark Reader. Announced in 1972, they join the IBM 1287 and 1288 readers to form a well-rounded line. They have an average input speed of about 11,000 bytes a minute. They are particularly well suited to installations desiring lower-cost equipment for large data-entry volume.

The 3886 reads OCR A and B fonts,

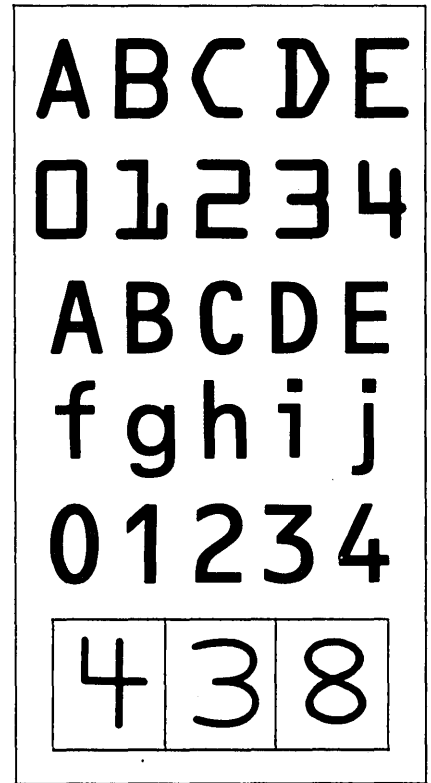
as well as hand-printed numbers. Data can be typewritten, machine-printed or hand-printed at its source on a machine-readable document. The 3886 reads this data directly from the document into the system, making for improved accuracy and eliminating intervening keypunching and key verifying steps.

The 3881, in addition to reading marks, has the optional capability of reading binary-coded identification preprinted on turnaround documents such as bill stubs.

Both machines process forms ranging in size from 3x3 to 9x12 inches, with format control capability incorporated in the machines. A variety of different document formats of the same size can be intermixed on a single pass.

In addition to models operating on line to the computer, both machines are also available as stand-alone models that transfer data to an IBM 3410 magnetic tape unit for later batch processing.

Full information on the new readers is available through IBM offices and local representatives. **IBM**



Virtual Storage is Working for F.W. Woolworth

VS1, the virtual storage operating system which is a compatible extension of OS/MFT, has already logged many thousands of hours in on-site use. Starting in May, 1972, it has been running at several companies with Model 145s formerly under MFT. One of the sites is F. W. Woolworth's Central Accounting Office in Milwaukee where Harlow Johnson is DP operations manager.

Looking back over seven months of



Operations manager Johnson with system operator Alice Ebert at the 145 in Milwaukee.

VS1, Johnson is pleased. Total system throughput has increased approximately 35%. VS1 has helped Woolworth manage their DP resources better, thus enhancing the value of their DP investment.

"Capacity has been a problem for us," he says. "We have some jobs that eat up a lot of main storage. We were flattered that we were chosen as a test site for VS1 and welcomed the chance to try to extend our storage. It turns out we had quite a bit to gain."

The Central Accounting Office does accounts payable for 1,850 Woolworth stores, updates the payroll for all store employees and handles 750,000 monthly statements for 1,750,000 credit customers, among other tasks. The credit billing job is the most time-consuming one. With the 145 under MFT, it used eight tape drives, all the main storage and most of the available disk space for a good part of each month.

"With MFT we were running three partitions," reports operations supervisor John Lukaszewski. "At our best we could do only three jobs at a time. Now we're running five or six. We had 256K of real storage and now we have two megabytes of usable storage. Where we

used to have a 16K, a 52K and an 88K partition, we now have a 64K and five 128K partitions."

Are the jobs running faster than they did under MFT? "Not much faster—at least not yet," replies Dennis Paschke, technical support group supervisor. "In fact, some of them are running slower. We're in the classic problem determination phase on a couple of these questions, but we expect to iron them out."

"However, everything we ran under MFT runs under VS1. The compatibility of the system is fantastic. We changed our entire shop from MFT to VS1 and some of our programmers didn't even know we were making the change. That's how smoothly it went."

Woolworth is an expanding company. Over a hundred new Woolco retail stores have been opened in the last 36 months with many more on the way. Woolworth's DP applications have expanded even faster.

"VS1 is a cheap and effective way to handle growth problems by getting more main storage," is the way Harlow Johnson sums it up. "And everyone needs more these days because it seems everyone is building bigger programs to get the work out." **IBM**

Toward a Better Knee?

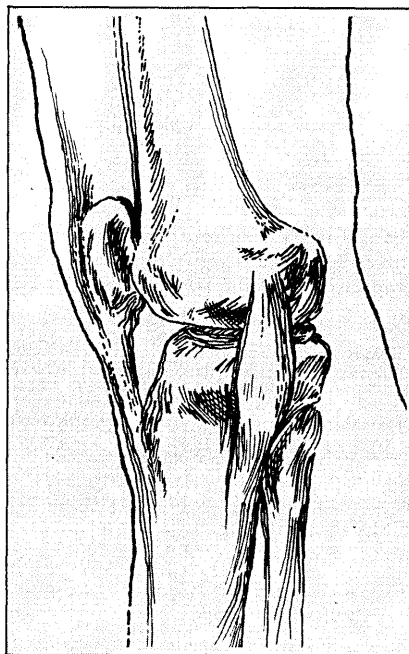
It is a curious fact that in this age of scientific marvels, no practical way has yet been found for re-creating the complex motion of the human knee joint. Among other things, this represents a problem in prosthetics. Seeking a better artificial knee, a Columbia professor of mechanical engineering, Ferdinand Freudenstein, decided to ask Lin Woo, a mathematician and now a staff member of IBM's Watson Research Center, to collaborate with him in tackling the problems involved. He also wondered if there was any way computers could help.

Woo was immediately interested. Several years earlier, as part of an IBM research project, he had begun an investigation of the ways computers might be used to design machinery. One result of his work was an original theory for classifying mechanisms that move in a single plane. While knee action is not entirely two-dimensional, it is sufficiently so for Woo's theory to be applicable. An indispensable step, he and Professor Freudenstein agreed, was to work out a mathematical model, based on the most precise anatomical studies available, of exactly what goes on at the knee joint.

Essentially, this involves the rolling and sliding motion of the femur, the big bone of the upper leg, on the tibia, the principal bone of the lower leg. Between them a cushion of cartilage provides resiliency. As anatomy fans have noticed, femurs and tibias vary from one individual to another, so that in any given case their combined motion will involve some departure from a norm. A norm, however, was what was needed and to establish it Woo and Freudenstein obtained from a previous study a large number of measurements of human knees in action.

Their next need was to determine, for each knee measured, the relative positions of the curved surfaces of the femur and tibia when the knee is in action. The two resulting paths were then expressed as a pair of irregularly curved lines called centrodes. When all the centrodes for some 200 human knees were determined, Woo and Freudenstein were confronted with the need for consolidating them in order to find the "ideal" pair of centrodes for an average adult.

Pondering the upper-leg centrode patterns, it occurred to Woo that they might all fit a formula for determining the curvature of point paths known as the Euler-Savary equation. If this should prove to be the case, a way



would be opened for generating the "ideal" centrodes. After laborious calculations, Woo determined that his data did indeed satisfy the Euler-Savary equation.

He was now in a position to apply further mathematical reasoning to his data. To his surprise and pleasure, he discovered that he ended up with a "quite beautiful" mathematical representation of the sought-for upper-leg centrode—none other than a logarithmic spiral. As Woo put it, "They (log spirals) have frequently been observed in nature and their properties are well known".

With this development, light appeared at the end of the tunnel. Next, the log spiral centrode had to be matched with the averages of the centrodes derived from actual observation—a procedure akin to comparing theory with practice. Here an IBM computer proved of value in making the complex adjustments involved. The result was a close correlation of the log spiral centrode with the "real-life" upper-leg centrodes, confirming the validity of the log spiral as representative of knee-joint action.

The final step in the study was the translation of the mathematical model into mechanics useable in the design of an artificial knee. Woo and Freudenstein concluded that the log spiral upper-leg centrode rolling on a straight-line lower-leg centrode was, in geometrical terms, a circular arc rolling on a straight-line segment. And that this in turn could be expressed mechanically by a gear rolling on a rack.

Here pure research ends and applied research begins. What follows is the design of an artificial knee employing the gear-and-rack principle. As Woo and Freudenstein see it, such a knee is

likely to provide "significantly improved knee-motion relative to the single-pivot types of artificial knees in use today".

Anatomy. Mathematics. Mechanical engineering. Kinematics. Biophysics. Computer sciences. They all came together in Woo and Freudenstein's study of a way to make a slight improvement in the human condition. **IBM**

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DATAMATION

news in perspective

New York, the CDC personnel had the Cyberloan terminal assembled, up and on-line in 30 minutes. He also commented that ROM program modifications can be made by a user, as it is easy to learn how to wire the plastic rod-cell memory. Just who will maintain the Nixdorf terminals hasn't been decided yet. (Nixdorf generally charges a maintenance fee of 5-7% of purchase or rental.)

Nassif himself is quite happy that Heinz Nixdorf has taken over the Victor operation. He is "quick to keep his word and provide support in a trouble situation," although he is a "hard, tough bargainer and stubbornly resists change, not bad characteristics." That stubbornness, says Nassif, has meant hard battles for CDC, but that is what has kept the Nixdorf units standard and reliable and the production costs down. As Nixdorf gets more deeply involved in the market and must "Americanize" features of his product lines, Nassif doesn't expect him to resist necessary changes, certainly not when thousands of systems are involved.

Heinz Nixdorf considers Burroughs to be his prime competitor in his small business and intelligent terminal markets, but he'll have to buck numerous competitors in each of his computer, terminal, and point-of-sale markets: NCR, IBM, Singer, Litton, Basic-Four, Alpex, you name them. The buffered, emulating, firmwared, peripheral-laden system with communications ability is no longer the domain of the few.

Can Nixdorf control a rapidly expanding U.S. operation from Paderborn? Will he be able to gear up his U.S. production facility and keep his prices competitive? Will the firm be able to develop the necessary applications software support for the larger systems in the line? Is U.S. economic nationalism real and will it impact a German firm? Even though Nixdorf Computer Inc. will be American-managed, how difficult will it be to compete with firms native to the U.S. market?

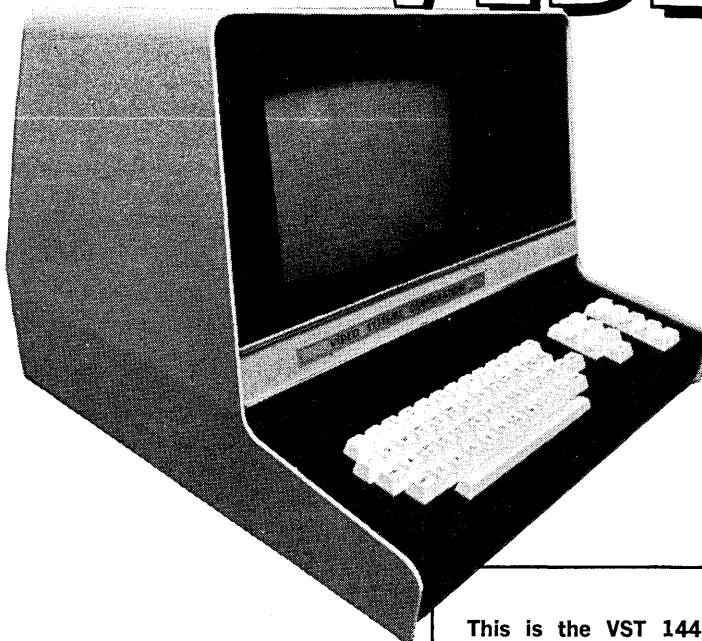
Time will tell, but meanwhile, we remember how the excited Nixdorf ushered us into a room in Paderborn where we got a peek at experimental models of cabinetry for the office-oriented systems. Flowing curves of white molded plastic, CRT throned above the desk at eye-level, all operations within arm's reach—hardly resistant to the future. —Angeline Pantages

February, 1973

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Networks

Thank Goodness for Thanksgiving

"Everything that could go wrong did go wrong, and even some things that couldn't."

Isaac Main, acting director of the California State University and Colleges computer network, one-upped Murphy's Law in describing problems encountered in consolidating two regional data centers into one central center in the chancellor's office in Los Angeles. But the story had a happy ending.

The consolidated center was officially opened last Aug. 1, taking over the job formerly handled by two separate centers at San Jose State College in the north and California State College, Los Angeles, in the south. There was no parallel operation. Each of the separate centers had had a CDC 3300. The consolidated center has dual 3300s.

An early problem was getting the equipment in. The center is on the 27th floor of a Los Angeles office building. This was solved with helicopters.

"Our big problem was the fact that our configuration was totally different," said Main. "Dual 3300s are unique. We had to use software which hadn't even been released, which was being installed as it was developed." And there were no diagnostics for the dual configuration. Everything had to be isolated on one machine. Main said CDC is preparing new diagnostics, which they expect to have by Feb. 28.

Hardware problems were complicated by the fact that no one had maintenance experience on a dual configuration. It was a real on-the-job training situation.

Turnaround time was being measured in days and even weeks. "We were losing credibility with the users," said Main. "We could have put more emphasis on production and less on system development to counteract this, but we wanted to prove our concept and we did."

Rental and staff cut

Last Thanksgiving, Nov. 26, the center was shut down for two days and the center staff, with round-the-clock help from CDC, ran a thorough checkout of the system, perfecting it to a point where, in the month of De-

cember, more than 95% availability and trouble-free operation was experienced. The same number of cpu units were generated as in December 1971 with the two regional centers, and this was accomplished with six fewer full-time staffers and from \$10-15,000 less in monthly equipment rental.

Turnaround time improved dramatically. For jobs which came in over communications lines in December, 53% were processed in less than one hour, 69% in less than 2, 82% in less than 4, and 92% in less than 24. For jobs which came in over the counter, the rates were 32% - in less than an hour, 61% in less than 4, 75% in less than 8, and 96% in less than 24.

The dual 3300s at the center are supported by a CDC 3170. A Computer Transmission Corp. multiplexor serves as a switching link into two CDC 3170 interactive time-sharing units at California State University, Northridge, and an IBM 360/91 at UCLA. Main said use of the 91 "has not been extensive despite an earlier hew and cry for more exotic uses." This possibly could be because UCLA charges the center for any 91 time used, and the charges are passed on to the using campuses, which do not have to pay to use of any other portion of the system.

The system serves a total of 19 campuses. The 13 larger campuses have

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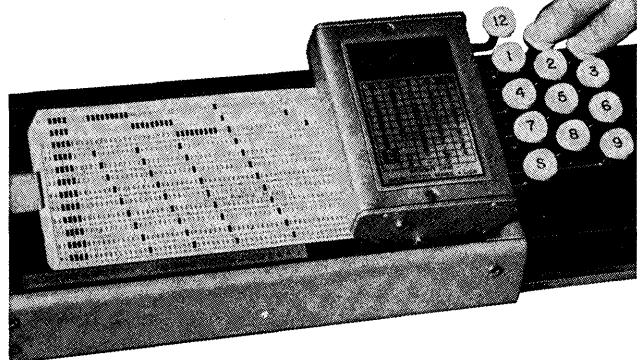
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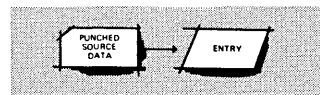
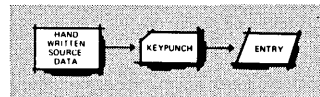
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DATAMATION

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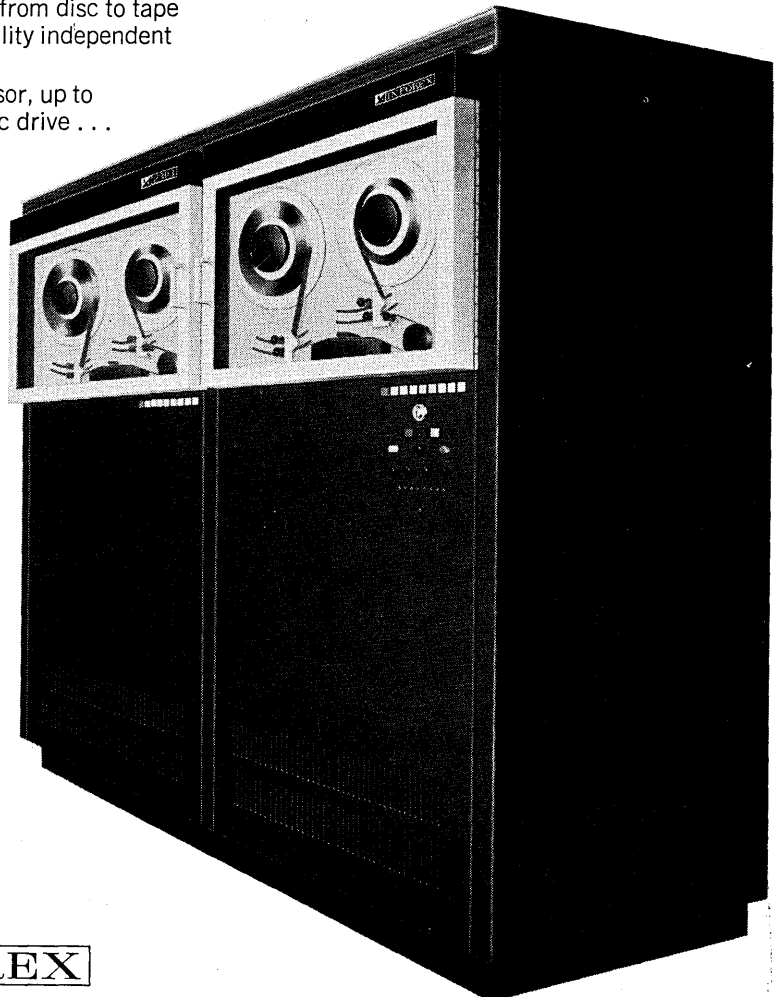
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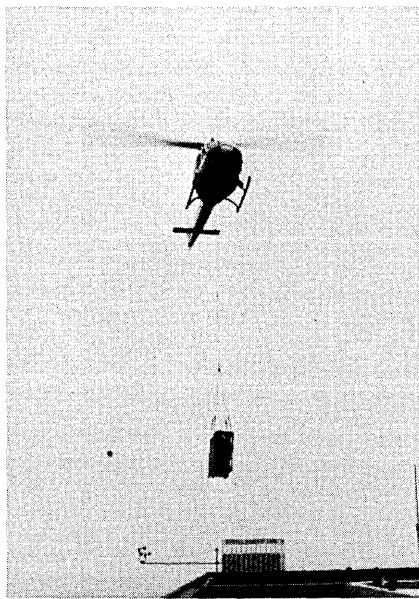
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CDC 3150s or IBM 360/40s which have stand-alone capability in addition to their link with other components in the network. Of the smaller campuses, four have 360/20s and one has an NCR 200, all of which perform essentially as remote job entry terminals.

Upgrade in '75

The network was established by the 1968-69 State Budget Act and is supported entirely with state funds. Most of the equipment is leased. An rfp was issued in 1968 and CDC came out best in the competitive bidding following a lengthy evaluation which included cost-benefit analysis and benchmarking. The



Helicopters transported computer room equipment for the California State University and Colleges new central data center from the ground to the top of the building in which the center occupies the 27th and top floors.

lease on the CDC equipment in the center expires in 1974, and the colleges already are looking ahead to a complete reevaluation of their needs and an upgrade in the 1974-75 fiscal year. "We already have related our projected needs to vendors," said Main, "and have received responses from a significant number." These are now being analyzed, and a master plan is being developed which will lead to another rfp.

The state colleges' annual budget for edp is running at \$8.4 million, including salaries for 380 people, 69 of whom are at the hub center.

Users are closely involved in system planning. There is a state college advisory committee from different campuses which provides major policy advice. Under it are a technical advisory committee and an instructional advisory committee, each with representation from different campuses; and under these are numerous subcommittees for specific applications. For instance, a committee made up of representatives of four schools currently is looking into registration systems. Main said it probably will decide to buy outside software and modify it for eventual system-wide implementation.

The center draws its users into its experimentation, too. In January they were experimenting with a new job



Student at California State University at Northridge makes use of a time-sharing terminal. As many as 94 students at different campuses can use the time-sharing system simultaneously.

entry system which, via CDC terminals at the center, tells the operators exactly what to do for any given job. Without this they have to plow through piles of paper to find out which files to call up, etc. The experiment was conducted with the Stanislaus campus because "they've been our most severe critic."

The network supports both instructional and administrative usage, but the biggest use is instructional; and the center recently has beefed up its instructional support staff. Where there were no people a year ago, there now

are four dedicated to finding existing instructional-type software, converting it, bringing it up, and maintaining it. They also seek out data bases useful for instructional purposes and recently were responsible for the state system's joining the University of Michigan-sponsored Inter-University Consortium for Political Research which maintains a repository of surveys and historical data. The 19 campuses were able to join as a single unit for \$30,000 where normally it costs \$2900 per college and \$4500 per university. The only requirement is that requests for data bases from the repository must be funneled through the data center.

"Our credibility is improving now," says Main. "We still have unused potential with the capability we have at this time, so there is no workload problem."

Something must have gone right.

—Edith Myers

Governments

L.A. Data Center in New Quarters

They're a year and a half late (June 1, 1971, p. 49), they're hard to find, and they're short \$5,000 worth of carpet, but the city of Los Angeles' computers and data processing personnel are centralized in new quarters.

The new 30,000-sq.-ft. computer center is four floors underground near City Hall. The data processing offices are on the fourth floor of City Hall East, still under construction. The department is the building's first occupant, and access to its offices is via an enclosed bridge from the main City Hall. The offices are shy some carpeting because, said Tug Tamaru, Data Processing Bureau general manager, "the money just ran out."

But the bureau has more computing power and for less money than it was spending before. With the move it upgraded from two IBM 360/50s it was leasing for about \$85,000 per month to two 370/155s it has under IBM's state and local government lease-purchase plan for approximately \$65,000. The city will own the computers in five years. "We've got two times the capability we had before, maybe three," said bureau deputy director Bill Porter. "We've got more running room. We were saturated with the 50s."

And the bureau isn't as purely IBM as it was when it was scattered over several floors in City Hall. Last month it installed 24 Storage Technology Corp. tape drives, 20 on a two-year lease and four on a month-to-month basis pending determination of total

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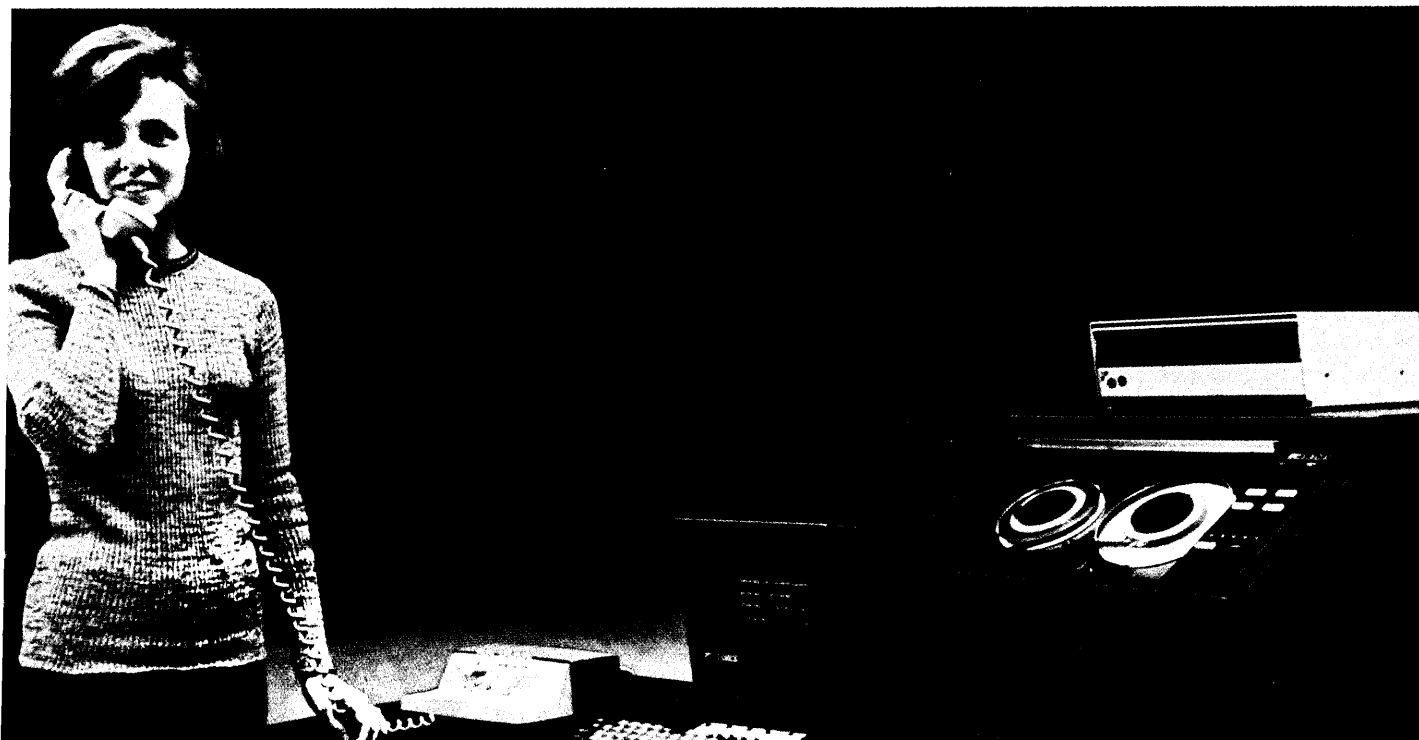
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requirements. And it has Data 100 remote job entry terminals linking the center to a System/3 at the harbor and a 360/20 at the airport. The city had ordered some EMR 6145s to replace Scantlin units in its fire command-and-control system but was uncertain last month as to what would come of this order as a result of Univac's acquisition of EMR Schlumberger.

One of the biggest jobs facing the new center this year will be helping to select its boss for the next four years. The city's computers, using Votomatic programs borrowed from Los Angeles County, will be used to count votes in this spring's mayoralty election in which a long list of candidates will compete for Mayor Sam Yorty's job. Even if he loses the election, Mayor Sam will still be a part of the computer room. Two tape decks there have been labeled Yorty A and Yorty B.

A big thrust for the Data Service Bureau as it entered a new year in new quarters was the streamlining of a system for one of its biggest users, the city library. After a long search it selected last month a transactor unit which essentially would be a point-of-sale system for libraries. A library

users' card would be like a credit card, explained Tamaru, who wouldn't name the vendor selected but said the units would be installed throughout the library system no sooner than one year and no later than two. "It will relieve us of our heaviest load of punched card work," he said.

A new fire command-and-control center, adjacent to the bureau's computer center and closely resembling a space flight control center, is scheduled to become operational this spring.

And what of the carpets? They haven't been scheduled, said Tamaru and Porter.

Software

Soon They'll Also Validate Fortran

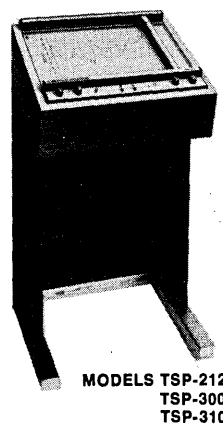
A FORTRAN compiler validation facility should be in operation at the National Bureau of Standards (NBS) before the end of this calendar year, says a bureau spokesman. All FORTRAN compilers offered to the federal govern-

ment will have to be tested by this facility before they can be acquired.

Test routines have been developed and are now being final-tested by major cpu makers. A staff headed by Betty Holberton, of the bureau's office of information processing standards, developed the routines. They're designed to determine whether a supplier's compiler performs the functions specified in the current ANSI FORTRAN standard, adopted in 1965. The routines will be modified when a new FORTRAN standard, now under development, is adopted. That's likely to occur next year. A draft of the new standard is expected to be released for public comment next September.

The FORTRAN validation project is the second of its type to be launched by the feds. A COBOL validation facility, headed by Navy Cmdr. Grace Hopper, is already in business—validating compilers offered to DOD. Her facility will be authorized to test COBOL compilers acquired by all federal agencies as soon as some sticky details can be worked out by DOD, the Office of Management and Budget (OMB), and NBS.

One unresolved problem involves the procedure for allowing a federal agency to use a compiler that fails the test. NBS, OMB, and DOD's front office reportedly are willing to allow such



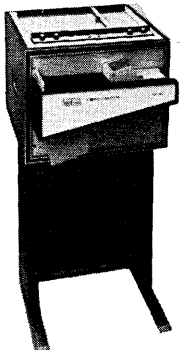
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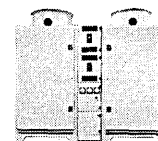
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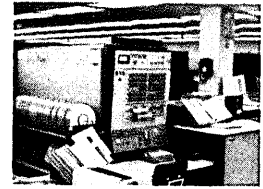
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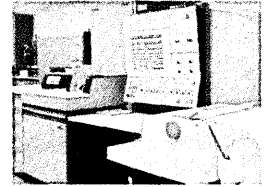
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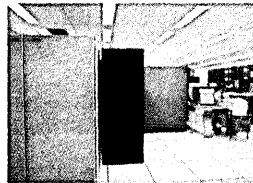
Model 65 — extended from
256K to 512K.
Western Airlines
Los Angeles, Calif.



Model 40 — extended from
32K to 384K.
University of South Dakota
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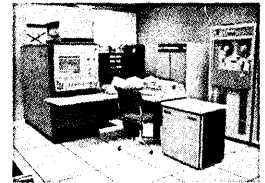
Model 22 — extended from 24K
to 64K.
United Farm Agency
Kansas City, Missouri



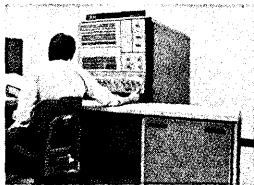
Model 50 — extended from
512K to 768K.
University of Wisconsin
Madison, Wisconsin



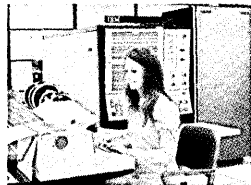
Model 30 — extended from
32K to 64K.
Chi., Mil., St. Paul & Pac. R.R.
Chicago, Illinois
Leased from Dearborn Leasing



Model 22 — extended from 32K
to 64K.
Computer Graphic Systems
Toronto, Ontario, Canada
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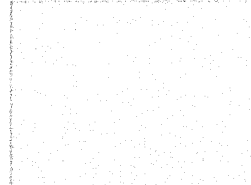
Model 30 — extended from 32K
to 64K.
Medtronic, Inc.
Minneapolis, Minnesota



Model 30 — extended from
64K to 128K.
American Broadcasting
Company
Hollywood, California



Model 30 — extended from 8K
to 64K.
Gant Shirtmakers
New Haven, Connecticut
Leased from Rockwood Leasing



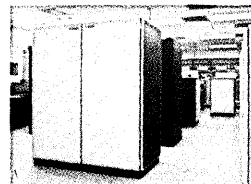
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news in perspective

use provided the agency applies to NBS for a waiver and the bureau approves it. Some users—the Air Force apparently is the chief holdout—want to have the final say themselves.

Privacy

Canada Cautious on Identifier Issue

“While the committee finds the standard acceptable from a technical point of view, it has decided that the sociological and political implications . . . are such that further study is required. It is also appreciated that no individual or organization wishes to undergo the social and political censure that may result from promotion of this standard.”

So said the Canadian Standards Association Committee on Representations of Data Elements when it decided recently not to support development of a standard individual identifier, known in Canada as a “Single Identifying Number” (SIN).

Last year the American National Standards Institute (ANSI) shelved a similar U.S. standard just before it was to be sent out for a final vote. But unlike the Canadians, who apparently were self-motivated, (ANSI) acted only after it was needed by

Sen. Sam Ervin. And ANSI’s announcement said nothing about the sociological and political implications of adopting a standard individual identifier, only that further action was being delayed until “public policy is resolved.”

An attempt to resolve that policy is now under way at the Dept. of Health, Education and Welfare (HEW). There, a group called the Secretary’s Advisory Committee on Automated Personal Data Systems is developing recommendations regarding individual identifiers and related matters (Dec., p. 90). A committee spokesman said the group’s final report should be finished by the middle of March. Its charter expires March 30.

The Canadian standards group, in its recent announcement, said that the decision not to support SIN would be reconsidered after members evaluate a recently released Canadian government report entitled “Privacy in Computers.” This report, written by members of the Canadian Departments of Justice and Communications, said: “It is possible that a de facto personal identification number will be developed in Canada either through an ever-widening use of the Social Insurance number or indirectly through credit card and bank numbers. However, it is important to insure that a SIN should not be adopted in Canada, directly or indirectly, without a full examination of its merits and consequences.”

Security

To Catch a Thief

Just about a year ago, Jerry Neal Schneider’s arrest on charges of stealing some \$1 million worth of supplies from Pacific Telephone Co. ended a short-lived career as a company president.

Schneider’s Los Angeles Telephone & Telegraph Co. ceased to function on the day of his arrest last February, but he’s formed a new company, EDP Security, Inc., which he says will draw heavily upon his experience in systematically depriving Pacific Telephone of the equipment that Los Angeles Telephone & Telegraph offered its customers.

In between companies, Schneider spent a month in hiding, many days in court, 40 days in prison, and six weeks in a hospital due to injuries sustained when he was struck by a car in a Los Angeles restaurant park-

ing lot. And he thought a lot about what he did.

What he did started back in 1968 when he was still a student at Los Angeles’ Hamilton High School. His route to and from school took him by a Pacific Telephone office, and its trash cans. For a young man with a technical bent these cans were a gold mine. “The waste factor at Pacific Telephone is extremely high. They throw away a lot of good, salvageable equipment,” says Schneider.

They should’ve shredded

Even better, he found documents: system instructions, Bell System practices, a written guide to ordering, plant operating instructions, catalogs — “all the information I needed to run my own telephone company.” And Schneider admits he’d always wanted to run his own telephone company.

He learned that the phone company had a computerized ordering system, and he learned how to use it, although he didn’t actually start using

it until June 1971. Then an engineering student at UCLA, he launched the Los Angeles Telephone & Telegraph Co. It started as a one-man operation and grew rapidly to where he had 10 employees, a 6,000-sq.-ft. warehouse, and executive offices in West Los Angeles. Schneider says his employees didn't know where he got the equipment the company sold.

Pacific Telephone, he explains, has an off-line ordering system through the switched network. He used a Touch-Tone telephone to place orders which went to a centralized ordering center. He used an authorized entry code he had obtained from an invoice found in the trash and which he identified through a manual also found in the trash. Then he would enter item numbers obtained from catalogs, quantities, and location. The latter he varied. He had learned from documents in his trash yield that the phone company allowed for a certain amount of loss for each authorized delivery point per quarter. He knew these amounts and he knew what was being ordered from each location, so he was able to keep his orders within the loss allowance. "I rationalized that there was no loss so I wasn't really stealing."

The night shift

Schneider was able to keep up with what was being ordered from each location he used because he had keys to each one. He got his first key from a friend who was leaving the telephone company's employ and reported his key had been lost. The rest was easy. That key not only got him into one location, but it opened a lock box that contained keys to other locations. Using a micrometer and the key codes, Schneider was able to have them reproduced without physically removing them from the phone company office. These keys led to other lock boxes and other keys, and "I soon had keys to every office and every phone company supply room in the Los Angeles area."

Schneider had learned that the phone company order center batch processed orders at 10:30 each morning and that orders were drop shipped around 2 a.m. "They even threw away copies of their computer programs," Schneider said, which is why he knew exactly how to instruct the computer to prepare invoices for the equipment he wanted. At night, after the stock had been pulled and shipped, Schneider would be waiting for it in a phone

company van he acquired at an auction. He would pick up his orders and the invoices, which he would sign and return to the central office indicating the goods had been received. "The thefts were completely undetectable," says Schneider.

How then was he detected? "I guess I was a poor judge of character," he says. He was going to school, running his company, and making the night pick-ups. He decided this was too much and found someone else to do the night work. So he confided in one employee and had him take over the night runs. "I paid him rather well, but he wanted more. He wanted too much, so I fired him. Two months later I found he had gone to the phone company and told them the whole story."

Time to think

And so on Jan. 17, 1972, a search warrant was issued. It was executed on the 18th, but Schneider wasn't arrested. "I was terrified," he said; "they took everything, even all my keys. I went into hiding to try to figure out what to do." On Feb. 8, 1972, he turned himself in to the Los Angeles district attorneys office. He was arraigned on two counts of grand theft, two counts of burglary, and one count of receiving stolen property.

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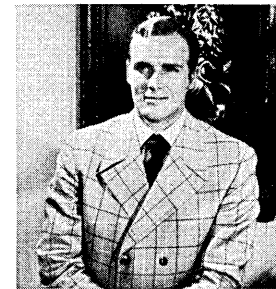
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CIRCLE 77 ON READER CARD

DATAMATION

"I was lucky, I had a good lawyer," said Schneider. He plead guilty to one count of grand theft and the other charges were dismissed. He spent 40 days in a minimum-security facility in Malibu, Calif., which he obviously didn't find too unpleasant. During his later hospital stay he had hanging on his hospital room wall a large four-color photograph of himself at the facility, which looked more like a resort hotel.

It was while he was incarcerated that Schneider decided he should go into the security business. "I tried to sell the phone company my services, but they didn't want any part of me." So he decided to make his services available to others.

He has two partners in EDP Security Inc.—Michael Scott, a lock expert, and Paul Servey, a business consultant. What they'll do for clients (they already have one—Matric Co., an advertising agency) is go in and break their systems, Schneider handling the data part and Scott the physical portion. "Then we'll show them how we did it and how to make it so secure it'll be unbreakable even by us. We'll be burglars under controlled conditions."

And Schneider will be sharing his experience gained as a computer thief in other ways. He's working on a

paper for the National Computer Conference titled "A Quantitative Examination of Computer-Related Theft of Property and Protective Analysis," and while he was in the hospital he began writing a book on his experiences.

—E.M.

Phone Phreak Phined, Phreed

A man who built an electronic device with which he could make long-distance phone calls for free has been fined \$1,000 and given a five-year probation for his caper. John Thomas Draper of San Jose, Calif., was also given a stern reprimand by the judge and told that a single repetition of his act would result in his getting the full sentence—five years in the federal pen.

The 29-year-old Draper was nicknamed Captain Crunch, after the breakfast cereal of the same name that at one time came with a toy whistle that produced a pitch that could trigger the phone company's long distance relays. Local phone phreaks had a ball with it for a while. But Draper went further with the concept, developing a so-called blue box that duplicated the phone system's multifrequency signals

and with which he could call for free anywhere in the world. He reportedly also had automated the system, taping the tones of frequently called numbers.

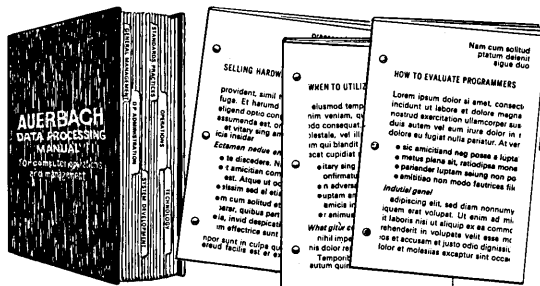
But last May, armed with a search warrant and a complaint by the phone company, the FBI arrested Draper and confiscated "considerable" electronic equipment, including the blue box. He was charged, among other things, with making a toll-free call to Sydney, Australia, which would have cost \$9.90, as well as calls to New York and Oklahoma. He pleaded no contest to the first count, of making that call to Australia, and when the fine and probationary period were imposed, six other counts were dropped.

Communications

Interconnection: Closing in on Bell

Ma Bell and the Federal Communications Commission appear headed toward a major confrontation.

Just before the New Year, the commission's common carrier bureau asked AT&T to loosen its interconnect restrictions. The phone company was told in effect it could no longer ban



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department which give comprehensive information on shelf stock available to buyers.

Datapoint 2200's are also being used in Day's accounts receivable department, the payroll department and in production planning where their ability to accommodate large volumes of data according to pre-programmed formats is a major advantage. "The Datapoint 2200's have not only streamlined our data entry activities throughout the company but they have added as much as three years of useful life to our present central computer installation," said Decker. "Without them, we would have had to have gone to a larger computer system with RJE terminals for our remote data users at a cost far in excess of what we're paying for the 2200's — and not have their on-site computing capability."

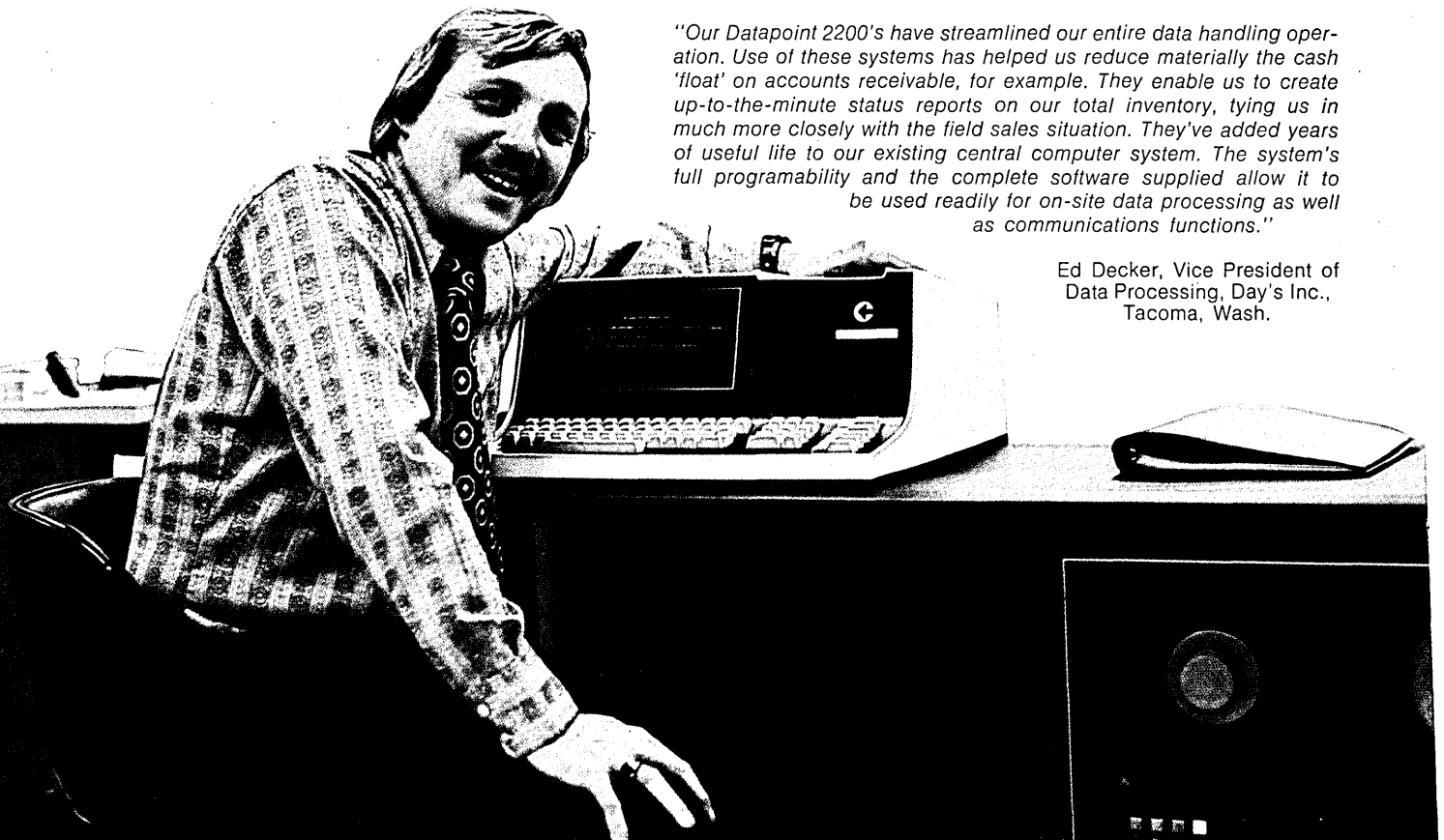
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Ed Decker, Vice President of
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the use of customer-provided terminals that perform network control signaling, since New York state's recent adoption of the "Rochester Plan" (Oct., p. 137) allows customers of the Rochester Telephone Co. to access the interstate dial-up network through such terminals.

The common carrier bureau's letter to AT&T also said that because of California's decision a few weeks previously in the now-celebrated Phonetele case, "it appears necessary that revisions must be made in your interstate tariffs" to allow direct connection of foreign attachments when tariff-specified connecting arrangements can't be provided within 30 days. This, in essence, is what California's public utilities commission told Pacific Tel and General Tel of California to do regarding installations of Phonetele, a toll call diversion device. The common carrier bureau's point was that since Phonetele users can access the interstate dial-up network, as well as intrastate facilities, AT&T tariffs must conform with the California PUC ruling.

AT&T, judging from its recent pronouncements on the subject of interconnection, won't follow the bureau's suggestions. Last December, the company filed tariff revisions allowing the direct connection of headsets and conferencing devices but emphasized that this equipment inherently poses no threat of physical harm or service degradation to users of the dial-up network. So it contends that permitting headsets and conferencing devices to be connected directly does not imply any change in attitude toward independently made terminal equipment. It still considers them a potential menace which must be contained by requiring the dial-up user to rent a connecting arrangement that increases his costs and the phone company's revenue.

Perfectly clear

Last month, AT&T made its position even clearer, if possible.

Several weeks earlier, the common carrier bureau suggested the phone company's methods of marketing the Magicall automatic dialer "raises serious and substantial questions of lawfulness." Specifically, the bureau wondered why AT&T rents Magicalls to its dial-up customers without connecting arrangements while simultaneously insisting that other dial-up customers, who prefer to acquire the same equipment directly from the manufacturer, must use connecting arrangements.

Bell answered this question last

month by threatening to drop the Magicall from its line of terminal equipment. The actual language used by the phone company, of course, was far less direct: AT&T is "presently considering the feasibility of recommending that procedures be initiated by all Bell System companies to terminate their offering of the Magicall device to future customers and to continue to provide such service only to existing customers for additions and maintenance purposes." Other automatic dialers would be offered in place of Magicall, it was added.

A common carrier bureau source was asked what will happen if AT&T is equally uncooperative about loosening its interconnect restrictions to reflect recent developments in New York and California. "The phone company will be fined," he answered, explaining that the Communications Act of 1934 bars any carrier from providing service that violates a current tariff. A separate fine would be assessed for each day the present AT&T interconnect restrictions were violated by cus-

tomers in California and New York, and each customer would represent a separate offense. The spokesman added that the bureau would obtain the data needed to assess the fines from the three telephone operating companies involved. AT&T was given until the beginning of this month to decide whether it will make the tariff modifications.

Closing in

Even if Ma Bell manages, somehow, to fend off this latest challenge to her interconnect restrictions, it seems pretty clear that the old lady is being forced slowly but inexorably into a corner. Ironically, it is other communications carriers, rather than the federal government or competing terminal equipment makers, who are doing the most effective shoving.

Rochester Telephone was the first to break the carriers' solid front, when it proposed a liberalized interconnect scheme last year. And last month, as reported in DATAMATION (Jan., p. 105), Western Union became the second when it filed an even more liberal plan, affecting a far greater number of data communications users located throughout the country.



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The new WU plan, basically, applies present AT&T interconnect restrictions to TWX users of foreign attachments, while allowing users of similar equipment to connect it directly to the Telex network. John Spirito, assistant vp for exchange services, explained the rationale as follows in a statement filed with the FCC along with the proposed tariff:

"The TWX network interconnect arrangement for CPTs (customer-provided terminals) is governed by contract agreements with the telephone companies. Western Union will meet these agreements by interconnecting a CPT via a TWX access arrangement (TAA). The TAA provides the protective circuits the telephone companies believe they require (italics added). Access to the Telex network, on the other hand, will be provided by a Telex Line Adapter (TLA). The TLA is designed to simply provide a standard interface, applicable throughout the country, and does not contain any protective devices." Spirito added that "Western Union expects the (Telex) customer, via his equipment supplier," to protect the network. "As the CPT program develops, Western Union will review the experience gained and make such changes in its interconnection requirements as may be required to protect the network if these expectations are not met."

Prolonging the monopoly

This position is diametrically opposed to the one taken by the phone company, which has insisted not only that detailed network protection standards must be worked out before non-Bell equipment is directly interfaced with the dial-up network, but also that an elaborate scheme for certifying that this equipment meets these standards before and after installation must be developed jointly by carriers and independent suppliers. FCC advisory groups representing the affected interests have been arguing about foreign attachment standards and certification schemes for more than a year. It will be many more months, if ever, before these projects are completed. Cynics suggest that AT&T's support of the advisory groups is really a delaying tactic, designed to preserve its present interconnect restrictions and its present monopoly over telephone terminal equipment.

The new Western Union tariff, if it's accepted by the commission, will raise TWX terminal charges a maximum of \$15/month. The typical user, who has a WU-supplied Model 33 KSR,

will pay \$58.50—\$11.50 as an access charge and \$47 for the terminal. A customer who provides his own terminal will pay the same access charge. But customer-supplied TWX terminals will be unable to communicate with WU-supplied TWX terminals unless the former user gets his data set from Western Union (at an additional cost of \$28.75/month), or the independently made terminal and modem provide answer-back capability and accommodate the TWX message format and communications protocol. All TWX users, regardless of who provides their terminal equipment, pay a \$50 installation charge under the proposed tariff.

Telex terminal rates go up a maximum of \$10/month, but in most cases the increase is \$8.50. There is also a \$50 charge for each terminal installation. A typical customer, using a Model 32 KSR, would pay \$73.50/month—\$49.50 for the terminal plus \$24 for access—versus \$65 previously. Here again, the Telex user who supplies his own terminal pays the same access charge as the customer equipped by Western Union. And assuming the foreign attachment meets the CCITT standard, it will be able to talk to all other Telex terminals.

—Phil Hirsch

First "Domsat" to Fly in '74

Western Union was authorized to begin building a domestic satellite system last month, winning a possibly significant headstart over seven other "domsat" applicants.

Although the FCC's approval means the company may build three satellites, it must go back for permission to launch them, and go back again for authority to build the seven ground stations planned.

WU president Earl Hilburn expects the first "Westar" satellite to be launched in April '74. Two satellites will be orbited initially, each having 12 transponders and be able to communicate with all 50 states. A single transponder will accommodate 600 two-way voice channels, one video channel with associated audio, or a single 50-megabit/second data link.

The major applications, said WU, include the company's public message, Telex, and private line services; but Westar channels will also be available for wideband services and "other services where communications will ben-

efit from the cost insensitivity to distance . . . of satellite transmission." General Electric is one of three large companies that have already indicated interest in leasing Westar channels, Hilburn said.

Other domsat applicants are AT&T, RCA, Comsat Corp., Western Telecommunications and three joint venture groups: Hughes and GTE, MCI and Lockheed, and American Satellite Corp., a consortium of Western Union International and Fairchild.

Report Explores Two-Way CATV

A tv viewer may be able to directly access memory banks and the computational capabilities of computers over his tv hooked into a cable, if the recommendations in Mitre's "Urban Cable Systems" report are implemented. Studying the potential of Community Antenna Television (CATV) in Washington, D.C., Mitre found that besides a demand for conventional one-way services, there was also a substantial market for two-way services, made possible by a computer installed at headends, the originating section of the cable system.

The two-way services come in two forms—the Subscriber Response Service and the more sophisticated Electronic Information Handling Service. The Subscriber Response Service would require a small computer at headend and a keyboard coupler and address decoder in the home. For an estimated charge of \$6.50 per month, slightly more than the average fee charged by conventional one-way cable systems, interactive entertainment and education could be brought to the home screen. Other services brought home via tv would include preference polling, catalog shopping, alarm communications, and communication for utility and maintenance service. Terminals are currently being tested in El Segundo, Calif.; Overland Park, Kansas; Orlando, Fla.; and Reston, Va. The incremental capital costs per subscriber are set at \$150.

With the Electronic Information Handling Service, a tv viewer could access computers for informational, educational, and cultural material. The information retrieved from the data banks would then be flashed on the screen for the viewer's education or enjoyment. Students could progress at their own rates with the computer-aided instruction. Vocational counseling in the privacy of the home could be provided. Tv viewers would not have to leave the comfort of their homes to go shopping or make reser-

vations or go to the bank or apply for credit.

To provide these specialized services, a high-capacity computer would have to be installed at headend. A single-frame alphanumeric frame stopper would also be required; however, the unit has not yet been developed. Video storage needed for EHS could be provided by either a video tape recorder, an image storage tube, a video disc, or solid state memory. Incremental capital costs are set at \$400 per

subscriber with an additional monthly charge of \$8.50 to \$15.50.

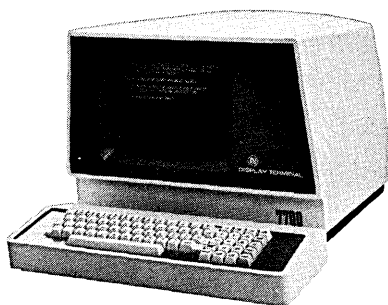
The Washington Cable System, as envisioned in the report, could also provide such special services as improving health care by the electronic exchange of patient records, remote diagnostic analyses, and by updating and continuing the education of medical personnel—all via cable. Information on health problems could be transmitted from the computers to the viewer's home screen with data entry

terminals. Two-way video hookups would allow specialists in central hospitals to see, diagnose, and prescribe treatment for patients in outlying clinics. Traffic jams in Washington could be remedied with the proposed cable connecting traffic lights and computers.

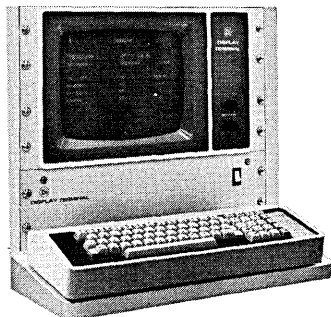
When can the tv viewer in Washington expect this interchange with computers? The City Council is working on terms of a franchise ordinance so that a CATV franchise can be awarded in the city. The Washington Committee on Economic Opportunity, Manpower and Labor said it was taking a long, careful look at Mitre's recommendations, but there is "no sense of urgency" in implementation. The Subscriber Response Service is ready technologically for implementation, but EHS is at least 10 years away in terms of hardware development, according to Carol Paquette, who helped prepare the report. Although a decade away, Italy, France, Japan, Time/Life, and all the major cable manufacturers have contacted Mitre about the feasibility of EHS.



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Societies

"Still Talking to Ourselves"

Gordon (Whispering) Smith, ACM's executive director, has been lured back to the international computing scene by Singer Business Systems. He is now vice president for international marketing there, a familiar task, since he served as Univac's marketing vp for Europe, Africa, and the Middle East from 1959 to 1966.

Smith was chief administrator for the Assn. for Computing Machinery for three years. He was brought in during Walter Carlton's presidency with, he said, three particular goals: to boost membership, encourage corporate support, and improve ACM's image. While some of that was accomplished, he feels "we still tend to talk to ourselves more than to the outside world . . . our publications are the best, but they don't address what the user can put to work tomorrow. Our professional development activity hasn't found the key to appealing to the working data processing manager and still is aimed at the highly technical person."

Smith was pushing ACM toward a "Triboro Bridge" of the academician, R/D person at the manufacturer and software house, and the user. "ACM should function in the way those elements communicate."

He did note ACM was trying, point-

ing to the new special interest group on measurement and evaluation and to cooperative projects between ACM, IEEE, and DPMA. For example, ACM has joined DPMA in supporting the new Computer Foundation formed to examine new ways to certify the dp professional. "There is solid acceptance in these societies that the computer industry needs more people pulling together."

Smith also noted ACM's efforts to improve computing's public image via the ombudsman program. The tasks Smith regrets not completing are ob-



GORDON SMITH
Leaves ACM for Singer post.

taining more corporate support and more government-funded projects for ACM. "We have more than 25,000 members, an intellectual resource that's stupendous and could undertake all kinds of projects now going to other sources." He was referring to more projects like the National Science Foundation grant in which ACM and the National Bureau of Standards are developing reports on data accessibility, privacy, and system performance.

ACM is perpetually "on the verge of a financial crisis," said Smith, and excluding its accounting problems, that's as it should be. "There are always more things to do than we have money for. We won't ever be that strong financially."

Accounting problems did strike ACM again, this past fall, but this time it wasn't for lack of control. Ironically for the association, errors in calculation that everyone, including the auditor, missed caused an expected \$50,000 surplus to turn into a \$120,000 deficit. This forced ACM to borrow money last fall. What happened was that ACM switched from a cash accounting method to an accrual method to avoid the confusion caused by sudden peaks in income from subscription and membership renewals. But somehow, the complicated formulas for calculating the accruals were botched.

By the accrual method, which essen-

tially spreads income over the year according to services due the member or subscriber, ACM is \$400,000 in debt. This means "debt" to its membership of about \$300,000 and over \$100,000 of real deficit. On a cash basis, things aren't that bad and may get better with the increase in dues. As of mid-December, ACM had \$190,000 cash and \$120,000 in accounts receivable versus \$250,000 in accounts payable and notes of \$80,000 to its printer.

In hopes of solving this accounting nemesis, ACM is turning to a third accounting method, a combination of cash and estimated accrual accounting.

Group to Funnel Certification Work

Scattered efforts throughout the information processing industry to foster and measure individual skill and knowledge soon may have a focal point.

At least that's what the embryonic Computer Foundation hopes to become. The concept of the foundation grew out of recommendations made by a Certification and Testing Advisory Committee formed by the Data Processing Management Assn. (DPMA) in late 1971 to include members from

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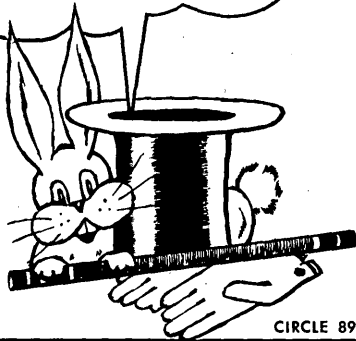
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CIRCLE 85 ON READER CARD

news in perspective

various segments of industry and related associations.

Committee members included: William Horne, assistant vice president and director, management information systems, USM Corp.; John K. Swearingen, vice president and general manager, Environmental Research Corp.; Fred H. Harris, director, The Univ. of Chicago Computation Center; Cmdr. Grace M. Hopper, head of Navy Programming Languages Section; and W. J. S. Ellis, manager of administrative services, Chicago Tribune.

Early this year the executive councils of DPMA and the Assn. for Computing Machinery (ACM) approved both the concept developed by the committee and participation in an organizing committee seeking to generate a final proposal for establishing a Computer Foundation. This committee, co-chaired by Harris and Swearingen, held an open meeting in Chicago last month at which the concept was outlined for representatives of eight other organizations. They were the IEEE Computer Society, the Society of Certified Data Processors (SCDP), the Society of Professional Data Processors (SPDP), the Assn. of Computer Programmers and Analysts (ACPA), the Society of Data Educators (SDE), the Illinois Society of Certified Data Processors, the Assn. for Educational Data Systems (AEDS), and the Assn. for Systems Management (ASM).

"It was an information presentation type session," said Harris, "designed to acquaint the groups with the foundation concept and invite their participation on the organizing committee." Participants would be required to underwrite a portion of the organizing costs.

Target span for the organizing period is six months. During this time, Harris said, attempts will be made to more clearly specify what are now broadly defined statements of purpose. "A name will be one of the things considered."

A first major endeavor, he said, will be to foster and enhance existing certification and testing activities. This will include, as soon as the foundation is organized and functioning, administration of the Certificate in Data Processing and the Registered Business Programmer examinations. "We want to draw on DPMA's experience in administering exams," said Harris, "but we won't stop there. There are business-oriented data processing exams at the supervisory and management level. We want to spread out horizontally to

DATAMATION

scientific and other data processing areas, and vertically to other grades of proficiency."

Administer existing tests?

Several of the groups interested in the foundation have existing certification programs and tests, and Harris said it is "conceivable" the foundation could administer these.

One which has and is committed to participation in the organizing efforts is ACPA. This group has been working on a programmer certification exam since its inception two years ago. Geoffrey Thomas, national vice-chairman, said the ACPA test "in essence is just about finished. In fact it could be taken right now, but as it stands it is a six-part, three-day test, and we want to cut it back to one day." And the administration details have yet to be tackled; that's where Thomas hopes the proposed foundation will come in.

Thomas also hopes the foundation can help when ACPA receives an expected approval from the British Computer Society to administer its test in this country. "We want to come up with a test that would have international recognition," he said. If they get the BCS approval, ACPA would cut its own test back to cover entry level, using the British test for higher level examination, adapting it to the needs of this country and to a program which includes recertification every two years. In Britain the test is taken only once.

Another participant in last month's meeting which has its own certification program is the Society of Data Educators with its Certificate in Data Education and Certified Data Educator programs. SDE, along with the Society of Certified Data Processors and the Society of Professional Data Processors, is participating in another effort whose goals partially overlap those of the proposed foundation.

This is a proposed American Institute of Automated Data Professionals headed by acting president Dr. Enoch Haga, executive director of SDE. The group has, as a starter, developed an "integrated plan for the upgrading of data processing practice over the next five years." The plan includes a program for upgrading data processing practitioners and, with interest by the three organizing societies evidenced in the proposed foundation, it is possible that efforts toward this upgrading could be funneled through the foundation.

An increasing interest in certification was reflected in the number of applications received for DPMA's 1973 Certificate in Data Processing exam, and John A. Guerrieri, Jr., director of DPMA's research and professional services, sees formation of the foundation

as a possible reason.

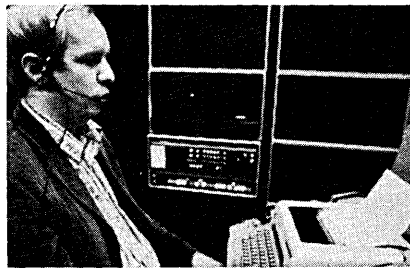
A total of 3,145 applications were filed by the Dec. 1 deadline. This compares with 2,944 for the 1972 examination. This year's test will be Feb. 17 in 100 test centers. Of the total applications for it, 2,025 were from those taking the test for the first time. Guerrieri said this is an increase of 25% over the 1,512 new applicants for the 1972 examination.

Health Care

Computer Assists Stuttering Therapy

Dr. Ronald L. Webster, associate professor of psychology at Hollins College in Roanoke, Va., is using a PDP-81 in the treatment of stuttering.

The minicomputer is being used in the college's Fluency Shaping Program, which provides a treatment procedure for stuttering based on the observation that the specific, observable speech behaviors of stutterers can be reconstructed to yield from markedly improved to normal, fluent speech. Dr. Webster views stuttering as a behavioral problem, not as a component of an underlying emotional disorder. Careful, intensive, systematic retraining in how the stutterer makes the sounds, syllables, words, and sen-



Using earphones and a tiny mike, a stutterer talks to the computer, and it replies via the typewriter.

tences of his language forms the basis for the program, he explains.

Dr. Webster developed the computer-assisted fluency shaping program in collaboration with professor Keith Hege of the college's department of physics, and Reggie Schoonover, a graduate student. Their first task was to introduce the sounds made by the stutterer to the computer. The sound of a stutterer's voice was translated by a microphone into an electrical signal transmitted to the computer through a special circuit. Another device took the continuously changing electrical signals associated with the stutterer's voice and converted them into a series of pulses suitable for

reading by the PDP-81's main processing unit.

Next they developed a series of instructions to get the computer first to read the properties of an incoming signal and place it in memory, next to search memory to find the appropriate reference values for the specific sound spoken, and finally to compare the incoming signal with the standard and make a decision. If the incoming signal meets certain criteria, the computer will signal the subject that the speech sound has been made properly.

The better judge

The subject sits at a typewriter terminal wearing a headset microphone. He talks into the microphone and gets back via typewriter such responses as: That was an awful sound, you dummy; Whoops; very good response; that was a very good sound, Charlie; Bad, Bad, Bad !!!!!; and try that one more time. Dr. Webster says stutterers in the program have really liked working with the computer. "They feel the computer is consistent and fair in its judgements about the adequacy of their speech responses. Previously we had been asking human therapists to make decisions about rather minute characteristics of behavior. It was no surprise to find that the computer was a more reliable judge."

One of the more meaningful results of using the computer, he said, was that stutterers learned more quickly the specific movement patterns involved in producing speech sounds. "We decided this was because removing the human reduced disruptions and allowed the subject to concentrate on learning the speech task."

At present the computer is working solely as a judge of speech sound accuracy. The stutterer works through a programmed text while the computer listens, tells him whether or not he is correct, and signals when to go on to the next step.

Performance goals next

The Hollins group's next step will be to develop a computer program that will contain performance goals that must be met by the subject at each step of the program before he is permitted to go on. Dr. Webster also foresees improving the capabilities of the computer to the point where it will be able to make judgements about sounds contained within sentences. It now judges only single-syllable and single-word utterances.

The group also is exploring the possibility of having the computer diagnose the speech sound deficiencies of

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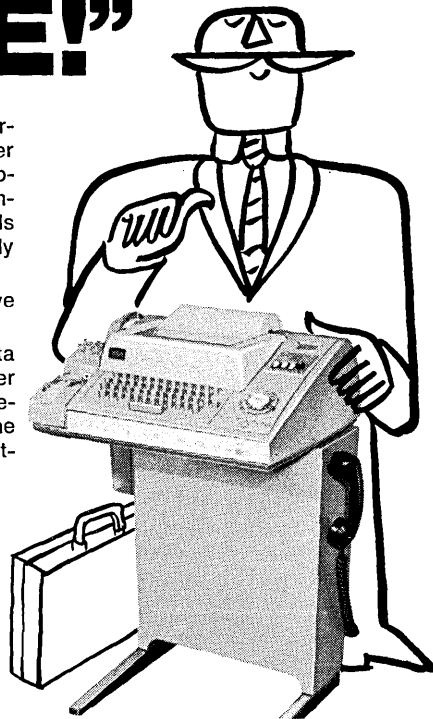
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CIRCLE 74 ON READER CARD

news in perspective

individual stutterers to provide a profile of sounds that will require the greatest amount of attention during the retraining period.

Ultimately, Dr. Webster sees the advent of "dial-a-therapy," where subjects could work with computers via telephones connected to regional computer centers for treatment of stuttering and possibly other speech disorders.

International

Flight Simulators: Entry to China

The U.K.'s Redifon company outbid U.S. and Japanese competitors for an order for two digital control flight simulators from Red China's CAAC Airline. The \$5 million contract, awarded early this winter, is considered an important market breakthrough for the British electronics and computer industry in the potentially enormous Chinese arena.

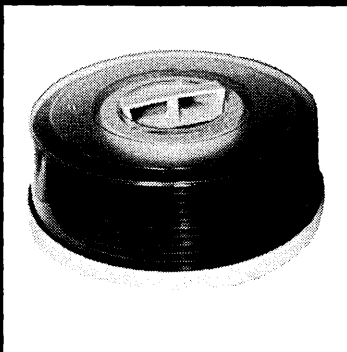
The Chinese airline will use the simulators for crew training with a fleet of 10 Boeing 707s and Hawker Siddeley Trident 2Es ordered in the fall.

The Redifon group is a broadly based electronics and communications company spanning tv broadcasting, defense systems, and industrial and commercial data processing. Development of flight simulators started in 1949 as an extension to aviation communications.

The systems for China include a new development for displaying the chosen airport panorama to a pilot in the simulator cockpit. This is called DUOVUEW. It gives a display with an image of vision to infinity, as if looking through a real windscreen; and the perspective obtained is also realistic in the way it changes when moving from one side of the flight deck to the other. The simulators use a 48K R2000 processor, a 24-bit word machine belonging to the commercial and industrial range of the Redifon Data Systems Div.

Most of the 200 simulator systems installed by Redifon are of the big digital variety. Mike Long, area manager of Redifon's Simulators Div., who headed the sales team to Peking, says the necessary computer capacity for digital control doubles every five to seven years, and this is reflected in the rising level of sophistication requested by the customers. He calcu-

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lates that software control for the visual display and motion mechanism of a simulator occupies about 2.5K of store. Radio and navigation simulations take about 8K to 9K, and a similar amount is used for the introduction of engineering malfunctions by the flight examiner.

First proposals to the Chinese CAAC contained economic studies showing the cost-effectiveness of pilot training on the various systems being offered. To Western airlines, the productivity of pilot training clearly forms a high priority in a well-recognized competitive business. Perhaps because they are establishing a new international airline service requiring both the confidence and safety certificates of other national aviation agencies, the Chinese have placed safety requirements at the top of the list. Marginal arguments on cost-performance between proposals appear to have carried little weight.

In fact, one of the Chinese airline's requests is for the visual display to include a seascape into which trainee pilots could simulate ditching at sea. Long believes this is the first time this facility has ever been requested and will call for close collaboration with the airframe manufacturers. Data on the behavior in the sea is apparently not standard information carried in the files of the airplane companies. Models of this behavior are being constructed to add to the R2000 software.

Software Industry: France and U.K.

Although there are more computers in Britain than in France, a recent study shows France's software industry revenues are double those of the U.K. A study by Société d'Etudes et des Systèmes d'Automation (SESA) and Logica Ltd., in the U.K., shows that in France last year, some \$98 million was spent for professional services such as consultancy, analysis, and programming compared with \$43 million in Britain. Spending for all services, including independent service bureaus and those of manufacturers, amounted to \$276 million in France and \$155 million in the U.K.

A breakdown of the users shows the French government's commitment to supporting both a software and a hardware industry. Almost 13% of services are bought by the central government, and state-owned industries contribute another 15%. In the U.K., the relevant statistics are 7% and 10%. The report notes that support through the central government in Britain was beginning to rise steeply by the end of '72.

Of 5,800 consultants, analysts, and

programmers in France, the professional services companies employ 3,650 and the service bureaus 2,150. In the U.K. a total of 4,700 was divided into 3,300 in professional services and 1,400 with computer bureaus. Analysis of the professional service companies' income shows a return of almost \$29,000 a head a year in France against \$13,000 for each member of professional firms in the U.K. The survey notes that higher charges exist for professional services in France but indicates this is not the complete explanation. Logica's management believes some underestimates must have occurred because its own income is about \$18,000 a head.

In a detailed discussion on the information, Philip Hughes of Logica and Jacques Stern of SESA recommend the respective government departments recognize the potential export business from the computer service industry and ask them to harmonize the base for statistical data of the two countries.

Changing Face of U.K. Computer Meets

Both the British Computer Society and the U.K.'s Business Equipment Trades Assn. (BETA) have thrown in the towel over the gruelling job of running conferences and exhibitions for computermen and computer users.

The BCS decided it could no longer afford to speculate with its "Datafair" gatherings, the next of which is to be held in April. So the BCS has linked with a commercial conference firm, International Business Communications, after turning down many other partners, including a three-year-old organization called Online Computer Systems Ltd.

The "Online Group," as it's better known, succeeded, however, in wooing BETA; and the next big computer show in the U.K. using BETA members for formal support will be called Eurocomp 74. Eurocomps will be run by a joint panel of advisers drawn from BETA and Online.

The new European Computing Congress (which is the full-month version of Eurocomp) is also hoping to have advisory members drawn from European organizations such as the U.K.'s National Computing Centre. The NCC is examining a request to nominate a member to the embryo panel for Eurocomp 74.

In May '74 the first Eurocomp will please everybody because there is no competing show planned, and the Eurocomp 74 format is aimed at business needs in computing. However, in Eu-

rocomp 75 there is a major threat to the planned Datafair 75 sponsored by the BCS because the content of Eurocomp 75 is intended to serve the scientific and technical computing groups.

Since Online has been in existence for only three years, and by contrast the BCS is 15 years old, the BCS would seem to have the edge, with its record of devoted service to both the scientific and business computing communities and confrères. However, the sad truth is somehow different.

Online started as the response from a small group of the computing staff at Brunel Univ. to the need to confront potential users of computer-based graphics techniques with a live snapshot of progress in universities and commercial research. Liveliness and smallness paid off, and there are few in the U.K. who doubt that the attractiveness of Eurocomp 75 for the technical users of computers will be a real threat to the "middle-of-the-road" pattern of the BCS series of Datafairs.

Incidentally, the Datafair series was started by a band of enthusiasts inside the BCS who thought that the use of data transmission facilities in computing techniques needed a self-contained format where crude selling was draped with a fig-leaf of a seminar or two. But whereas the BCS has become a tiny bit pompous with its attempt to woo the support of the business computing user, the Online group has stuck to the high-spirits-high-technology drive for its series of conferences and exhibitions.

Meanwhile, back at the money shops, the BETA format of trade shows took the road toward a total computer focus with Computer '70, which hit the trade at a most inauspicious moment in October of that year. The result of this was that this year's Computer '72, held in December, was something of a frenzied hybrid in content. The total attendance was down to around 27,000 (the price kept students away and encouraged the serious enquirer and buyer). However, Computer '72 had no stands labeled IBM or ICL, and the Honeywell booth merely contained the fantasy machine designed by Emmett. To balance the books, therefore, the weight of the U.S. Trade Center was thrown behind Computer '72. Nearly 90 U.S. firms were herded into the show, vastly outnumbering BETA members but providing good cash for the BETA coffers.

But it was clearly the end of an era. On the second day of the show the marriage of BETA and Online for conference purposes covering computers was formally announced. However, the real search had still to be undertaken. The home of these future Eurocomps will need to be inhabited by a

news in perspective

full set of European collaborators with an acute ear for the concerns of users. Yet the U.S. Trade Center circuses continue to attract, and their organizational heart simply pumps a single bloodstream. Mixed organisms tend to be weak creatures, bloated with committees. So where will the next spurt of lively lads come from?

—Hedley Voysey

Benchmarks

The Ins and Outs: At the end of its first full year out of the general-purpose computer business, RCA was expecting to report record sales and earnings of \$2 a share. In 1971 RCA's earnings equaled \$1.20 a share before the write-off of \$250 million for closing the computer operations. Still very much in the computer business, both IBM and Burroughs showed earnings increases in 1972 over '71. IBM earned \$340,427,043 last year, up from \$306,019,438 the year before. Burroughs' 1972 earnings were \$38,690,000 against \$33,603,000 in 1971.

Two-Thirds of the Globe: General Electric's Mark III network spans two-thirds of the globe following expansion into Japan and extension of a distribution agreement in Europe. The Japanese expansion was under local management of Dentsu Advertising Ltd. of Tokyo, which will provide local sales and service for the time-sharing network to which Tokyo is linked via leased satellite channels. The European extension adds Mark III services to the GE services already marketed in Western Europe by Honeywell Information Systems Inc.

A First in Communications: Western Tele-Communications, Inc., Denver, has placed a portion of its recently authorized Los Angeles to El Paso microwave common carrier system in service, becoming the first to implement an operating service under Docket 18920, in which the FCC in mid-August 1971 spelled out the rights of miscellaneous common carriers to construct and provide long-haul communications systems. The implemented segment, from San Diego to Yuma, Ariz., is providing data service to Cubic Corp., WTC's first data communications customer. Completion of the Los Angeles to El Paso system is scheduled for late spring. WTC's second authorized route, from San Francisco to Seattle, is due to be finished late this year.

Illiac Passes Test: The Illiac IV computer works, and the concept of a parallel processor is valid. Or at least that seems to be the significance of last month's announcement by NASA's Ames Research Center that the Illiac IV had passed its acceptance test. In effect, the contractors—the Univ. of Illinois, which designed it, and Burroughs Corp., which built it—successfully completed their requirements. During the test, which ran some 80-100 hours, it provided in excess of 70% uptime at a minimum of 15 megaHertz, and performed arithmetic and data transfer operations specified in the contract. Among the work remaining: tie the Illiac to a companion PDP-10 and a billion-bit parallel disc file, and get the software for all this working. The current plan is to get a limited number of users on the system this spring and to achieve operational status in the fall.

GT&E Appeals: GT&E is appealing an order by federal district court in Hawaii to split itself into seven separate entities. Under the court order, Automatic Electric and Lenkurt Electric would be among the properties put on the block. GT&E would be barred from manufacturing any telecommunications systems in the U.S. or Canada except for military equipment and computer software.

Down with DDS: University Computing Co.'s Datran division, MCI, and three other opponents fired big barages at AT&T's digital data system proposal. Datran, in a 102-page filing before the FCC, said the commission

should deny the phone company's request to begin construction (see Dec., p. 93) because the system would "frustrate competition" and have "derogatory effects on the voice network." MCI, sounding a popular theme, said that AT&T "has every incentive to produce cost and market studies which bear the incremental cost label (and) . . . which always end up justifying very low rates for its competitive services . . . especially for the largest users of those services."

Computers and Society: The National Science Foundation has a new Computer Impact on Society section which will support research on the effects of computers on organizations and the individual. Projects to be considered in the organizations program will include investigations of legal and economic problems; security and privacy questions; and problems in areas such as automation, robotics, and traffic flow. The individual program will support work on improving citizen access to automated information systems and will emphasize the improvement of man/machine communications.

Happy Birthday: The University of Pennsylvania's Moore School of Electrical Engineering, which pioneered in digital computing with development of the ENIAC during World War II, is observing its 50th anniversary this year with a year-long program of scientific, professional, and ceremonial events, the first of which is a special Engineer's Week program this month. The Moore School, in addition to being the birthplace of the digital computer, was the first school in the U.S. to award a PhD in computer sciences. □



A NEW FACILITY has been built by Goodyear Aerospace Corp. at its Akron, Ohio, headquarters to showcase its giant Staran computer. Potential customers will be shown the array processor's ability to perform complicated file search applications, and those who decide to purchase will be able to check out software being developed for the machine until theirs comes off the assembly line. The Staran in this particular configuration acts as an auxiliary processor to a Xerox Sigma 5 and an Electronic Associates 7800 analog computer, but interfaces for almost any computer can be provided. With up to 32 hardware processors, each operating at 15.8 million instructions per second, the Staran is one of the most powerful computers in the world.

FOR LIBRARY CIRCLE 22 ON READER CARD →

The Olivetti girl presents her family



Meet the direct descendants of a distinguished line of Olivetti information systems that started a half-century ago. It's a big, big family adaptable to almost any situation. With over 50,000 already installed! Teleprinters for administrative tasks. High-speed buffered systems for full-service banks and savings institutions. Smart terminals that communicate with computers and each other. All displaying those fine old Olivetti family traits of ingenuity, great design and terrific service backup. (There are Olivetti branch offices all over the U.S. with trained personnel on call!) Ask us for a proposal on your next terminal installation. Join the family.

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The American Dream Machines

office typewriters
portable typewriters
adding machines
calculators
word processing systems
accounting systems
electronic billing systems
microcomputers
on-line systems
office copiers

CIRCLE 33 ON READER CARD

Hardware

Hardware Notes . . .

A doubling of the maximum memory capacity on the IBM 370/145 has been announced by ITEL Corp., San Francisco. A system with a full megabyte of semiconductor memory might make for some interesting benchmark figures. One computer designer we know recently stated that the only reason a 145 couldn't outperform a 370/155 in many applications was because IBM offered only 512K of memory on it.

The first large-scale computer system ever built in Canada was shipped in late December, a full month ahead of schedule. Attending the ceremony were Canada's Minister of State for Science and Technology and executives from the manufacturer--Control Data Canada. The CYBER 70 model 72 went to Northeastern Univ. in Boston.

An eight-minute film entitled "Computer History Digest" that was prepared by ACM for viewing at the association's 25th anniversary in Boston last August is now available to all interested parties. ACM says the chronicle of the most important events in computing history proved so popular that it had to go into production of the film. It's available to ACM chapters for handling and mailing charges only. For others, it rents for \$15 for two weeks' showing privileges. Purchase price is \$95. ACM, 1133 Ave. of the Americas, New York City.

Scientists at Carnegie-Mellon Univ. in Pittsburgh are using sophisticated digitizing, graphics, pattern recognition, and computing techniques to study the nervous system of lobsters. Dr. D.R. Reddy says the lobster was chosen simply because its nervous system is considerably easier to study than that of humans. One can't help wondering whether minicomputers couldn't be used to tell us more about crabs, and microprocessors further our knowledge of shrimp.

Auxiliary Storage

Most auxiliary storage devices offered for teletypewriter terminals are mechanical in nature, usually cassettes, cartridge drives, or the paper-tape reader. But this storage unit, the model 7132, is a solid-state memory with editing features that can transmit at 1200 baud over voice-grade lines. The memory is expandable from 4-16K characters and can be provided with an internal 202C equivalent modem or with a standard EIA interface to an external modem.

The 7132 is said to be easily installed in the stand of a model 33 or 38 tty, with buttons atop the teleprinter to control message preparation, editing, transmission, and reception. The unit can be interfaced to teletypewriters transmitting 5-, 6-, or 8-level code between 30 and 110 baud. The price of a 4K unit is \$1300, with each additional 4K adding \$500 to the price. Delivery is approximately 120 days. PULSECOM, Falls Church, Va.

FOR DATA CIRCLE 231 ON READER CARD

Office DP

The Q1 is another product that combines features from a number of conventional products into a new blend that is generically difficult to classify. The Q1's builders call it an office computer. In support of that are a programmable processor expandable from 4-16K bytes of 500-nsec MOS/LSI memory, approximately 48 mnemonic instructions, seven general-purpose registers, and a combination compiler/interpreter that supports, of all lan-



guages, PL/1. But the Q1 is dependent on an operator for its speed, and since it is specifically aimed at order entry, inventory, and accounts receivables and payables processing, we think it's a very capable electronic accounting machine whose real competition will be products like the NCR 399.

Emphasis has been placed on making the Q1 compact. A one-line, 80-character display has been incorporated into the front of the teleprinter console, providing soft, as well as hard, copy. The display can hold information being entered on the keyboard or

fetched from main or peripheral memory. The teleprinter knows a 96-character ASCII set and can print it across 158 print positions. Additionally, the printer can be programmed to plot, proportionally space characters, and justify lines, qualifying it for word-processing applications. Auxiliary storage consists of a small disc unit and magnetic cards, each card capable of storing 20,000 digits, or 2,000 words of text. The reader operates at 160 words/second.

The systems software consists of the assembler, an operating system, a text editor, and some utilities. Application software development is left to the user since the Q1 can be used in so many applications.

A typical Q1, with 8K of storage, teleprinter/display, and disc, sells for approximately \$15K and is available 90 days ARO. The vendor says initial customers have received their units. Q1 CORP., New York, N.Y.

FOR DATA CIRCLE 230 ON READER CARD

Drum Plotters

The 8000 series is just now coming to the U.S. shores from Britain, where it is said to have enjoyed reasonable success competing against the CalComp 500 series. The drum is offered in 14-, 30-, and 36-inch lengths and accommodates paper up to 144 feet long. The plotter operates at 600 increments/second, and these increments can be specified at order time to be .005 or .01 inches or .1 or .2 millimeters. The pen up/down time is 20 msec, and two pens are standard on the two larger models. Interfaces for on-line operation are available for the IBM 1130, 1800, and most 360 models; and the Honeywell 16 series of minicomputers. Off-line operation is performed with the aid of a paper tape reader or from a choice of magnetic tape units.

Basic software is supplied for many computers that would generate off-line inputs for the 8000 series, including many Burroughs, CDC, Univac, and Honeywell systems, and nearly every 16-bit minicomputer. The 8000 series is also compatible with CalComp 500 series software, it's claimed. Prices range from \$6-13K depending on size of drum, on- or off-line operation, etc. Delivery is within 90 days. AUTO-TROL CORP., Arvada, Colo.

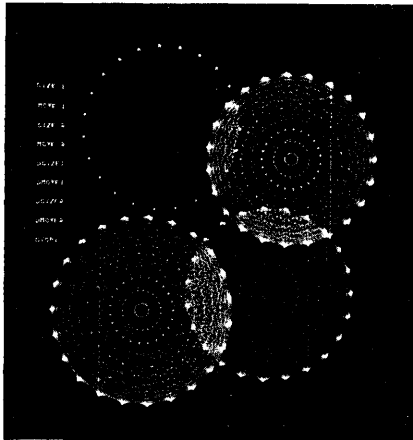
FOR DATA CIRCLE 232 ON READER CARD

Color Display Tube

This is one of the products displayed in Anaheim that made the final FJCC such a success. It's called the cps-8001 color monitor, and it can display red,

orange, yellow, and green images in remarkable clarity. The tube is offered to oem's for fulfilling increasing demands for color capability.

The tube measures 21 inches diago-



nally. The standard resolution is .025 inches, with .015 inches optional. The vector generator operates at 1.5 usec/inch, and the light output measures 25 foot lamberts in worst case. The price in quantities of 1-25 is \$11,800, and delivery is 90 days. CPS, INC., Sunnyvale, Calif.

FOR DATA CIRCLE 233 ON READER CARD

Flexible-Disc Drive

The flexible-disc drive is obviously going to be with us for a while because it provides something cassette storage cannot: random access to information. A number of companies are battling to get the "inside track" in this market, and Memorex' latest offering, the model 651, is an enhanced version of the earlier 650. It has faster data access time (10 msec track-to-track, and 80 msec latency) than the 650, increased capacity (2.5 megabits), and a higher transfer rate of 250 Kilobits. The single quantity price of \$750 is one of the lowest we've seen for this type of peripheral. Production quantities will be available during the next quarter. MEMOREX CORP., Santa Clara, Calif.

FOR DATA CIRCLE 234 ON READER CARD

Small Systems

Honeywell has added two more small-scale processing systems to the low end of its 2000 series. The models 2020 and 2030 processors fit between the model 58 (originally from GE) and the 2040 in power, placing them in same monthly rental range as the S/3, Burroughs 1700, NCR model 50, and Univac 9200.

The 2020 is expandable from 24-64K characters of 2.75 usec (standard) or 2.5 usec (optional) core memory. Models above the 40K level can be equipped with hardware multiply/divide, which is standard on all model 2030 processors. A minimum

system consists of the cpu and 24K of memory, card reader/punch, a 450-lpm 132-column line printer, and 9.2 million characters of disc storage. It sells for \$96,220, and rents for \$2341 per month on a one-year lease.

The 2030 starts with 40K 6-bit characters of 2-usec memory, expandable to 96K through five increments. Standard features it shares with the 2020 include automatic I/O and data communications interrupt, financial editing (things like leading zero suppression), and integrated peripheral controllers.

Software available for both systems include assembler, RPG, COBOL, FORTRAN, programming languages, the operating system, and a number of applications programs. A 2030 with 40K of memory, card reader/punch, console, 650-lpm printer, and 18 million characters of storage rents for \$5058/month on a one-year lease or can be purchased for \$196,170. Both systems are available as of this month. HONEYWELL INFORMATION SYSTEMS, INC., Waltham, Mass.

FOR DATA CIRCLE 237 ON READER CARD

Optical Reader

The model 20/10 optical character reader retains many of the operating features of this firm's first product, the model 20/20 introduced three years ago. Unchanged are the 2000-cps scanning rate and most of the electronics. But the document handling mechanisms have been scaled down for users who only need the capability of reading documents ranging in size from 2¼ x 3 inches to 6 x 9 inches. And the user can have the 20/10 field upgraded to a 20/20 if his needs change.

Fonts understood are OCR-A, OCR-B, 1428, 407-1/1403, 12F, NOF, E13B, 7B, handprinted numerals and symbols, and the letters C,S,T,X, and Z. There is a choice of tape drives for the off-line unit that include 7-, and 9-track heads and 556-, 800-, and 1600-bpi densities. The 20/10 reads 6 lines/inch at a maximum of 500 forms/minute, with no limit to the number of lines per document. Optional are 80- and 132-column line printers with speeds up to 1800 lpm.

Software in the Hewlett-Packard

product spotlight



Line Printer

There aren't many printers for oem's to choose from that operate at speeds where the serial printers leave off (around 160 characters/second) and where the very fast and expensive 600-, 1000-, and 2500-lpm printers start. But this attractively styled product fits right in the middle of the range. The model 2230 operates at 300 lpm across full 132-character lines. Up to six carbon copies can be printed by the drum mechanism which carries a standard complement of 64 ASCII characters,

with 86 and 96 character sets optional. Also included in the standard unit are the necessary control logic, power supply, and test printing electronics. What few printers we know of in this speed range typically sell for as much as \$25K, but the 2230's price of \$5K each in quantities of 100 should drop the final price to users far below the \$25K figure. Deliveries are slated to begin around the middle of the year. DATA PRODUCTS CORP., Woodland Hills, Calif.

FOR DATA CIRCLE 252 ON READER CARD

Microdata unwraps a bold, new communications package.

We've combined microprogramming with communications and created a system which outperforms them all at a price no one else can match. It's the new Microdata 1600/60. And it features our Twin Mini, a processor with two microprogrammed CPU's each having separate high speed control memories and I/O facilities. The Microdata 1600/60 handles up to 256 asynchronous lines, up to 32 synchronous lines or any combination of the two at the rate of 40,000 characters per second. Find out why our entry into the communications market is the finest package available today. Write for details. Microdata Corporation, 17481 Red Hill Avenue, Irvine, California 92705. (714) 540-6730.



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Microdata™

CIRCLE 60 ON READER CARD

hardware

2100 minicomputer controller performs selective field scanning, editing, and formatting. A crt is used to display rejected characters. A system with 4K memory, mtu drive and controller, IBM 2741-type console, crt, transport mechanism, one font, and 90° character rotation capability is priced at \$85,680 and would rent for under \$2K/month on a two-year lease. SCAN-OPTICS, INC., East Hartford, Conn.

FOR DATA CIRCLE 242 ON READER CARD

ASR Terminal

The 260-6 is an automatic send/receive terminal that communicates at 300 baud directly to computers or over voice-grade phone lines. The 30-cps printer uses a special heat-sensitive paper to record its 96-character ASCII set



across 80 columns. A standard Philips-type cassette drive is used to store 2,000 80-character blocks. Blocks are located using a search feature for local or remote transmission. The terminal is scheduled for delivery in June and will rent for \$150/month. NCR, Dayton, Ohio.

FOR DATA CIRCLE 235 ON READER CARD

Oem Tape Drives

Pertec's latest tape drive design is the Series 8000. The asynchronous units are available in read-after-write, read/write, and read-only models with speeds ranging from 12.5 to 45 ips. The single-capstan drives differ from the old 6000 series in that the rewind speed has been upped to 200 ips regardless of reading speeds, and there are additional features such as a quick-locking hub that automatically seats the reel, retractable tension arms, and a contoured head cover for easier loading. The mechanical portions of the tape drive have been redesigned, making the 8000s somewhat cheaper to produce. These savings are passed along to the customer, according to the firm, with the drives no more expensive than the older 6000 series. An order of 100 single-gap head drives with 25-ips

speed brings the price down to \$2365 each. PERTEC CORP., Los Angeles, Calif.

FOR DATA CIRCLE 239 ON READER CARD

Portable Terminal

The 150T is a portable terminal that operates at switch-selectable speeds of 10 and 15 cps from 115V wall outlets. The unit differs from many other portable terminals in that its impact printer mechanism can print on anything



from friction-fed standard paper to sprocket-fed 6-part stock. The 150T weighs less than 30 pounds, including its built-in acoustic coupler, and is compact enough to store under commercial aircraft seats. Switch-selectable operation at 110 or 150 baud is standard through the coupler, or RS232-B and tty interfaces can be supplied. The 150T is priced at \$2100, and initial deliveries have begun. MITE CORP., New Haven, Conn.

FOR DATA CIRCLE 236 ON READER CARD

40X Fiche Reader

The Easamatic 40 microfiche reader accepts both 4 x 6-inch and 3¼ x 7¾-inch (tab card size) microfiche, magnifies frames selected with the fingertip pointer at 40X, and displays them on a 10½ x 15¼-inch screen. A hood has been added to shield the screen from ambient light, and some curvature has been added to one surface of the glass inside to increase screen illumination. Finally, the mounting system has been modified to enable the operator to read within 3.5 mm of the bottom of the fiche. The reader is priced at \$265 and is available this month. EASTMAN KODAK CO., Rochester, N.Y.

FOR DATA CIRCLE 243 ON READER CARD

Mixed Media Data Entry

The reasons behind combining an optical scanner with a number of crt data entry terminals seem sound: Input quantities are skyrocketing along with labor rates, and systems like these are potentially less expensive ways to get input into the computer. Also, more and more firms are using both scanning and keyed input, so why not use a common processor to control both?

The 4400 mixed media data entry system is based on a 16-bit minicomputer controller designed specifically

for the system. It controls up to 32 crt data entry stations, and one or more types of optical scanners that the company has marketed in the past. A conversational and tutorial language called SKIL is used to set up the types of editing/formatting operations desired on both the scanners and the individual keystations. Additionally, an RPG II compiler runs on the 32-64K byte system.

The basic scanner for the system is the Scanak 216 which reads OCR-A, OCR-B, IBM 1403 (4-7-1), Farrington 7B, and the ABA E13B fonts. A MICR reader in the 216 reads the E13B font optically and magnetically to minimize errors. The Scanak can also be provided with sorting capability. Another scanner for the system, the model 229, reads small merchandise tags such as the Dennison tag. Additional peripherals include 400-cpm 51- and 80-column card readers, a 600-lpm 132-column line printer, and a communications controller for remote job entry to 360 and 370 computers with the OS/HASP operating system at rates up to 9600 baud.

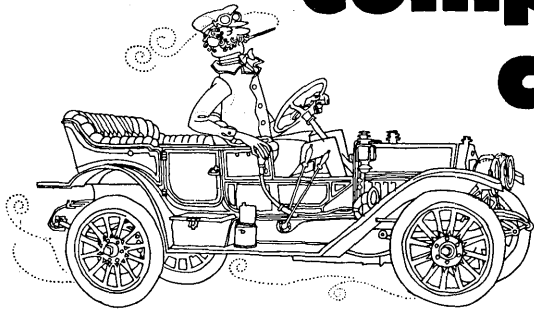
Intermediate storage on the 4400 is held on one or more 2.45-megabyte discs before it is dumped onto one or more 7- or 9-track, 800- or 1600-bpi tape drives. A typical system, with 4-12 crt key/verify stations, a tape drive, two disc drives, and the printer rents for approximately \$2500/month on an 18-month lease. Deliveries are booked up until approximately August. CUMMINS-CHICAGO CORP., Chicago, Ill.

FOR DATA CIRCLE 244 ON READER CARD

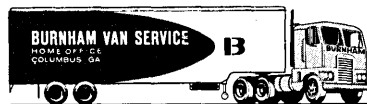
Computer System

The Century 251 is offered to installations implementing medium-scale on-line multiprogramming applications that don't currently require the power of the larger Century 300. But if the user eventually requires the largest Century, the 251 can be upgraded in the field. The smallest 251 has 96K bytes of 1.2-usec memory, expandable to 256K. Each cpu cycle pulls four bytes, giving it roughly half the power of the Century 300. The B-4 software monitor can keep track of up to nine simultaneously active programs running in COBOL, FORTRAN, or NCR's NEAT/3 package, and the entire Century 300 application program library is available for the 251. The computer won't be available until the final quarter of the year, but it's thought that typical systems (96K, line printer, card reader, dual-spindle disc storage unit, and controller) will rent for around \$10K/month, competitive with the 370/135, the Burroughs 2700 and 3700, the Univac 9400, and two of the recently introduced Honeywell 2000

computers carted with care



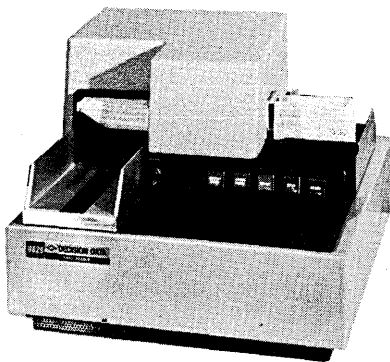
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CIRCLE 97 ON READER CARD

hardware _____

series models, the 2050 and 2060. NCR, Dayton, Ohio.

FOR DATA CIRCLE 241 ON READER CARD

Display Terminal

The TD 800 terminal is for communication with Burroughs computers at baud rates ranging from 2400-9600. In addition, the 800 observes IBM 2260 communications protocol, operating asynchronously over switched or



leased telephone lines at rates ranging from 75-1800 baud. The 64-character ASCII set is displayed in 12 lines of 960 5x7 dot-matrix characters, with 12 additional lines optional. The 960-character terminal has a purchase price of \$4750 and rents for \$112/month. Burroughs can supply the modem necessary for communication to other computer systems. Deliveries begin during the next quarter. BURROUGHS CORP., Detroit, Mich.

FOR DATA CIRCLE 238 ON READER CARD

Time-Sharing System

A Hewlett-Packard 2100 minicomputer is the basis of this firm's 3000 interactive time-sharing system. The BASIC language system supports up to 16 interactive terminals operating at individually selected data rates from 100 to 2500 baud over standard telephone lines or by direct connection to the system.

The standard hardware configuration consists of the cpu, system clock, floating-point arithmetic hardware, a direct memory access channel, 24K 16-bit words of 980-nsec memory, one disc controller and 2.4-megabyte non-removable cartridge type disc drive, and an eight-port communications controller. The price for the starting system is \$44,500. The system can be

built up with additional 2.4-megabyte drives, or with up to seven 49-megabyte removable-pack drives (similar to the IBM 2314), and eight additional terminal ports for the communications controller.

Software includes the operating system, the BASIC compiler, and features for noninterfering simultaneous file write access, run-only programs and read-only files, and nonabort programs. A fairly large library of programs can be supplied by Hewlett-Packard for the 2100. No applications programs are offered by this vendor for the 3000 at this point in time.

Several systems have already gone to the field, and it's claimed that the hardware has enjoyed an MTBF of 3,000 hours. For this reason, preventive maintenance nationwide will be done either by the supplier, gaining access to the user system over phone lines to monitor its performance, or on an agreed-to periodic schedule. The model 3000, available within 90 days ARO, comes with a one-year warranty. BASIC TIMESHARING, Mountain View, Calif.

FOR DATA CIRCLE 245 ON READER CARD

Data Entry

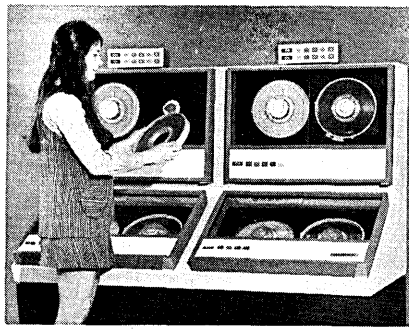
The In-Line data entry system is the largest yet introduced by Inforex. While it is fully compatible with output produced by its earlier products, the 1301 and 1302 key entry systems, the In-Line system is for those users who need more in the way of editing and checking, record-flagging, branching, validation, and field-to-field transfer operations. The operator consoles, from 1-16 of them, have an expanded set of the control functions of the consoles on the previous systems, so the use of the In-Line system for those operators won't require extensive retraining.

Standard system features include a 25-ips 7- or 9-track tape drive, eight levels of program control, 64 balance accumulators that can be dynamically allocated, crossfooting capability, etc. Intermediate storage is on the same fixed-platter disc used in earlier systems, typically storing 18,000 125-character records before transfer to tape. The programmable controller rents for \$1400/month, and each key station adds \$50/month to that, with both rates including prime-shift maintenance. First deliveries are slated in the third quarter. INFOREX, INC., Burlington, Mass.

FOR DATA CIRCLE 246 ON READER CARD

Multiple Tape Drives

Sometimes the packaging of a product can be just as significant as its function. The twin TM-34 is such a product. Ampex has combined two of its



TM-34 tape units, which are offered as replacements for the IBM 3420 series tape drives, into an attractive-looking product that might be a solution to a floor space problem in many installations. The tape units are offered in varying densities (200, 556, 800, and 1600 bpi), tracks (7 and 9), and transfer rates (75-125 ips). One twin TM-34 unit with capabilities comparable to the IBM 3420-V drive rents for \$850/month on a two-year lease, including maintenance. AMPEX CORP., Marina del Rey, Calif.

FOR DATA CIRCLE 247 ON READER CARD

Graphics System

The ADDS/500 is a stand-alone interactive graphics processing system consisting of an 8K PDP-11 controller, 21-inch crt display with phosphor protect, an ASR 33 teletypewriter, utility soft-

ware and display generator, priced at \$39,900. The standard display generator features a digital display controller with subroutine/stack capability and 26 unique display instructions. A 22-stroke ASCII generator is standard, as is a constant velocity vector generator (3.3 usec/inch). The 500 differs from the previously announced ADDS/900 in that the processor handles image refreshing and processing, while the 900 had a separate hardware controller that wasn't needed in many applications. Options to the basic ADDS/500 include alphanumeric and function keyboards, light pen, trackball, data tablet, hardcopy, microfilm output, and a number of peripherals. Initial units have been shipped. SANDERS ASSOCIATES, INC., Nashua, N.H.

FOR DATA CIRCLE 248 ON READER CARD

360/65,67,75 Memory

This small new firm of ex-Cogar and ex-IBM employees is offering 750-nsec memory alternatives for the models 65, 67, and 75 in the IBM 360 line. The series 70 memories are said to be plug-to-plug compatible with the 360, both physically and logically, and are offered in 256K increments up to 4 megabytes for the model 65. Price for 256K is \$84K, and a megabyte sells for just under \$200K. Leasing can be arranged; the memories will be main-

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January 10, 1973

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E. F. Hutton & Company Inc.

hardware

tained nationwide by Comma Corp. Delivery is 60 days. INTERMEM CORP., Wappingers Falls, N.Y.

FOR DATA CIRCLE 249 ON READER CARD

3330-type Disc Drives

Ampex is announcing its 3330-type disc storage system piecemeal; the spindles are ready for oem's now (90 days ARO), but the controller won't follow until sometime next year.

The DM-330 drive shaves 2 msec off the IBM 3330's 30 msec access time, attributable to the use of voice coil head positioning. Other than that the specs are 3330: 100 megabyte pack capacity and 806KB transfer rate from whichever controller one uses. Each DM-330 sells for \$25K and (will) rent for \$465/month on a two-year lease, including 24-hour maintenance. AMPLEX CORP., Marina del Rey, Calif.

FOR DATA CIRCLE 253 ON READER CARD

MOS/LSI Modem

The model 440/48 is an all MOS/LSI technology unit designed to operate in full-duplex mode at 4800 baud over both unconditioned and conditioned voice-grade phone lines. A nice feature

of the unit is that if line conditions deteriorate to the point that 4800 baud cannot be supported, the flip of a switch enables the unit to multiplex two independent 2400-baud lines. Standard test features include local data and line loopback, and remote loopback for one-point system testing. Optional is a line quality indicator that provides a two-digit light-emitting diode with an average line quality figure. The 440/48 priced at \$2950, single quantity with enclosure, and it can also be supplied in pc card form, with 500 units priced at \$1450 each. AMERICAN DATA SYSTEMS, Canoga Park, Calif.

FOR DATA CIRCLE 250 ON READER CARD

Oem Cassettes

The model 138 is an addition to the Termi series of oem digital cassettes. The standard unit comes with a synchronous hysteresis motor; a DC servo-controlled motor is optional. The asynchronous start/stop time is typically 22 msec at 6 ips, with a range of 2-15 ips offered for bidirectional operation. The standard head is a two-track, 800-bpi, read/write, phase-encoding unit, with a read-after-write head optional.

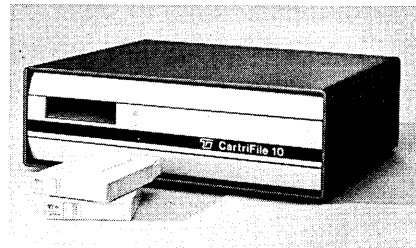
A series of sensors on the 138, said to facilitate interface considerations, includes file protect, clear tape, low tape, and cassette-in-place. The unit is avail-

able in several configurations, ranging from a deck only (transport, bidirectional head, the sensors, and a customer-specified speed) for \$165 in orders of 100, to models with RS 232C interfaces priced at \$1130 in single quantity. Initial deliveries have begun. TELEX CORP., Minneapolis, Minn.

FOR DATA CIRCLE 254 ON READER CARD

Mini Peripheral

The CartriFile 10 is the latest tape cartridge storage unit offered by this firm. Its performance falls between that provided by cassettes and much more expensive disc storage. The single cartridge drive stores a maximum of



140,000 16-bit, or 320,000 8-bit words on tapes in various lengths up to 150 feet. The transfer rate for these two word lengths is 1,000 and 1,800 words/second, respectively. Interfaces, including cabling, and software drivers and diagnostics are available for a

Even Webster's Knows About QUEST

QUEST (kwěst). v. 1. To make a search; to go on a quest.

QUEST SYSTEMS, INC. n. 1. A corporation founded in 1968. 2. The largest professional recruitment firm in the U.S. functioning solely in the computer sciences; its client companies pay all employment fees, interviewing and relocation expenses. Quest is known for its deep personal commitment to relate to each candidate as an individual with individual goals. 3. Its professional staff averages over 6 years of experience in EDP recruiting (additionally, staff members have direct hands-on experience in programming, systems, hardware sales, etc.) 4. Quest is presently searching for degreed programmers and analysts (commercial, scientific, systems software) for over 3,500 client companies in the U.S. *Quest has openings in over 700 U.S. towns and cities.* 5. Methodology — see Questsystem.

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QUEST SYSTEMS INC

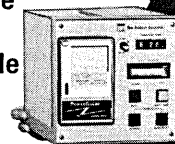
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CIRCLE 98 ON READER CARD

large number of minicomputers. With interface, the model 10 sells for \$3350; without it's priced at \$2550. Depending on quantity, the model 10 is available in about 30 days. TRI-DATA CORP., Mountain View, Calif.

FOR DATA CIRCLE 251 ON READER CARD

Mini Keypunch

Input to the 404 Vari-Punch may be from digital instruments, minicomputers, or from its own keyboard. Built to punch alpha or numerics at 12 characters per second, it can also print the numerics. The 17½ x 6½-inch unit weighs only 15 pounds. Its price is \$1095 in standard trim, and a punch-only model is \$975. VARIFAB INC., Old Greenwich, Conn.

FOR DATA CIRCLE 255 ON READER CARD

Serial Printer

The model 100A is a 70-cps serial impact printer intended for use as a mini-computer peripheral, in off-line print stations, and in data communication and crt hard copy situations. It's similar to the firm's first product, the 100 introduced late last year (Dec. 1, p. 55) but adds 32 additional ASCII characters for full upper/lower case printing across 132 columns. Complete with a 2-channel vertical format unit (VFU)

and an 8-bit ASCII interface, the 100A is priced at \$2600. Optional are buffers, modems, different print fonts, an 8-channel VFU, and assorted interfaces. PRINTER TECHNOLOGY, INC., Woburn, Mass.

FOR DATA CIRCLE 256 ON READER CARD

Optical Mark Reader

The Sentry 7010 can simultaneously read student test forms, purchase requisitions, attendance records and other dissimilar documents in sizes from 3 x 7 inches to 8½ x 11 inches at rates to 3,000 per hour. Further, it can read both sides of these documents at the same time, doubling the data input rate of other devices that shuffle paper as fast.

A stand-alone system, the 7010 comes with a cassette tape for its control programs (to specify forms size and design, field formats and output formats), a teleprinter, operator control console, and 7- or 9-track mag tape unit for \$49,500. NATIONAL COMPUTER SYSTEMS, Minneapolis, Minn.

FOR DATA CIRCLE 257 ON READER CARD

POS Peripherals

The transportable cassette recorder is for small retailing outfits or companies that do not require on-line communications capability. It attaches to the

terminals used in Singer's MDTs POS systems, and it stores up to 75,000 characters on each cassette. The unit is priced at \$1400.

The model 835 is a pooler that takes the cassettes generated above and converts the information onto half-inch computer-compatible tape in either ASCII or EBCDIC recording mode. Including the tape deck, the 835 is priced at \$15K. Both peripherals are available for 90 day delivery. THE SINGER CO., San Leandro, Calif.

FOR DATA CIRCLE 258 ON READER CARD

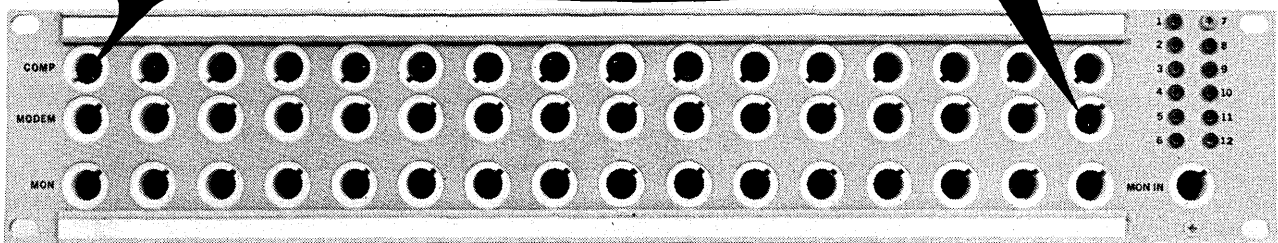
Terminal Controller

The 9020 was developed to make it easier for equipment such as the ubiquitous 33 and 35 Teletype (both ASR and KSR) and other terminals that use the Bell 202 or 103F modems to communicate with the Datacraft model 6024/5 24-bit computer. The controller handles 12 assorted baud rates ranging from 75-9600 baud at the flip of a switch and converts 5-, 6-, 7-, or 8-level serial codes to parallel data, and vice versa. Including the interconnecting cable for installation in the I/O channel of the 6024/5, the controller is priced at \$800. Deliveries begin this month. DATACRAFT CORP., Ft. Lauderdale, Fla.

FOR DATA CIRCLE 259 ON READER CARD

"Who has a line of low cost patching jacks and accessories for distributing, rerouting, and testing full duplex data circuits with the ease and confidence normally associated with single audio or control circuits."

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Software & Services

Software Notes . . .

Today's software does not warrant the trust most people have in it, according to Dr. Barry Boehm and Lt. Col. Allen C. Haile, who reviewed the results of the recently completed Air Force Command and Control Information Processing Forecast for 1985. As might be expected, the study showed that present software problems stem from the two most costly and involved phases of system development: design and analysis of the requirements of the system, and the testing and validation of the completed project. The study also finds that it is false economy to skimp on hardware acquisition because of its great impact on the costs of software development for current systems. Dr. Boehm has written an article reviewing the study which will appear in our March or April issue.

A set of equations for controlling an automatic braking system for automobiles has been worked out by a General Motors engineer. The anti-collision formulae could be stored in a small on-board computer in future cars. Using data supplied by a radar unit mounted up front, the computer would calculate vehicle speed, distance to an object in its path, and the relative speed between the two. Taking into account what can be controlled (speed, distance, and closing rate) with what cannot be (gravity and friction), the formulae attempt to keep the car on the "safe" side of the computations, even considering sloping or level road conditions.

Documatic, a program that provides English language rather than flowchart documentation of RPG programs, is now available to IBM System/3 users from its developers, Data Usage Corp., Ft. Lee, N.J. The program was previously available for IBM 360 and Univac 9000 series computers, with 200 installations claimed. The program sells for \$1600 and may also be leased.

Modeling Help

Repro-modeling is the name of both an unusual technique and a service offered to users whose existing models have become too unwieldy for a number of reasons. These might include such problems as requiring too long to run in order to generate the specific information required, using too much memory, etc. In effect, the troubled user supplies this firm the questions for the model (the inputs) and answers (examples of the desired output).

The vendor then generates a version of the model that will satisfy both the input and output criteria. This is done by using some proprietary software running on a CDC 6400 to extensively analyze the original model, determining the relative significance of various input parameters. It's claimed that after reviewing these input parameters, models often can be collapsed enough to reduce machine run time by factors of 100-10,000. And while the outputs may or may not be quite as accurate as the original ones, the collapsed version can be run more often to tune the inputs and outputs.

The technique has already been used with models of air pollution patterns, vehicle flow, radar coverage patterns, and to combine the separate air pollution and vehicle flow models into one. The charge for the service depends on how involved the vendor must get with the problem model, but charges to date have ranged from \$2-12K. TECHNOLOGY SERVICE CORP., Santa Monica, Calif.

FOR DATA CIRCLE 221 ON READER CARD

OS/360 Utility

MFS-18725 is the identification assigned by the COSMIC Information Services Center at the Univ. of Georgia to this small program developed at North American Rockwell. It uses FORTRAN calling sequences and QSAM data management routines to read and write sequential data sets, but its most useful feature is said to be the ability to read records of unknown length under the IBM OS/360 monitor. The \$25 utility program is supplied in listing form, with the documentation describing the routine and its usage contained within the comments of the listing. COSMIC, Athens, Ga.

FOR DATA CIRCLE 222 ON READER CARD

Purchasing Management

Four programs that provide functions common to distribution and manufacturing environments are now available for use on HIS 200 and 2000 machines.

The first of these, called Vendor, updates information on suppliers and generates reports that aid company management in analyzing vendor performance. The Purchase Order program contains a master record for each item on a purchase order. When schedules, receipts, rejections, etc., are processed, a record is automatically created and tied in with the original purchase order.

The third program is called Buyer, and it enables distributors and manufacturers to develop and maintain a file on buyers. The program can be used to supply such typical information as orders and price quotations. The last program, Purchase Order Maintenance, processes order deletions and produces reports on demand as an order is closed.

A system sufficient to run the programs typically consists of a computer with 32K characters of main storage, three 9.2-million-character disc units, a card reader/punch, and a high-speed printer. The software is bundled to the price of the system, or is available free to current HIS users. HONEYWELL INFORMATION SYSTEMS, Waltham, Mass.
FOR DATA CIRCLE 223 ON READER CARD

CICS Performance Aid

SAMPSON is described as a very powerful tool for monitoring performance of the IBM CICS (Customer Information Control System) real-time submonitor. It provides continuously updated information showing the current number of tasks in CICS, lists of active and suspended tasks, the dispatchability status of each task, and task priorities. The user, controlling SAMPSON through any terminal connected to CICS, can specify how frequently information is to be updated (which can be as often as one second), the number of times these "pages" of information are to be generated before SAMPSON terminates, and the paging interval between pages of a multiple-page display. The program is written in assembly language and supplied in object deck form, complete with documentation, for \$500. ON-LINE SOFTWARE, INC., New York, N.Y.

FOR DATA CIRCLE 224 ON READER CARD

Commercial Software

Hewlett-Packard has developed a comprehensive commercial software package that should help sales of the System/3000 small-scale computer in installations that have a need for both scientific and business dp. The innovative computer, introduced in late

Caught in the old cassette vs. 1/2"-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.

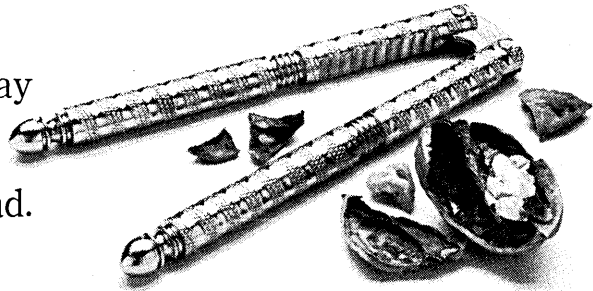
It's a unique approach to digital tape storage that's priced like a cassette but performs like a 1/2"-compatible drive.

It operates at speeds up to 90 ips, starts/stops with accelerations up to 2000 in/sec² and offers transfer rates up to 48,000 bps.

It uses 1/4" 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.

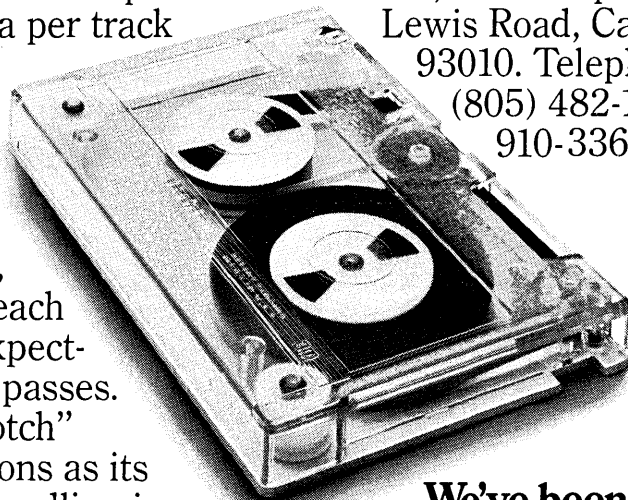
And if you need more information, you've got a choice there, too.

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.

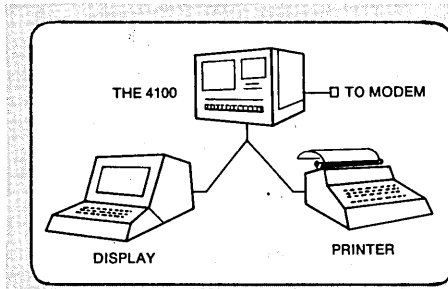


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And brought the answers back.**

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Super Compatible.

Below are only some of the data terminals to which the "super compatible" Techtran 4100 Terminal now adds High Speed communications and Cassette Storage capabilities on a plug-in basis.



DISPLAYS	PRINTERS
Hazeltine 2000	Teletype 33, 35, 37, 38
Tektronix 4002	IBM 2741
Datapoint 2200, 3000, 3300	Univac DCT-500
Beehive	GE TermiNet 300
Infoton	TI 700 Series
ADDS	NCR 260
TEC Series 500	Anderson Jacobson 841, 630
Data 100	Memorex
Delta Data	Execuport
ITT	Tally
Computek	Portacom

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 CIRCLE 61 ON READER CARD

software & services

1971 (see Jan., 1972, p. 76) could already do batch, real-time, and time-sharing operations in BASIC, FORTRAN, and SPL (resembling ALGOL). Now it gets an ANSI COBOL compiler, COBOL/3000, a data base management system called IMAGE/3000, the QUERY/3000 language for nonprogrammers that allows them to access and generate reports from the IMAGE/3000 data base, and a sort package, SORT/3000. COBOL features include direct communication with SORT/3000 via the SORT verb, communication with COBOL or non-COBOL subprograms, compilation time editing, and data segmentation.

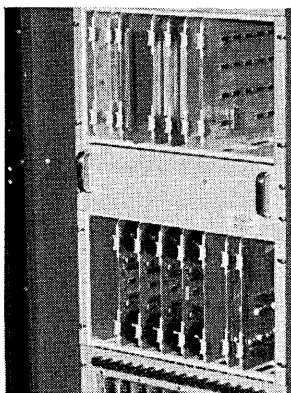
The IMAGE/3000 subsystem organizes data in master detail form, permitting automatic cross referencing of data items. There are four access modes—associative, chained, serial, and direct—and features for data base creation and restructuring, dumping, and restoration.

Monthly rental for the COBOL compiler is \$50; IMAGE/3000 is \$200; QUERY/3000 is \$150; and SORT/3000, \$10. HEWLETT-PACKARD, Palo Alto, Calif.

FOR DATA CIRCLE 225 ON READER CARD

NEW BENDIX COMMUNICATIONS ADAPTER

Drive ASCII Peripherals From IBM 1800 or 1130!



You have an IBM 1800 Computer, or even an 1130, and you would like to connect with medium-speed line printers, teletype or TV monitors to get production and maintenance reports and, you'd like to do it at a low cost. *Now you can!* The Bendix Communications Adapter mates IBM to ASCII-type peripherals such as these to provide low-cost computer communication stations on the factory floor. A low initial cost will be paid back in less than two years.

Write The Bendix Corporation, Industrial Controls Division, 12843 Greenfield Road, Detroit, Michigan 48227.



CIRCLE 64 ON READER CARD

Zip Code Processing

The zip codes for nearly every city, town, post office—even some individual places like the Empire State Building—are on-line with ZAP, a program for processing address records. ZAP is claimed to be completely random access in design, requiring no preformatting or file sorting prior to its use. The 54K-byte assembly language program, which operates under the OS and DOS monitors on IBM 360 and 370 computers, has additional capabilities that include the ability to correct misspelled city names, generate county codes, and list why it was not able to zip individual records. ZAP is offered on a one-year lease for \$10K, and for five years for \$22K. The program is also the basis for a local service, with charges of \$16 per thousand for the first 125,000 records. LIST PROCESSING CO., Elmhurst, Ill.

FOR DATA CIRCLE 226 ON READER CARD

Statistical Analysis

STATSYSTEM has been operational on GE's Mark III nationwide time-sharing network for some time, but the word is just now getting out about it, so to many it will be new. The program performs most types of statistical analysis, including standard and summary sta-

tistics, simple regression (including six curve types), multiple regression (correlation analysis), stepwise multiple regression, polynomial curve fitting, analysis of variance, exponential smoothing, reliability analysis, T-statistics, chi-square, confidence limits, and still others.

Conversational BASIC is used to control the entry, editing storage, selection, modification, and printing of data. Users can choose several types of reports, including bargraphs, histograms, frequency tables, or cumulative distributions. To access STATSYSTEM one needs only a terminal with an acoustic coupler, a telephone, and a GE supplied phone number. An in-depth description of the Mark III network and its "sophisticated" pricing structure were detailed in the November issue (p. 191), but the basic terminal connect rate is \$7/hour, with additional charges for size of files, type of service, etc. GENERAL ELECTRIC INFORMATION SERVICES, Washington, D.C.

FOR DATA CIRCLE 227 ON READER CARD

software spotlight

Fortran V, DOS

The development of sophisticated software products for end-user markets continues to be a high-priority item at Data General Corp. The latest announcements in this effort include an optimizing FORTRAN V compiler (DG chooses to call it FORTRAN 5), and a dynamically partitionable disc-based operating system.

The FORTRAN IV superset is said to be fully compatible with Univac, ANSI, and IBM level H editions. To run it requires a Nova 800 minicomputer with a minimum of 28K 16-bit words, 512K words of disc storage, a floating-point processor, the hardware multiply/divide feature, a magnetic tape unit, and a console terminal. This configuration, capable of compiling and executing programs, is priced at approximately \$48K. Compiled programs can then run on any Nova computer with sufficient memory for the individual program size, the floating-point processor, and the multiply/divide feature.

The compiler features global optimization, DO loop optimization, reentrant code that permits multiple users to share a common program, fully recursive routines, English language diagnostics to aid in debugging, and in-line subscript handling that computes subscripts only once, though

it might appear in several locations in the program. Double-precision arithmetic execution times range between 9.1 usec for additions, and 22.5 usec for divides. The software price is bundled with the price of the hardware required to run it.

RDOS (Real-time Disc Operating System) is the new monitor. It is a prerequisite for running the FORTRAN 5 package, and it can also manipulate programs written in ALGOL, FORTRAN IV, and DG's macroassembler language simultaneously. The DOS features dynamically alterable foreground/back-

ground capability. Partition fencing is performed totally in the software, with up to 31K memory words assignable to either or both foreground and background users. There is multitasking, with up to 256 priority levels; the provision for accommodating a second hardware processor and sharing disc storage, and safeguards against user programs being able to address RDOS working areas on disc. The price of the monitor is bundled with the DG 800 minicomputer that runs it. DATA GENERAL CORP., Southboro, Mass.

FOR DATA CIRCLE 220 ON READER CARD

Diagnostic Aid

CHKSTOP is a little routine (less than 2K bytes) that is inserted into COBOL or assembly language programs on any IBM computer having the OS monitor. The routine arrests OC7 program checks caused by trying to perform arithmetic operations on nonnumeric data fields before a memory dump is given. The invalid field is corrected, and the aborted instruction reexecuted. (The ED and EDM instructions are not reexecuted.) There are a number of programs on the market that perform this task, but what sets this one apart, according to its developers, is the fact

that using (or not using) CHKSTOP doesn't require a recompilation or link edit pass; its use depends totally on whether JCL for it is present or not. The contents of the field before and after correction, the address of the field of error and of the failing instruction, and the failing mnemonic are printed along with the load address of the problem program. The CHKSTOP object deck and documentation for installing it are included in the \$275 price. SOLUTIONS, INC., Warren, Vt. For information:

FOR DATA CIRCLE 228 ON READER CARD

OS Computer professionals, take part in Source EDP's

Computer Career Conference

Seventy-six progressive organizations will participate with Source EDP in a nationwide computer talent search during February and March. These organizations while diverse in industry, size and geography share a common objective— attract outstanding computer professionals to meet significant growth objectives. The number and variety of specific openings available within these firms are too broad to describe here. In general, however, if you have at least one to three years of experience in OS/JCL, OS communications, OS systems programming or OS data base design we urge you to participate in this exciting new program. Opportunities exist on both the local and national levels with starting salaries ranging from \$12,500 to over \$20,000 per year plus additional incentives. Be sure you are a part of the Computer Career Conference when it visits a city near you soon. Your participation will be in complete confidence and without obligation. For details, call your nearest Source EDP office listed below.

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Client companies assume our charges

CIRCLE 405 ON READER CARD

Literature

Datamation Subject Index

The 12-page subject index of 1972 DATAMATION, Vol. 18, Nos. 1-12, includes references to feature articles, conference reports, book reviews, News in Perspective, Editor's Readout, and The Forum. DATAMATION, Los Angeles, Calif.

FOR COPY CIRCLE 210 ON READER CARD

Plug-in Memories for Minis

Plug-in disc memories for minicomputers are described in an illustrated four-page brochure. These fixed-head systems, designed as secondary storage units, have an average access time of 16.7 msec and capacities range from 32K to 1 million words. Applications include temporary storage in key-to-tape systems, swapping and library memories in time-sharing systems, and on-line memories in power utility systems. DATA DISC, INC., Sunnyvale, Calif.

FOR COPY CIRCLE 200 ON READER CARD

Fast Debugging

"Debugging Microprogrammed Systems" is a four-page application leaflet written to tell engineers how flaws can be removed from computer memories. In addition to troubleshooting guidelines and charts, it tells the designer what to build to aid in system debug and how to check out a complex microprogrammed system with 1,024 words of microcode in less than one week. SIGNETICS MEMORY SYSTEMS, Sunnyvale, Calif.

FOR COPY CIRCLE 201 ON READER CARD

Data Transmission System

Complete information on the type 25C data transmission system is provided by a 28-page technical bulletin. A frequency division data multiplexor, the 25C uses frequency shift keying (FSK) to process data signals with speeds from 75 baud to 600 baud for transmission over standard unconditioned telephone circuits. It is particularly suited for data transmission operations of telephone companies, businesses, utilities, educational institutions, government agencies, and others in point-to-point, multipoint, and polling data applications. GTE LENKURT INC., San Carlos, Calif.

FOR COPY CIRCLE 202 ON READER CARD

Automating Utilities

"Computer Monitoring and Control of Electric Utility Systems" is a 16-page brochure describing the capabilities of the vendor's real-time systems for electric utility applications. The brochure

emphasizes the growing size and complexity of power systems and a corresponding need for the more sophisticated control which computer systems provide. The match of Systems' computer line with current utility monitoring and control needs is stressed throughout, and recent electric utility installations are described. SYSTEMS ENGINEERING LABORATORIES, Fort Lauderdale, Fla.

FOR COPY CIRCLE 203 ON READER CARD

Image Analysis

A 10-page color brochure describes QMS (Quantitative Metallurgical System) for automated measurement, classification, and evaluation of selected features of an image. It explains in detail the equipment and operation of this image analysis system which can perform 19 different measurements from a single image at a rate of 13.6 different measurements per second. BAUSCH AND LOMB, Rochester, N.Y.

FOR COPY CIRCLE 204 ON READER CARD

Cold Comfort

A computer-directed system for automated storage and distribution of refrigerated and frozen foods which is said to reduce manpower 50% and cut space requirements by as much as 40% is described in an eight-page illustrated brochure. The economics of the system is demonstrated in charts and graphs and other applications are explored. AEROJET INDUSTRIAL SYSTEMS, Frederick, Md.

FOR COPY CIRCLE 205 ON READER CARD

Low-cost Graphics Display

A new graphic display system, the GT40, suited for graphics research, design, engineering, architecture business information systems—or any field requiring low-cost graphics display—is described in a 12-page illustrated color brochure. Major system components are fully covered as well as details on standard features of the GT40, which may be used either as a stand-alone system or a remote terminal interacting with various types of host computers. DIGITAL EQUIPMENT CORP., Maynard, Mass.

FOR COPY CIRCLE 206 ON READER CARD

Remote Order Entry

A 21-page booklet describes the vendor's Distribution Management System, an intelligent, remote order entry terminal which employs key-to-disc transaction entry using up to 12 video data terminals and performs transaction error detection, correction, and control total verification. The terminal

also offers remote order processing, file inquiry, and inventory accounting so that regional centers can operate temporarily independent of telephone service. CODON CORP., Bedford, Mass.

FOR COPY CIRCLE 208 ON READER CARD

Alphabet Soup Sorter

A new 38-page pocket-sized Glossary of Electronic Terms provides a quick reference to commonly used computer, semiconductor, general electronic, and military terminology. Single copies are \$1.50. (Quantity prices available on request.) HENRY LAVIN ASSOCIATES INC., P.O. Box 921, Meriden, Conn. 06450.

Tape Commands Display

Applications bulletin describes how the alphanumeric vsn-1 Tape Mount Message Display may be used to help the operator or tape handler verify mount messages without reference to the console. (See Jan., p. 128.) ADVANCED DIGITAL SYSTEMS, INC., Mohawk, N.Y.

FOR COPY CIRCLE 209 ON READER CARD

Audit Offer

A firm of consultants in government edp marketing is offering a flyer describing their company, the potential of the government market, and offering a free introductory Government Market Potential Audit for your company. PLAISANCE & WEBBER, INC., McLean, Va.

FOR COPY CIRCLE 211 ON READER CARD

Utility Costs Forecast

A six-page brochure describes PROCOS, a computer program for electric utility production costing using probabilistic methods. The program obtains predictions of unit loadings for up to 20 years in the future and is used for forecasting fuel budgets, maintenance scheduling studies, interchange contract evaluations, system expansion planning, and nuclear fuel scheduling. The software runs on IBM 360/50 computers and above. SYSTEMS CONTROL, INC., Palo Alto, Calif.

FOR COPY CIRCLE 212 ON READER CARD

Educational Terminals

Brochure describes vendor's series 200 crt terminals plus compatible free-standing keyboards and monitors. It illustrates application of the units as teaching aids in conjunction with computer terminals which already exist in educational institutions. ANN ARBOR TERMINALS, INC., Ann Arbor, Mich.

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Our new 'Mini' DMS should get the other 60%.

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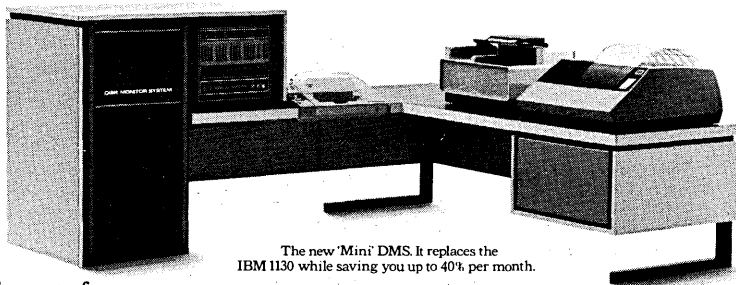
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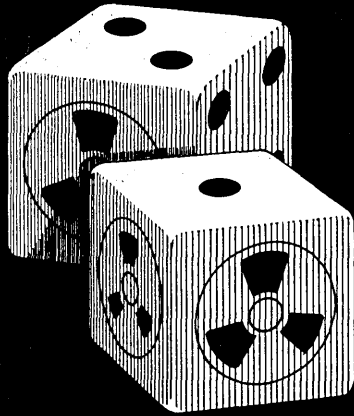
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Books

EDP Facility Evaluator

Management Information Corp.,
140 Barclay Center, Cherry Hill, N.J.
\$125

Housed in two looseleaf notebooks (about two-thirds of the pages are response analysis worksheets), this report enables a user to evaluate his own installation(s) and is also suitable for use by outside evaluators. Batch, batch plus data communications, and real-time computer facilities can be analyzed.

The report explains the criteria for selecting an evaluation team and then details the procedures for conducting the evaluation. A series of more than 50 exhaustive checklists is provided, covering: facility performance, system utilization, data entry, data transmission, data control, scheduling, machine room performance, program library, backup, customer relations, service, systems programming, application design and programming, development management, edp management and organization, procurement procedures, personnel communications, and security.

The evaluation analysis methodology is explained with examples, and guidelines are presented for proper follow-up procedures.

Computing With the BASIC Language

by Fred Gruenberger
Harper & Row, Publishers, Inc.,
49 E. 33rd St., New York, N.Y.,
1972
140 pp. \$6.95 (paperback)

This is a textbook, suitable for a one-semester introductory course in computing, and should not be viewed as a reference manual in BASIC. The text assumes access to BASIC via a time-shared terminal. The system described accesses a Control Data 3170, but differences to be expected for BASIC systems implemented on other machines are duly noted. Emphasis is on proper and efficient computation; whenever a rule is stated, the student is encouraged to explore that action or told what to expect if the rule is violated.

Computer Management: A Common Sense Approach

by Nancy Foy
Auerbach Publishers Inc., 121 N.
Broad St., Philadelphia, Pa., 1972
210 pp. \$9.95

This book is written mainly for non-technical top management so that they may understand electronic data processing and knowledgeably participate in planning and controlling dp resources. Chapters cover how to keep management on top of computer activities; dealing with computer vendors;

choosing peripherals; working with consultants; developing, buying, and selling software; using and misusing information; computer audits; leasing vs. buying; facilities management and dedicated computer services; buying used computers; using service bureaus; data communications; finding and keeping good people; training—in-house and out.

Directory of the Computer Industry in the Washington, D.C., Area

ALR, Inc., 2430 Pennsylvania Ave.,
N.W., Washington, D.C. 20037
69 pp. \$19.95

The 1972-73 edition contains listings of computer companies and computer users in Maryland, Virginia, and Washington, D.C. The vendor listings give company name, address, phone number, key marketing or sales person, and product or service offered. The computer user listings have company name, address, phone, name of director of data processing, and make of



computer on site. The two indexes list vendors by product or service and users by computer manufacturer and model number. Similar booklets are available at the same price for the Philadelphia area (including Delaware and Camden, N.J.) and the Pittsburgh area (including West Virginia and central and western Pennsylvania).

Soviet Cybernetics Research: A Preliminary Study of Organizations and Personalities

by Simon Kassel
The Rand Corp., Publications Div.,
1700 Main St., Santa Monica, Calif.,
1971
212 pp. \$5 (paperback)

This report was prepared as the first part of an ARPA-supported preliminary study of Soviet cybernetics. It is an assessment of cybernetics as a major Soviet R&D progress indicator and should be of interest to those concerned with cybernetics development and with the gathering and interpreting of data on the development of the Soviet economy. The Soviet emphasis on cybernetics within the hierarchy of a national research and development effort is without precedent in the world. The future of Soviet efforts to automate economic planning, management, and accounting, and attempts to advance in distant space research, to modernize industry, and to compete in world markets are all tied to the technological sophistication of the computer.

A Guide to Computer Literature
by Alan Pritchard

The Shoe String Press, Inc., 995
Sherman Ave., Hamden, Conn.,
1972
194 pp. \$7.50

Of interest mostly to industrial and reference libraries, this book provides a guide to the various sources of information on published literature on computers and instructs in the bibliographical control of the literature. Primary sources of information are the major periodicals, research reports and government publications, trade literature, theses, patents, conference proceedings, and translations. Secondary sources cover those types which contain mostly known material—abstracts and indexes, books, annual reviews, bibliographies, glossaries, dictionaries, encyclopedias, handbooks, and standards. Tertiary sources deal with directories, service bureaus, and systems. Approximately 550 worldwide sources are cited, and many are evaluated in terms of coverage and user satisfaction.

A Practical Guide to Minicomputer Applications

Fred F. Coury, ed.
John Wiley & Sons, Inc., One
Wiley Dr., Somerset, N.J.,
1972

211 pp. \$9.95 (\$5, paperback)

The purpose of this book is primarily to acquaint the prospective user with minicomputer applications rather than to serve the computer professional as a textbook or state-of-the-art document. It is assumed that the reader's expertise is in a field other than minicomputers. The volume is a collection of recent (1969-1971) papers intended to provide the reader with sufficient background information and examples for him to learn: 1) if minicomputer techniques can be applied to his problem, and how well they apply; 2) what is involved in actually bringing a minicomputer to bear on his problem, and 3) if a minicomputer is a reasonable solution, how to go about the selection and connection process. The five parts in the book cover an introduction to minicomputers, peripheral and software considerations, minicomputer selection, general applications, and specific applications.

Statistical Computer Performance Evaluation

Walter Freiberger, ed.
Academic Press Inc., 111 Fifth Ave.,
New York, N.Y., 1972
514 pp. \$15

The editors of these proceedings of a November 1971 Brown Univ. conference have included only those papers dealing with real data in a reasonably sophisticated manner and have excluded computer performance evaluation methods that are either too haphazard or too theoretical. □

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ering of the computer community to cover the total spectrum of computer technology, its application, emerging uses and its impact on user industries and the world economy. More than 60 sessions, panels and seminars divided into two major program areas—Science & Technology and Methods & Applications. The world's largest exhibit of computer hardware, software, systems and services. And all in the heart of New York, the world's corporate, cultural and entertainment capital. Give yourself the gift of knowledge. Send today for full registration, housing and conference information.



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- Day 2 - Data Communications**
- Day 3 - Installation Management**

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- Day 1 - Data Communications Planning**
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- Day 3 - Small Systems Panel**

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AT & T	EM & M	Penril
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BASF Cambridge Memories	General Computer Systems	Prime Computer
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CIG	Incoterm	Sycor
Cincinnati Milacron	Inforex	SYS Associates
Computer Devices	Interdata	Systems Engineering Lab
Computer Transceiver Systems	ICC-Milgo	Techtran
Cullinane	I/O Devices	Tektronix
Data Disc	Iomec	Teletype
Data General	ITT	Texas Instruments
Data Products	Lockheed Electronics	Varian Data
Datapro Research	Modular Computer	Vermont Research
Delta Data		Western Union Data Services

Schedule

City	Dates	Location	City	Dates	Location
Boston	Feb. 13-15	Sheraton-Boston Hotel	Anaheim	Mar. 27-29	Disneyland Hotel
Washington	Feb. 20-22	Sheraton-Park Hotel	San Francisco	Apr. 3-5	Civic Auditorium
New York	Mar. 5-7	New York Hilton	Kansas City	Apr. 11-13	Municipal Auditorium
Atlanta	Mar. 13-15	Regency-Hyatt House	Chicago	Apr. 17-19	Conrad Hilton Hotel
Houston	Mar. 20-22	Hyatt-Regency Houston	Cleveland	Apr. 24-26	Convention Center



The Computer Caravan/73



COMPUTERWORLD

To: **Walter Boyd**
The Computer Caravan/73
797 Washington Street, Newton, Mass. 02160

I'd like to get all the details about attending the Computer Caravan. Please make sure you send me literature and registration forms in plenty of time for me to enroll for your Forums. I understand that if I wish to attend only the Exhibits and open sessions no advance registration is required.

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Company _____
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letters

(Continued from page 24)

pose lists that don't really help anyone. I suggest the following two steps:

1. Find out what your own individual organization's true requirements are. Identify the users of program documentation, find out what they really need to do their work, and then make them prove they need it. If someone really needs any particular type of documentation, he should be able to explain his requirement with such simple, logical clarity that any fool can see that it is worth his time and trouble to produce the material.

2. Define the desired documentation in such precise detail that any idiot will be able to see at a glance exactly what is expected of him. Programmers are not necessarily fools or idiots, but after they have made a genuine effort to do something right, they are peculiarly sensitive to being told they did it all wrong. This is one reason they put off documentation as long as possible.

Given clear instructions and an honest, believable explanation of why the work is necessary, amazing results are possible. Most people—even programmers—like to do their work well, even the obnoxious parts of it.

If all this information is provided, and the programmers still aren't turning out the material, take another look at the requirement. Chances are that it really isn't necessary after all.

JOSEPH T. RIGO
New York, New York

Second thoughts

I was somewhat misquoted in your November report on the AMA Distributed Computing Conference (p. 133), in regard to the trend in communications costs. Contrary to the quote, I do believe route pricing of facilities is imminent. Because of this, some users, depending upon the layout of their networks, will enjoy lower rates.

In general, however, we are pessimistic about overall costs. We do not see any major breakthroughs coming in transmission and switching which could result in lower costs. On the contrary, the reduced common carrier revenues attributable to route pricing and interconnection could result in higher costs for other services and routes.

It is for this reason that we believe the major expansion of edp must be through distributive computing. As the costs of minis and peripherals continue to drop, it is simple economic sense to

decentralize the data base and attendant processing, replying on communications only for integration and for transmission of total activity processing rather than transaction-oriented processing.

I agree with Ray Sanders that total communication costs have dropped, but they have dropped only because of developments in such auxiliary devices as terminals, multiplexors, concentrators, and modems. It is only by means of such developments that we have been able to compensate for the relatively flat price performance curves of transmission and switching.

R. G. BERGLUND
Cherry Hill, New Jersey

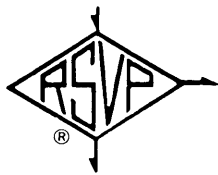
Compiling comments

For the case where the range of a do covers the entire program, I have found it helpful to code the CONTINUE statement leaving five blanks between each letter. This technique is very readable and avoids the situation of having to indent an entire program.

It would be nice to have the FORTRAN compilers refuse to compile any program that did not have at least 25% of the source cards as comment cards.

ZAVIE MILLER
Dorval, Quebec

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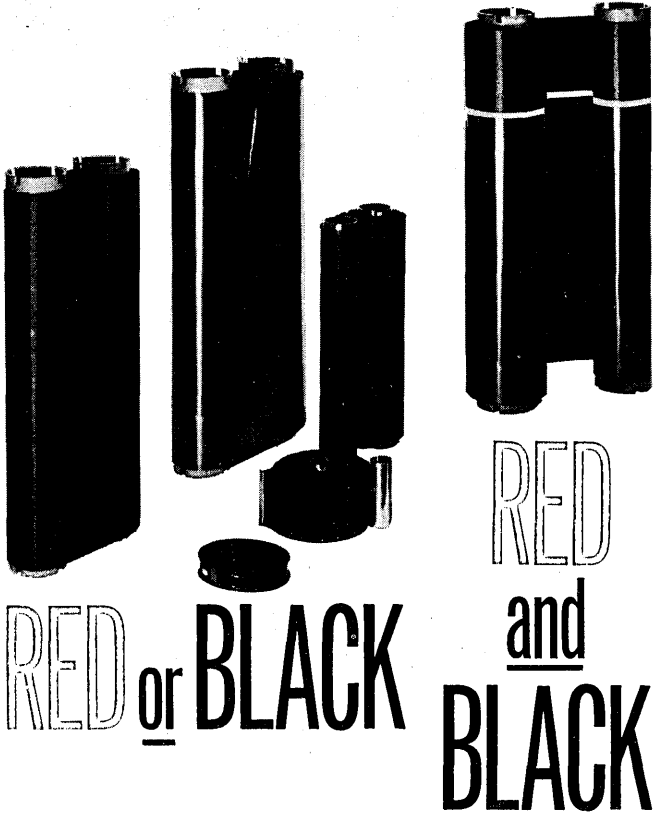


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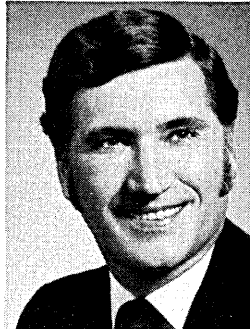
People

"The industry's major goal should be to make computers more compatible and useable by more people," says ERNEST BAYNARD, a key architect of federal dp policy for the past decade. "I'm not holding my breath, though, waiting for this to start happening." Baynard retired recently as staff director of a House Government Operations subcommittee headed by Congressman Jack Brooks of Texas. After years of seeing his most profound thoughts attributed to a "knowledgeable source" by this and other publications, he finally got the chance to be quoted directly.

Baynard indicated that he's pessimistic about making computers more compatible and useable because "timid bureaucrats and avaricious suppliers will squelch any changes along these lines." Passage of the Brooks Bill, most of which Baynard wrote, was the high point of his 18 years on Capitol Hill, including 10½ with the subcommittee. The bill would be much more effective, he contends, if GSA took title to all federal dp equipment and leased it back to the agencies. Also, the feds should do away with the Federal Supply Schedule for computers and rely solely on competitive procurements.

Baynard said "near-cataclysmic technological developments" in the next few years will make effective dp system management more, rather than less difficult. He didn't seem very confident that the movers and shakers in industry and Congress would respond adequately. Asked whether he might lend them a hand, Baynard said: "I don't have any future plans yet, but you can be sure I won't vegetate."

RUSSELL L. FENWICK, new chairman of the Operations and Automation Div. of the American Bankers Assn. is no stranger to either bank operations or automation. Vice president for planning, Bank of America, Fenwick has been with B of A since 1950, spending six years in operations and 16 in systems and equipment research before being named to his present post last April. As chairman of California's Special Committee on Paperless Entries (SCOPE), Fenwick headed up development of a system for exchanging paperless credits and debits among banks in California (see Nov., p. 155) which went on the air last October.



R. L. Fenwick

He continues to guide this effort as president of California's Automated Clearing House Assn. Of the SCOPE project, he says, "we're penetrating slowly and our penetration projections are carefully stated." At year-end the system had "broken the 100 mark" in entries processed. Fenwick believes automated clearing houses will be widespread on a regional basis within five years and looks for a national ACH within 10. For the two-year-old ABA committee he is chairing he hopes 1973 will bring "real identification, cohesiveness, and efficiency." He said the committee will be "issues and objectives oriented."

The first thing ALBERT H. BIESER did after he resigned as president of General Computer Systems in Dallas was the wrong thing for anyone to do: He contracted double pneumonia. He was back on his feet in a few days, however, trying to make up his mind on his next business venture. That has been something of a problem for a former disc jockey turned inventor-businessman, who claims he enjoys sailing his 42-ft. yacht in the Bahamas most of all. With a smile, Bieser says he would like to combine all those interests in one.



Albert H. Bieser

at the helm early last year. His successor at GCS is Barry Weinberg of the Wall Street consulting firm of Channing and Weinberg. Weinberg, a graduate of MIT, previously worked in engineering and management capacities at Sylvania and ITT.

"I used to think it was an unreal kind of life," said JULES I. SCHWARTZ of the industry he has been in since 1954 when he joined the Rand Corp. and began computational programming on the Johnniac and 701 computers. Known for his early research in time-sharing systems and his development of JOVIAL (Jules' Own Version of the International Algebraic Language), Schwartz is the new director of the senior technical staff of Computer Sciences Corp., a staff whose function is to serve as high-level consultants to all divisions of CSC. He doesn't think the industry is unreal any more. "It was a get-rich-quick industry. Now it's keep a job; I won't complain. It's not so brash. It's more realistic and perhaps healthier."



J. I. Schwartz

moving into period of gradual change which will bring fewer but bigger software companies, a decreased percentage of generalist-type systems programmers, and fewer but more profitable time-sharing systems. His 19-year stint in the computer profession has included 12 years with System Development Corp. following its spin-off from Rand and a year as vice president, Computer Systems Div., King Resources Co. He joined CSC in 1970 as a principal scientist and was responsible for development of DML, a data management language used in CSC's Infonet time-sharing system.

Believe it or not, computer companies today look for maturity—not youth—to staff their executive suites. That's the observation of E. W. (TED) GREEN who last fall became president of Intercon Systems of Los Angeles. The company does consulting and executive recruiting for computer and related technology clients.

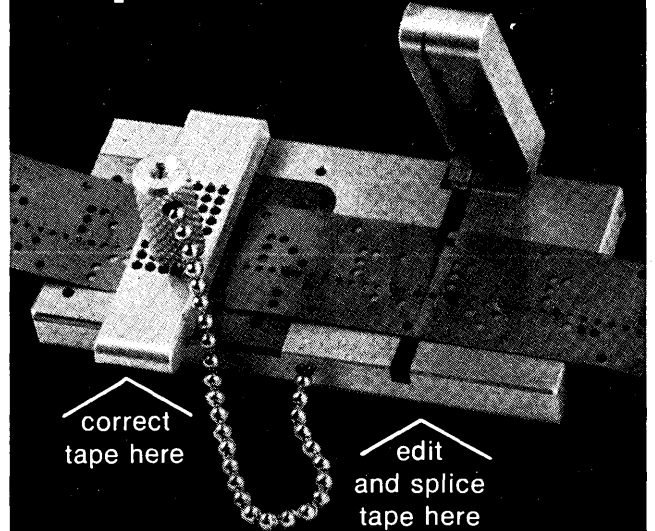
Intercon, a three-year-old firm of 50 people, soon will offer financial and marketing consulting to new computer companies, which Green sees emerging at a greater rate with the economic turnaround.

Green left Electronic Memories and Magnetics where he was president of the Computer Products division that he organized two years ago. He had been director of field marketing with Honeywell and before that held marketing posts with GE and Univac.

In recent years, he's witnessed changes in executive needs. "In the late 60s, computer companies wanted 30-year-olds to run their operations. Today, they're asking for men 43-50 in high posts; and, for presidents, they begin talking of someone in his early 50s." □

Bieser built his first ham radio when he was 12, and, as "Alkili Al" he once disc jockeyed a country music radio show. He says what he really wants to do is sail to Tahiti, but those who know him are betting he'll turn up in the computer industry soon. Bieser holds two of the three basic patents for Recognition Equipment's Electronic Retina Computing Reader, as well as being the systems designer of all GCS data entry systems. GCS turned the profit corner with Bieser

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Look Ahead

(Continued from page 8)

would be distributed through ANSI, assuming the vendor approved. But even with this control, the vendors don't like the idea, and, through CBEMA, they're trying to shoot it down.

WATSON MOVES INTO CARY'S OLD OFFICE

Frank Cary has moved into the chairman's office at IBM now, but the presidential quarters are not vacant. Thomas J. Watson, Jr., has settled in there, giving credence to rumors he will be a very active member of the all-powerful corporate office in his last year before retirement. And if office space is any criterion, IBM may not appoint a new president (Cary is chairman and president) until Watson decelerates.

COMPETITIVE BID OR SOLE-SOURCE: ARGUMENT IN AGRICULTURE

Whether to contract sole-source with IBM or request multiple competitive bids for a multimegabuck, on-line records system that will have about 2,500 remote terminals is being argued bitterly inside the Dept. of Agriculture. The department's office of information services wants to go sole-source, while the system's designers, who work for the Agricultural Stabilization and Conservation Services, the using agency, say GSA will insist on competitive bids.

POLITICS STAY AGREEMENT IN EUROPE

Rumor is the signing of a firm agreement between Siemens, CII, and Philips has been delayed in part by this year's French elections. Presumably Siemens and Philips are reticent about signing anything with a company in danger of being nationalized. Another problem is that Philips wants the agreement to be precise on every point. The three companies, however, are continuing to work on their cooperative for a new series of equipment.

AT&T CAN MARKET NEW DATA SET

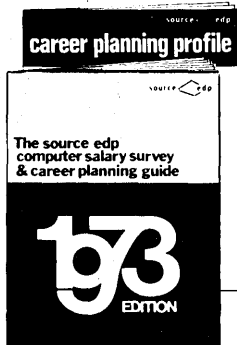
AT&T can begin marketing its new, 4800-bps, Type 208 data set March 24, the FCC decided last month over objections from IDCMA, which represents independent modem makers. But the commission said a hearing on the independents' complaint "should proceed without any further undue delay." The independents charge that AT&T's rates for the 208, as well as for the 201 and 202, which were filed earlier and approved by the commission, are anticompetitive.

RUMORS AND RAW RANDOM DATA

Where are they now department: Former wunderkind of the computer industry, RCA's L. Edwin Donegan, Jr., press-shy and avoiding the industry, isn't saying much about what he's doing, but he's been answering the phone these days at the Kane Financial Corp., a Boston venture capital outfit...The Clorox Co. of Oakland, Calif., published an advertisement in the Jan. 2 issue of the Palo Alto Times for a senior programmer. The requirements: "Minimum of three years COBALT programming experience."...Two men who amassed fortunes in computers are big contributors in Los Angeles' election for mayor. Max Palevsky, former Xerox director, is chairman of Councilman Tom Bradley's campaign. One-time Palevsky associate at Scientific Data Systems, James K. Sweeney, who founded Computer Machinery Corp., is listed as a major contributor to Bradley opponent, Jesse Unruh... Look for Mohawk to announce a 3330-compatible disc drive this month, supposed to offer a 10% throughput advantage over competition.

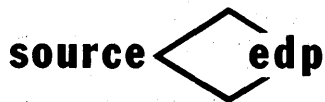
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The Forum

A Position on IBM

The IBM Corp. has achieved its position as the leader in the data processing industry by bringing vast technological capability to fruition in a broad marketplace. As a result, IBM has benefited the entire data processing community, vendors as well as users.

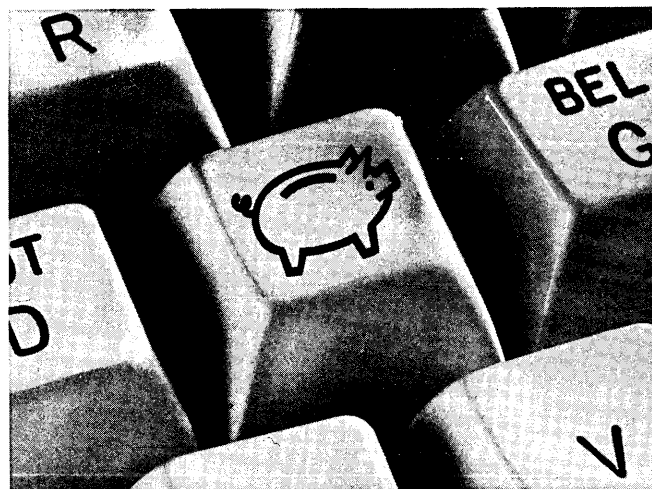
At the same time, other companies, both hardware and software, have developed and brought to the marketplace extremely valuable capabilities. These companies too have vitally benefited the entire community. Therefore, one must conclude that an environment in which both IBM and its competitors can continue to make these contributions must be sustained.

Because of its large size and its pervasiveness in the industry and in the marketplace, it is widely believed that IBM is in a position, either purposely or inadvertently, to damage other segments of the community—that is, its customers as well as its competitors. I believe that there are two main areas in which this potential damage could have an important negative impact: "attachments" and "pricing."

IBM provides to about 60 or 70% of the worldwide market a wide variety of hardware and software products. At the same time, a bewildering range of hardware and software products which must be "attached" to these IBM products has been developed by competitors. If the dp community is to realize the potential benefits of these IBM competitive products, now or in the future, their developers must be able to attach them to appropriate IBM products. Only in this way can the entire industry realize the benefits of both the IBM and the non-IBM capabilities.

Thus the characteristics of announced IBM products, both hardware and software, must be available to all so that everyone can attach his hardware or software to the corresponding IBM hardware or software facilities. He must not be precluded from doing so because engineering characteristics of the hardware are unknown to him or because tables, calling sequences, and other characteristics of software (as described in IBM's Program Logic Manuals) have not been revealed. Through such interfaces, the customer would not artificially be precluded from using the best products available from IBM or its competitors. If IBM were to inhibit such interfaces then IBM might benefit at the expense of the rest of the industry, competitors and end users alike.

Pricing is the other major area in which IBM can assume an advantage which may work to the detriment of the industry as a whole. Here too, it seems to me that the solution is straightforward: simply require that all dp products, hardware or software, separately priced by IBM be priced according to identical short term and long term profit considerations. Thus all products in a similar price range would be priced according to similar cost and expected sales volume criteria. This would reduce the leverage that IBM might obtain through differential pricing strategies designed to offer lower prices at reduced profits on products subject to more competitive activity and higher prices on products

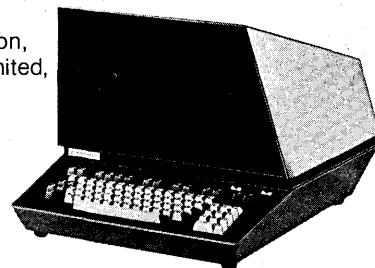


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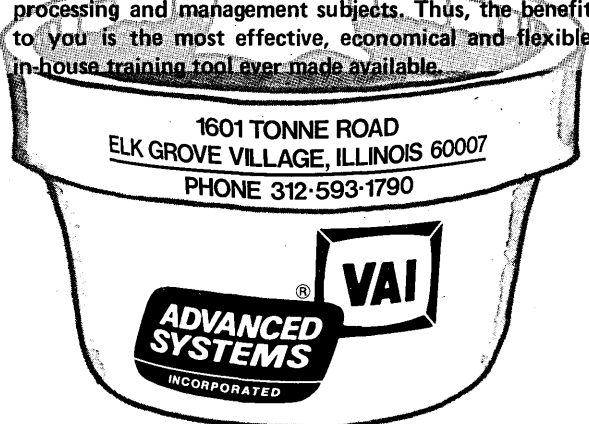


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CIRCLE 90 ON READER CARD

less subject to outside competition. It would also reduce the kind of leverage that IBM might obtain through differential lease/purchase ratios for those items which are available for purchase as well as for lease. (IBM could also obtain a similar advantage through differential *sales commissions* paid in support of these kinds of strategies.) In this area, of course, restrictions already exist in the form of prohibitions against "loss leaders" and tie-in pricing. But further pricing restrictions would seem indicated in order to prevent preferential pricing under the guise of "marketing."

I have been fortunate enough to have the opportunity to observe the dp industry rather extensively on the foreign as well as the domestic scene. As a result, it is evident to me that IBM's success in foreign markets is the single brightest spot in the entire spectrum of foreign trade. This success is due in very large measure, if not almost exclusively, to IBM's size as compared with foreign competitors. As the foreign market grows in importance in relation to our own, the value to the entire U.S. economy of this preeminence becomes increasingly evident. I believe it would be shortsighted for the U.S. to take any steps intended to reduce IBM's effectiveness in the foreign marketplace.

On balance, then, I believe the transgressions that have been or may be carried out by IBM are few, readily defined, and easily limited by appropriate controls. I believe that at least some of the remedies which go beyond the limiting of these transgressions in order to serve the immediate objectives of individual firms in special market segments are contrary to our national interest and in the long run contrary to the long term interest of those special segments as well.

I have tried to describe "the IBM problem" as I see it and to suggest a solution which has some relationship to the problem. I am convinced that this solution is viable in a practical sense, although I have not discussed the means of implementing it. In the final analysis, it is important to solve the problem so that we can devote our nation's rather substantial capabilities to the technology, the economics, and even the psychology of data processing rather than to the kind of internecine bickering which may reduce our contribution to world progress in this increasingly basic industry.

—John A. Postley
Mr. Postley is president of Software Products Company, an operating unit of Informatics Inc.

Some Implications of the Software Decision

In rejecting patent protection for computer programs, the United States Supreme Court concluded:

"If these programs are to be patentable, considerable problems are raised which only committees of Congress can manage, for broad powers of investigation are needed, including hearings which canvass the wide variety of views which those operating in this field entertain."

This is our highest court's first decision on a strictly computer-related issue. In the long run, the court's final words could be of far greater significance than the immediate decision on patentability, because they focus on and point up the need for broad public consideration of the

economic and social considerations involved in a wide variety of other computer-related issues.

The legal determination of software patentability has necessarily turned on such questions (among others, of course) as whether software is a "machine." The key underlying issue to which Justice Douglas was referring in his opinion written for the whole court, and with which even our Supreme Court could not deal, is society's determination of what is required to encourage software development without stifling competition.

Unfortunately, this resolution of important computer-related issues on the basis of conceptual analysis, without adequate consideration of the crucial fundamentals, is not limited to software patentability. Thus millions of dollars in personal property, sales and use taxes on software may ultimately be imposed depending on the outcome of such technical legal debates as whether software is "tangible" or "intangible"; whether its physical location or "situs" on the assessment date is in the jurisdiction imposing the tax; whether the taxpayer "owns" or has "title" to the software; and whether its "value" is to be determined by dividing its cost by the number of copies outstanding.

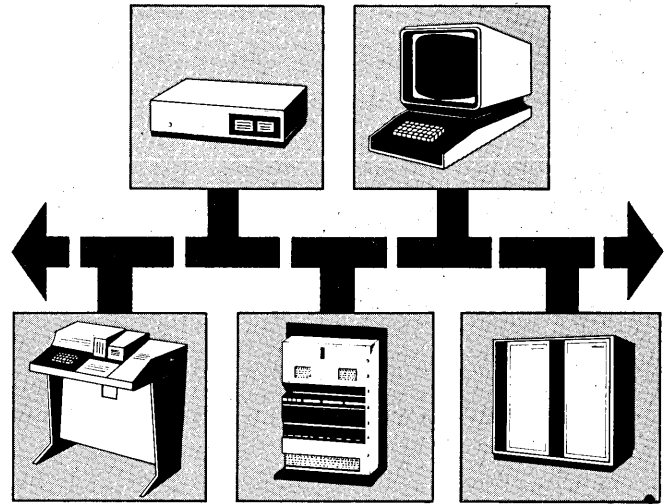
Necessary as judgments on these matters may be if we are to apply present law (for which we currently have no alternative), they overlook the fact that software is very different from any property we have ever known. Its form (which raises the issue of "tangibility") can be changed from mental concept, to card, to tape, to disc, to drum, almost instantaneously. It can be destroyed at a particular "situs" just before the assessment date (e.g., April 1 at 12:01 a.m.), and be recreated thereafter in an instant from a remote source. In a time-sharing application it can be ubiquitous, with impact at the same time in all 50 states and throughout the world. If necessary, its physical embodiment can be located across a foreign border, outside a three-mile jurisdictional limit or even in an orbiting satellite. If the number of copies becomes relevant (in determining a program's "value"), a multitude of additional copies can be produced in a flash. "Ownership" itself is nothing more than a bundle of rights, exclusive and nonexclusive, to use, sell, copy and license; accordingly, the holder of "title" who has given someone else the power to use and sublicense without restriction may have precious little left.

What is really needed, and what has been so sorely lacking to this point, is wide public discussion of the underlying economic and social considerations involved, just as Justice Douglas has suggested. Does it make sense for one state to impose a personal property tax on the software used in a legal research system serving attorneys nationally, just because the hardware is located within its borders? Would not such a tax constitute an unreasonable burden on interstate commerce? Might it not persuade the proprietor to move his hardware elsewhere, even if it would otherwise be uneconomical to do so? Shouldn't the amount of the tax be determined on the basis of considerations such as the fairness of the tax burden in comparison to that imposed on other properties and activity, and the economic and social benefits to be derived from encouraging the industry?

Unfortunately, other legal issues with respect to the industry are also being considered in traditional terms that are inappropriate for the unique problems and opportunities of the computer age. Whether a lien exists on a computer tape or other device to which information has been added, may be determined on the basis of whether the electronic impulses constitute an "improvement" of the tape—without an examination of the interplay of supplier-user rights and interests. Whether a computer's output of music, poetry or art is protectible may be determined by answering the question whether the computer or the programmer is the "author," and whether a computer's reproduction of a copyrighted drawing from an uncopyrighted program is an infringement, may turn on whether the computer is "copy-

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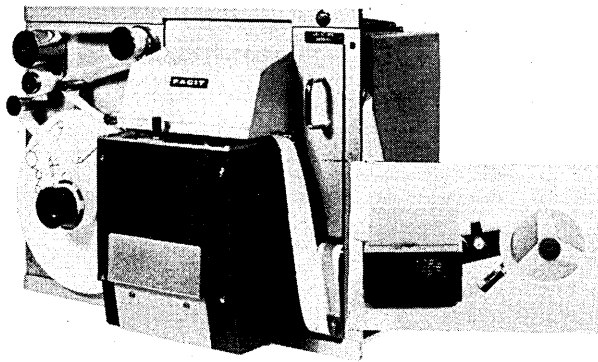
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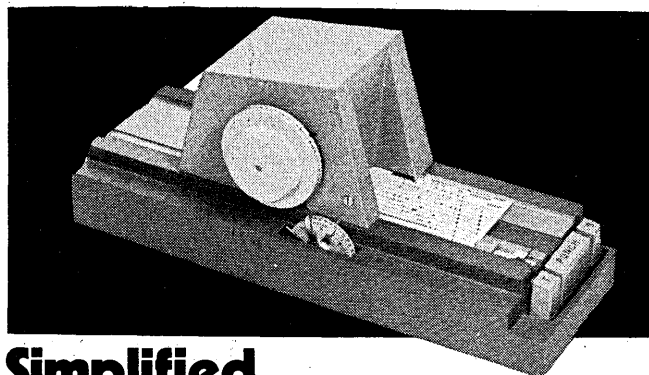
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ing"—each without considering the fundamental issue of the extent to which these new forms of art deserve encouragement. Whether the introduction of a copyrighted work into a computer data bank is an infringement of the copyright may be decided on the basis of whether a "copy" has been made; indeed, internal scanning of the work is already considered by many to be no more a "copy" than the reading of a book—even though uncompensated scanning may completely foreclose the author's market and anticipated return for his work, thereby frustrating one basic purpose of the copyright laws. Whether the Robinson-Patman Act's prohibition against discriminatory pricing (anathema to many antitrust lawyers in any event) applies to computer output may be decided by whether such output is a "commodity" or a "service"—rather than upon basic economic considerations.

It just doesn't make sense to predicate significant consequences on the outcome of debates regarding largely irrelevant concepts developed in different ages for different purposes. Software is precisely the same thing, whether it is "tangible" or "intangible"; the computer is no different if it is an "author." The current exchanges are much like arguing about how many angels can dance on the head of a pin—they just don't make any practical difference!

The above is not to suggest that the real issues are not understood and discussed by *some* computer scientists and *some* members of other professional disciplines. But such consideration has been limited at best, and in any event has been conducted at an esoteric and erudite level which has precluded effective public participation. What is needed is interdisciplinary explanation in simple, easy-to-understand terms, followed by broad dialogue and debate which will permit legislators, administrators, judges and the public to grapple with the key underlying problems and produce answers which make economic and social sense.

Sometimes computer people seem to delight in using unnecessary "computerese." One district judge wrote, following a lengthy trial:

"After hearing the evidence in this case the first finding the court is constrained to make is that, in the computer age, lawyers and courts need no longer feel ashamed or even sensitive about the charge, often made, that they confuse the issue by resorting to legal 'jargon,' law Latin or Norman French. By comparison, the misnomers and industrial shorthand of the computer world make the most esoteric legal writing seem as clear and lucid as the Ten Commandments or the Gettysburg Address; and to add to this Babel, the experts in the computer field, while using exactly the same words, uniformly disagree as to precisely what they mean."

The result of the lack of adequate general understanding has been to compel noncomputer people to deal with important issues in terms of considerations which are irrelevant to the realities of mid-twentieth century life—such as their classification into legal pigeonholes dating back to the Battle of Hastings from which far-reaching and sometimes most unfortunate conclusions are drawn and action taken. Non-computer society seems incapable of proceeding in any other fashion.

If sense is to emerge and the promise of the computer to be realized, the leadership of the computer industry must assume the responsibility to educate and encourage the dialogue and effective interaction to which the Supreme Court has referred, thereby making it possible for the rest of society to deal sensibly with what has been created.

—Milton R. Wessel

Mr. Wessel is a lawyer active in computer-related cases and recently joined Datamation as a contributing editor.

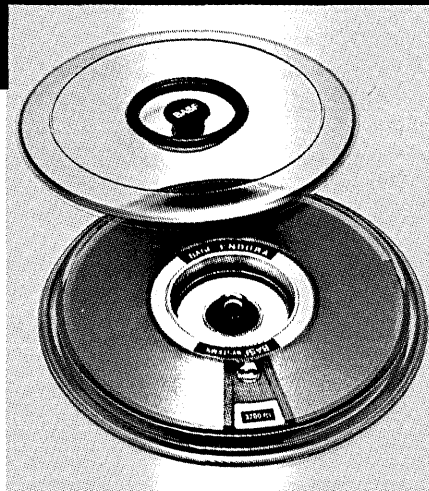
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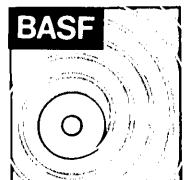
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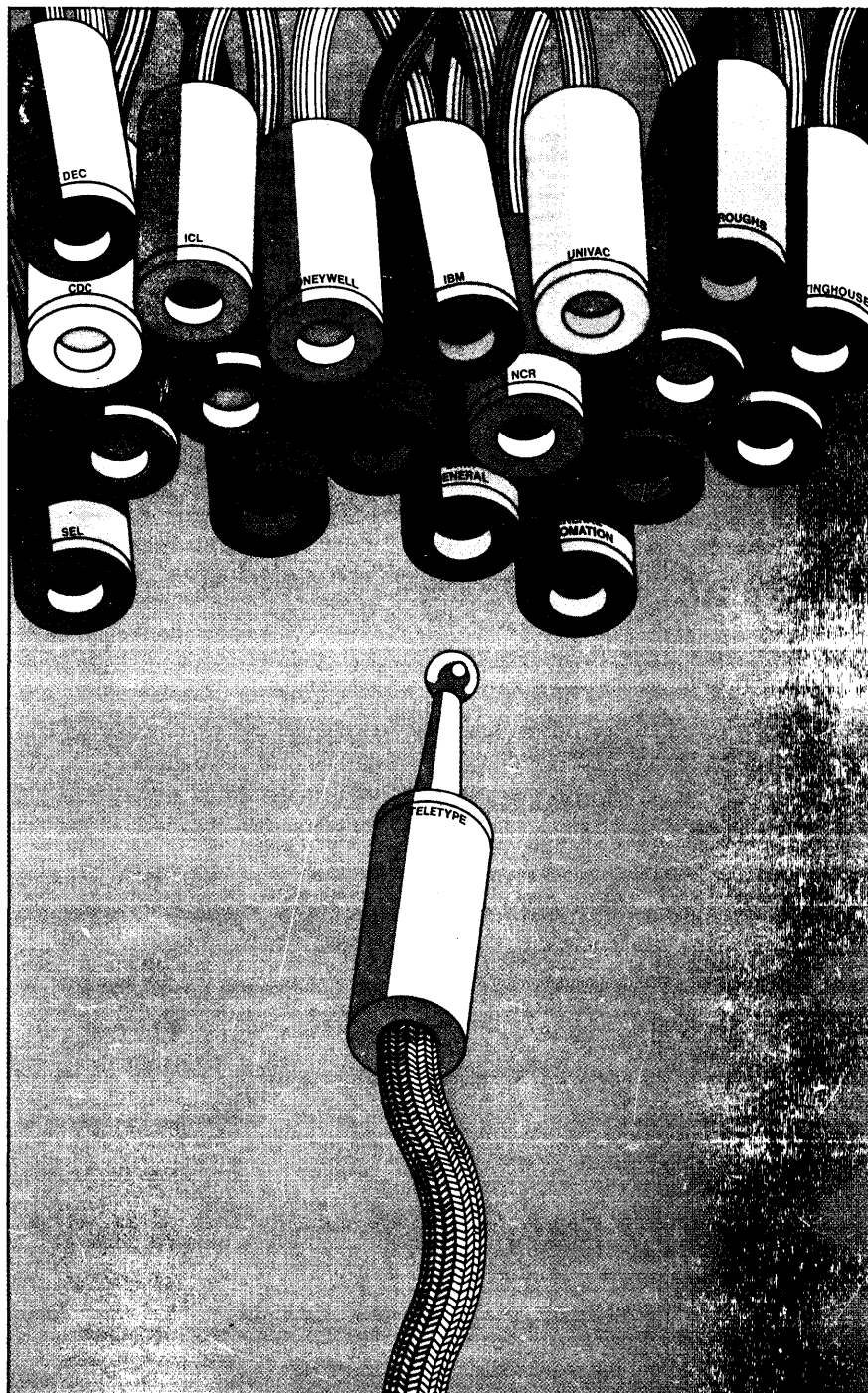
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