

DATA MATION[®]

'73

August

72



specialized common carriers

also... a cost allocation model,
regional computer sharing...

Buy Our Model 9000. Get a Test Lab Free.

Sound like an extravagant claim? It's not. Our Model 9000 synchronous tape transport is not only the finest low-cost digital tape deck ever built, it's the only one designed to help you get one-line faster, easier, and oh-so much more economically!

Testing the average peripheral can tie-up a lot of expensive hardware. We know that, so we designed Model 9000 to eliminate this with its own front-accessible test panel; merely hook it to a scope and you have:

- 1) Normal and high speed forward/reverse buttons which allow complete testing of the transport motion and control electronics.

- 2) A built-in pattern generator which writes an all ones test pattern on the tape to allow checking of read/write electronics.
- 3) A skew indicator which detects tapes written in a marginal manner and provides visual indication of possible problems. The character window can be monitored at test point.

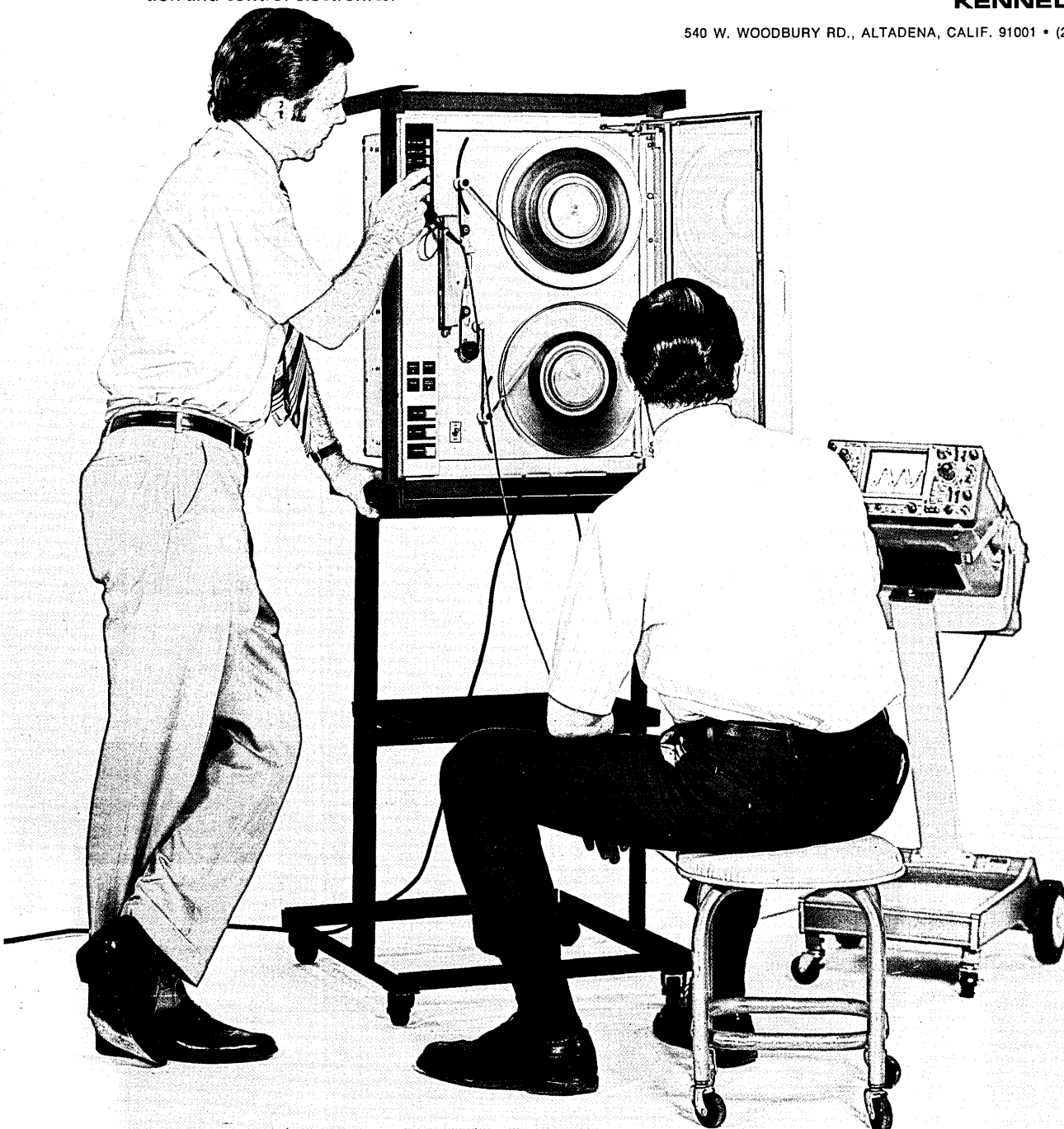
It's a typical Kennedy feature, and it could only be done by Kennedy. We've been doing it for over 12 years.

Twelve years in this business.

Think about it.

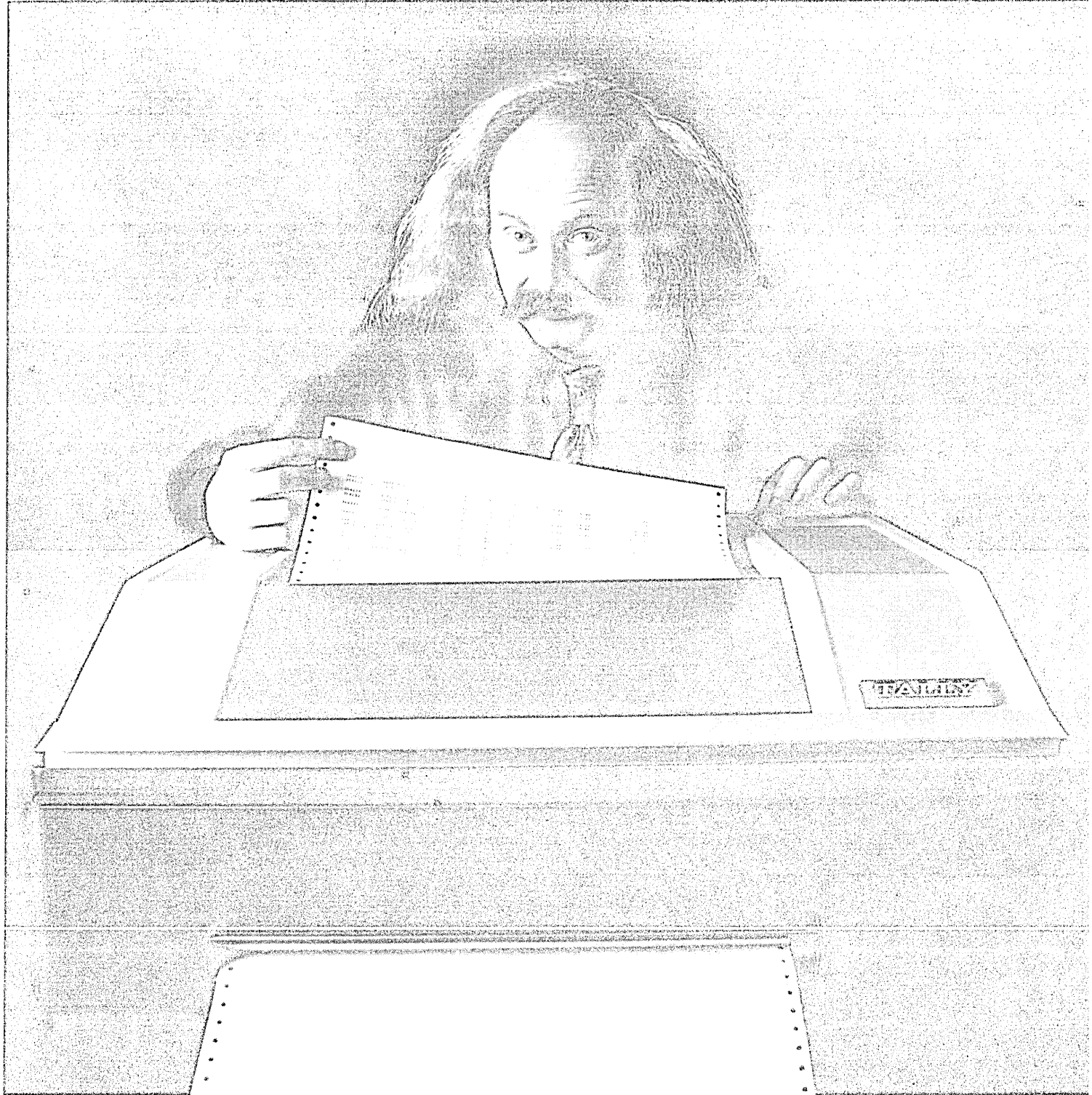
KENNEDY CO.

540 W. WOODBURY RD., ALTADENA, CALIF. 91001 • (213) 798-0953



KENNEDY • QUALITY • COUNT ON IT

CIRCLE 1 ON READER CARD



Watch this!

Watch the Tally Series 2000 line printer churn out your job at 200 lines per minute without fuss, without failure, without need for maintenance adjustments. That's because of its beautifully simple print mechanism that we cheerfully guarantee for one whole year or 1,000 hours of printing with no duty-cycle limitations.

No wonder it's the ultimate choice of computer system manufacturers and users who need unqualified dependability.

Before you buy, before you specify, before you do anything about any medium speed printer, watch this one do its stuff! Call your Tally man now for a demonstration.

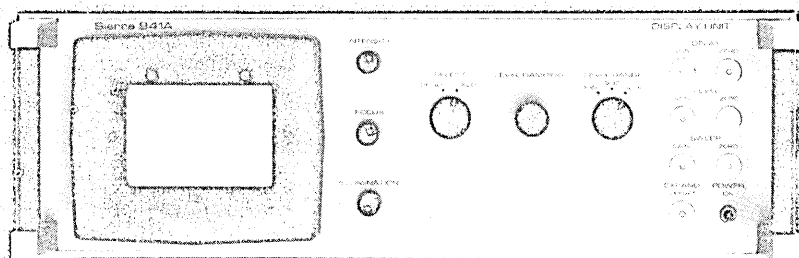
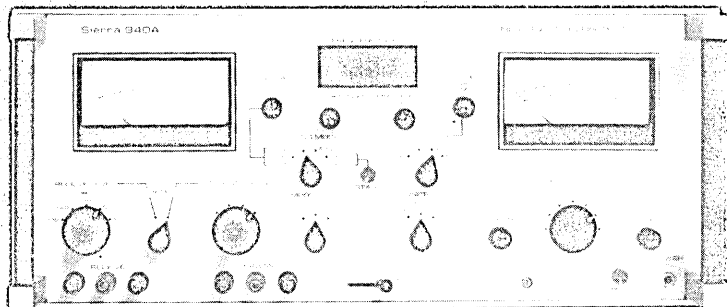
TALLY

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

TO TEST VOICE FREQUENCY DATA CIRCUITS:

SIERRA 940A LINE CONDITIONING TEST SET

This is a lightweight portable for measuring end-to-end delay and amplitude response characteristics. Make these measurements from any point along a voice frequency data circuit. Pushbutton selection of reference setting; manual or automatic sweep tuning.

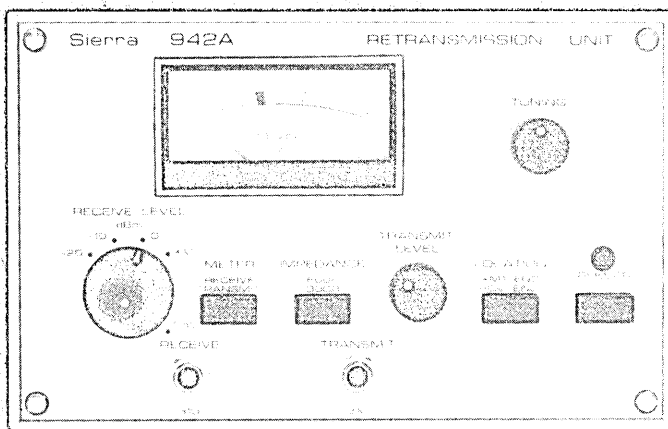


SIERRA 941A DISPLAY UNIT

It works with the 940A; gives you a visual presentation of both envelope delay and amplitude response characteristics. Can take a scope camera, graph paper for curve tracing or plastic overlay gratitudes for various line conditioning specifications.

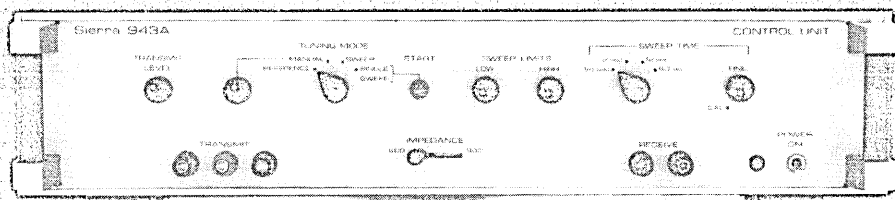
NEW: SIERRA 942A RETRANSMISSION UNIT

Unattended operation; retransmits the 940A signals back over another line. Automatically or manually. Remote frequency control from the 943A below.



NEW: SIERRA 943A CONTROL UNIT

Use it with the 940A and 942A for one-man checking of either end of a circuit from any point along the line. Provides remote frequency control of the 942A.



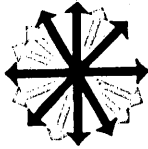
Want more information? Would you like to see any or all of these in action on your system? Just write or call.

Sierra

Sierra Electronic Operation

3885 Bohannon Drive, Menlo Park, California 94025 (415) 322-7222/TWX 910-373-1282

PHILCO 



AUGUST, 1973

volume 19 number 8

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Dear Ma:

Vadic Modems Play an Important Role in New York's Off-Track-Betting System!

Ma Bell
195 Broadway
New York, NY 10007

FROM THE DESK OF
Alexander Graham Jr.

Dear Ma:

I spent last weekend in the Big City and won \$28.40 in off track bets - with the help of your telephone network and Vadic modems.

When New York City's Off-Track-Betting Corporation decided to purchase modems they looked at a number of suppliers. Vadic was chosen because their modems cost less, perform well and have powerful built-in displays and diagnostics.

With over 1000 Vadic 202 & 103 type modems scattered over the city in betting parlors and in the central computer facility, the annual savings to OTB is substantial - partly because Vadic 1200 baud modems work beautifully on unconditioned lines.

Vadic's powerful built-in diagnostics such as remote loopback tests are particularly useful since OTB servicemen can quickly isolate a problem to the terminal, the network, the interface computer or the modem.

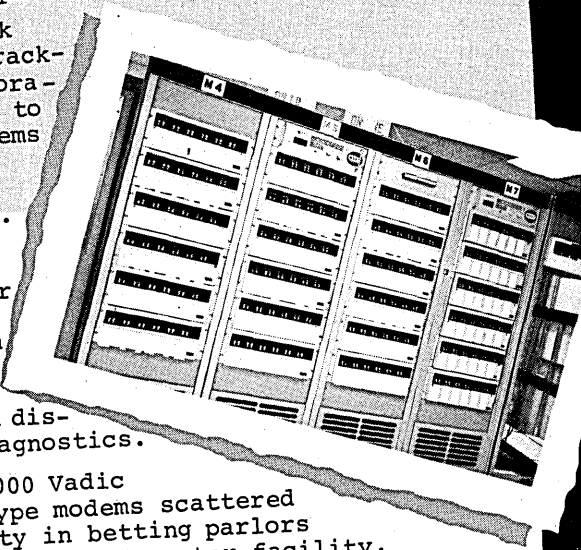
This ability to rapidly troubleshoot a faulty channel is very important since Off-Track-Betting has a daily sales volume greater than Macys or Gimbels - and just can't afford lengthy down-time.

No doubt about it, ma, Off-Track-Betting is an exciting new industry. I'm glad that you and Vadic are part of it.

P.S. Who's Vadic?
They've delivered over
20,000 modems to date.

Your independent-
thinking son

Alexander Graham Jr.



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Contributing Editors	Paul Armer, Howard Bromberg, Philip H. Dorn, Louis B. Marienthal, Ray W. Sanders, Milton R. Wessel, F. G. Withington

EDITORIAL OFFICES

Headquarters: 1801 S. La Cienega Blvd., Los Angeles, CA 90035. Phone (213) 559-5111. Eastern: 35 Mason St., Greenwich, CT 06830, (203) 661-5400. Lakeside Office Park, 599 North Avenue, Wakefield, Mass. 01880, (617) 246-2121, 9805 Singleton Dr., Bethesda, MD 20034, (301) 530-7271. Southwestern: 2711 Cedar Springs, Dallas, TX 75201, (214) 744-0161. Western: 61 Renato Ct., Redwood City, CA 94061, (415) 364-3171. Foreign: 65, Hill Road, Chelmsford, Essex, England, 64/90 Blues Point Rd., McMahons Point, NSW 2060, Australia.

GRAPHIC DESIGN & PRODUCTION

Art & Production Director: Cleve Marie Boutell
Production Manager: Marilee Pittman

CIRCULATION

35 Mason Street, Greenwich, CT 06830
Circulation Director: Suzanne A. Ryan
Marketing Research Director: Douglas De Carlo
Publisher: James M. Morris

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T-COMM 7 BRIDGES THE GAP

between any computer and every terminal...

... and gives you the kind of terminal independence and economy you've been looking for. Periphonics' versatile front-end processor interfaces with any computer, supports every type of terminal. Teleprinters, audio response, CRTs, data collection terminals and many others.

For the first time you can intermix any combination of different computers and terminals. And with surprising economy. This is why major automotive manufacturers, freight forwarders, banks and retailers across the country have elected to install Periphonics T-COMM 7.

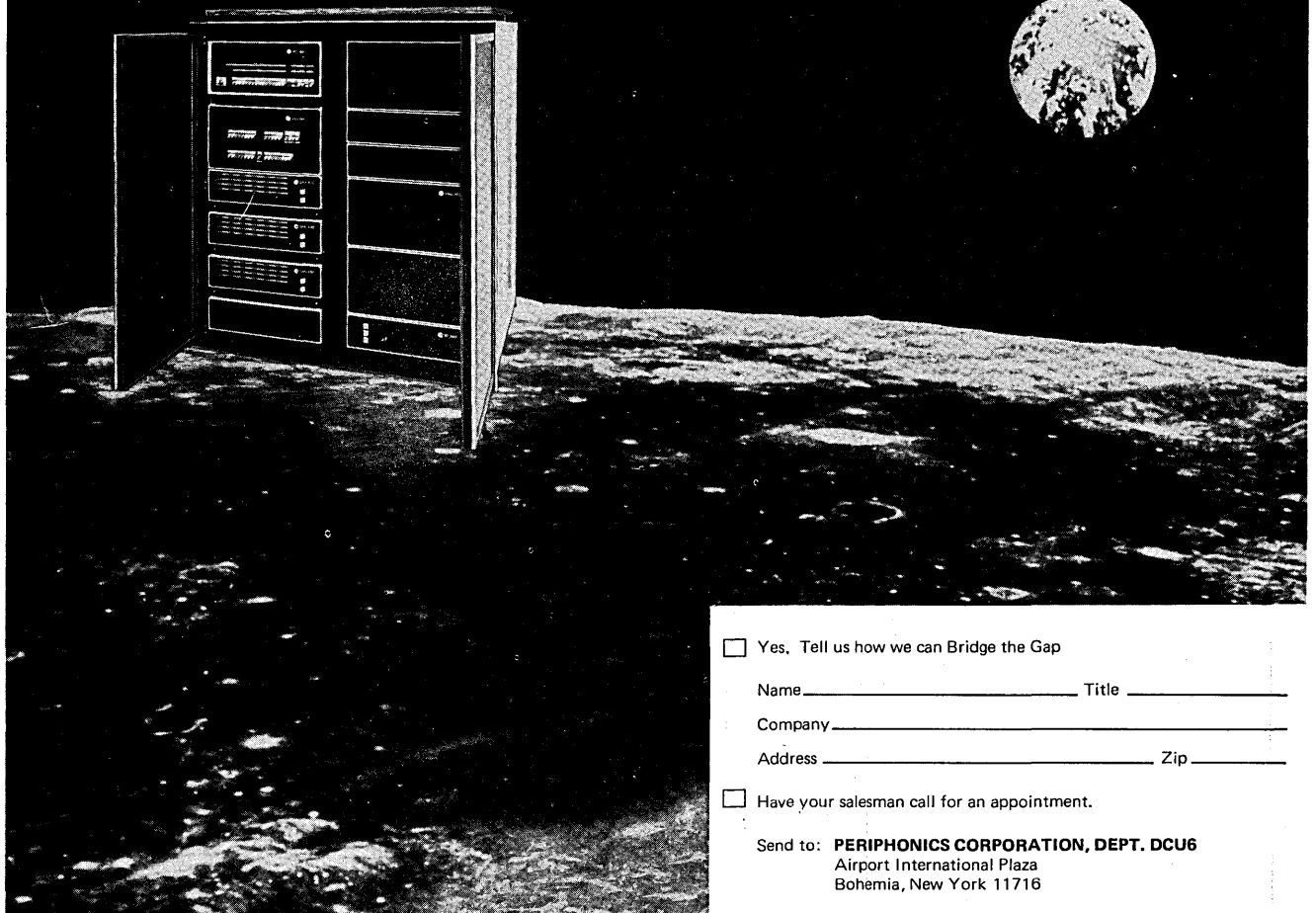
What's more, all teleprocessing control is handled by T-COMM 7. You do *no* communication programming! The Periphonics system comes equipped with one of the most extensive and reliable TP software packages in the industry.

As an option, T-COMM 7 offers VOICEPAC 2000, the world's most advanced system for audio response. VOICEPAC 2000 provides truly conversational audio with a vocabulary capacity of 1500 words.

Take the first step now! Call or write and get the full story on how to have really versatile data communications at a price you can afford.

 **Periphonics**
corporation

Airport International Plaza, Bohemia,
New York 11716 (516) 567-1000



Yes, Tell us how we can Bridge the Gap

Name _____ Title _____

Company _____

Address _____ Zip _____

Have your salesman call for an appointment.

Send to: **PERIPHONICS CORPORATION, DEPT. DCU6**
Airport International Plaza
Bohemia, New York 11716

WE CALL THE 840 THE LOADED NOVA.

IT'S TOO BIG AND HAIRY TO BE A MINICOMPUTER.

By minicomputer standards, our new Nova 840 is big and hairy and costs a lot of money.

But, in terms of combined hardware/software performance, minicomputer standards just don't apply to the 840.

BIG HARDWARE

We packed the 840 with a brand new Memory Management and Protection Unit that turns it into something far more than a minicomputer. MPMU lets the 840 grow to 128K total words (256K bytes) of main memory, and, most important, it's free advantage over all the hairy software we've developed.

The 840 also comes with a whole lot of peripherals and high performance options, including a super fast new Floating Point Unit that handles single and double precision arithmetic at speeds that match most big computers.

DATA SOFTWARE

But hardware is only the vehicle. What makes the 840 a different kind of machine is software: the most powerful software available with any

computer at anywhere near its price. Proven software we can deliver today.

It has a Real-time Disc Operating System that supervises the whole system; our new Fortran 5, that produces globally optimized, fast-executing code that's as efficient as machine language; Batch remote job entry software; timesharing BASICs; and Extended Algol.

Dual operations on the 840 lets you run any two major software streams concurrently and with complete security; multi-terminal timesharing BASIC along with remote job entry; or even full-time control application while you're doing prototype development in Algol.

THE PROOF

With all that hardware/software muscle, the 840 has embarrassed a lot of far bigger computers in price/performance benchmark comparisons.

For instance, there was the XDS Sigma 7 that was 40% faster running an independently conducted Fortran

benchmark. And then got wiped out by the 840's more than 10-to-1 price advantage.

Or the DEC system-105 that cost eight times more than the 840. And was actually 7% slower running the benchmark.

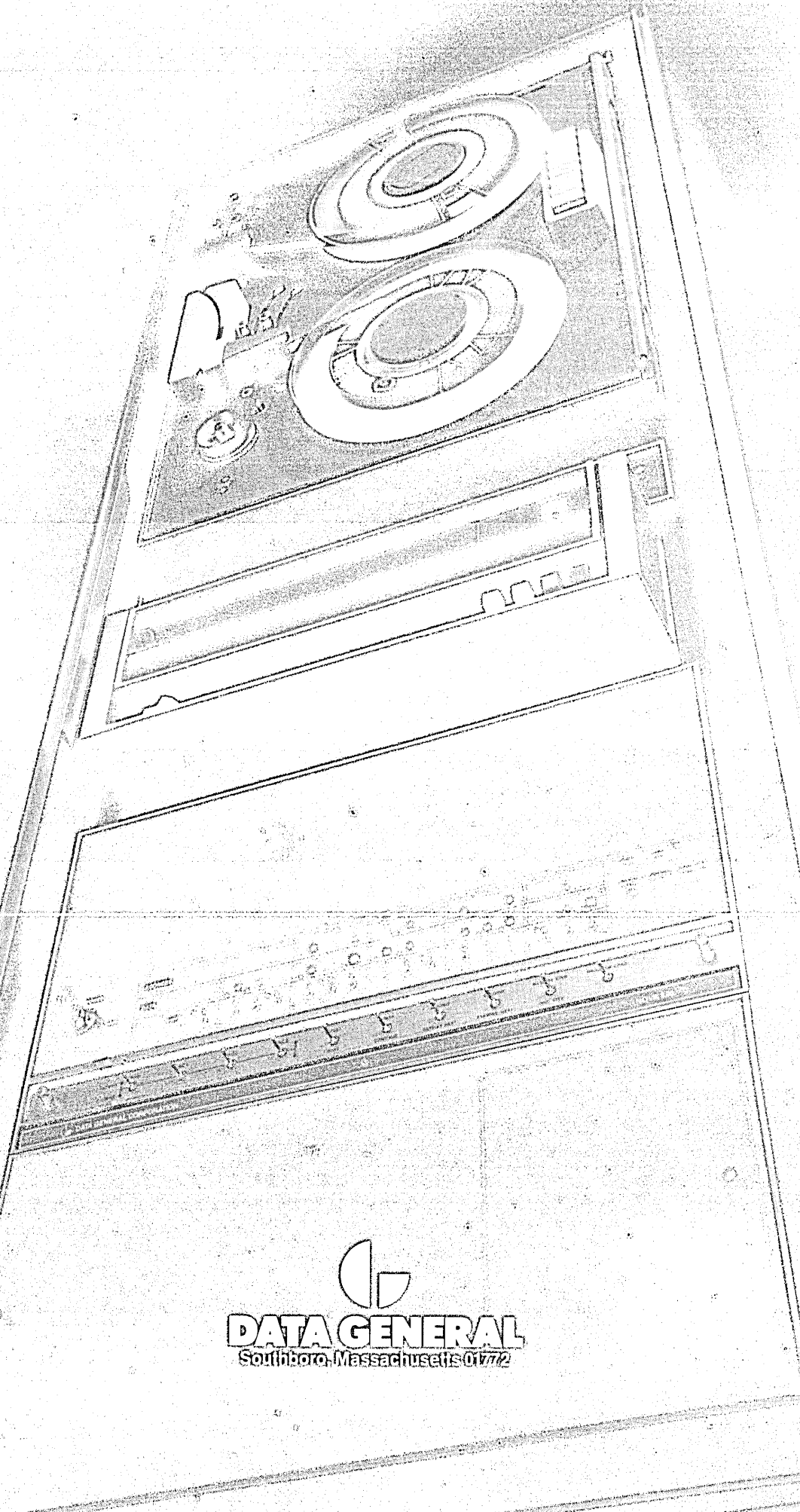
If you think those benchmarks are too good to be true, that's all right. We'll give you the chance to give you all the more details on the benchmarks and how our matchless software makes that whole price/performance possible.

THE BOTTOM

We know that Data General is the only minicomputer company with a big hairy machine.

We also know that the 840 is capability-for-capability, feature-for-feature, considerably less expensive than the competition.

And we know we can deliver the 840 faster than the competition can deliver their machines: 90 days after you call us with an order. (571) 855-9000.



DATA GENERAL
Southboro, Massachusetts 01772

We're capable of anything. To help your computers do everything.

The Communications and Terminals Division of Sperry Univac specializes in developing total communications systems.

And it doesn't matter whether your mainframe comes from Sperry Univac or anybody else you can name.

It doesn't matter whether your communications requirements are room-to-room, plant-to-plant or nationwide.

It doesn't matter how you want to communicate. Or how fast you want to communicate.

What does matter is the experience, equipment and worldwide service organization we can offer you.

Beginning with the UNIVAC® 3760 communications controller, your system builds. With the UNISCOPE® 100 display terminal, the DCT 500 keyboard-printer, the DCT 1000 remote-batch terminal, 610 tape cassette, card

readers, paper tape equipment, etc.

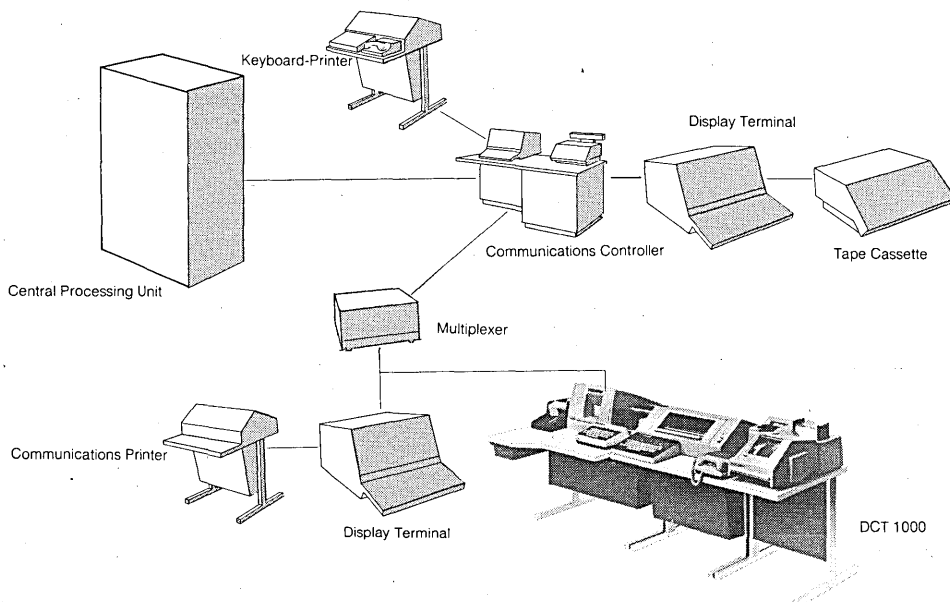
The result is a complete, flexible data communications system compatible with your computer.

All with the assurance of high-performance equipment.

The UNIVAC DCT 1000 communications terminal, for example, speeds information over common carrier lines at up to 4800 bps as it outperforms competitive equipment in just about every area. The DCT 1000 is fully buffered, synchronous or asynchronous, and operates in batch and interactive mode under computer control.

For a brochure on our total systems capability, contact the Sperry Univac representative in your area.

Or call free 800-453-5323.



COMMUNICATIONS AND TERMINALS DIVISION

SPERRY+UNIVAC

Only when our customers succeed do we succeed.

If you use more than one of these media

WE CAN HELP YOU MANAGE BETTER

Just look at all the different types of media you are using today.

As a manager, how can you organize your operations to get the highest productivity from the people and machines that use these media? And, if you are adding such things as microfilm, microfiche, word processing equipment, terminals and computer reports; how can you create storage systems and work station environments that will provide high efficiency; reduced worker fatigue and better housekeeping?

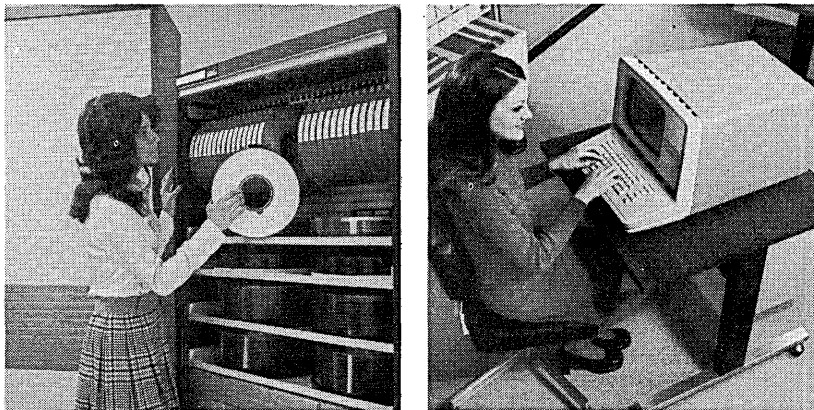
One thing you can do is to recognize the fact that the office furniture you've been used to all these years just can't adapt to the media explosion.



That's why we started with the basic problems of media and the people who work with them and designed an entirely new concept in equipment for the office and computer room.

THE OPTIMEDIA™ CONCEPT

It's called Optimedia because it allows you to tailor your systems to provide optimum use of media by both people and machines. Optimedia also gives you a built-in hedge against obsolescence since it is a living system which you can change at any time to meet your changing requirements. We'd like the opportunity to show you how the Optimedia concept can help you manage better. It's detailed in our new brochures. To receive copies, just circle the readers service number, or contact your nearest Wright Line Media Management Specialist. You'll find him in all principal cities.



Wright
LINE

MEDIA MANAGEMENT SYSTEMS

160 GOLD STAR BOULEVARD, WORCESTER, MASS. 01606
A DIVISION OF BARRY WRIGHT CORPORATION

CIRCLE 79 ON READER CARD

THE REASONS TO KEEP YOUR IBM 1130:

THE REASONS NOT TO:

Throughput. You already know there's a limit to the throughput your 1130 can handle. If you haven't reached that limit yet, you probably will. Then come the problems. You don't want to move up to a more expensive system. You don't want to rewrite your software. You don't want a lot of grief. We think you should check into our "Super" 18/30 DMS. It's a direct 1130 replacement that gives you three to ten times the throughput at about the same cost. And it still uses all your existing programs.

Real Time. Your 1130 doesn't have real time capability. Our 18/30 does. It's a fourth generation computer with real time, multi-programming (on-line CRT, etc.) capability. And we're prepared to help you make the conversion to real time, now or any time you are ready.

Money. The 18/30 does much more work for almost exactly the same number of dollars. And lets you avoid having to move up to a bigger, more expensive computer with all new software to write. The result: enormous savings in dollars, downtime and anguish.

None of the above. Even if you aren't throughput-bound and couldn't care less about real time at the moment, we can still help you cut costs. Our "Mini" DMS also works with your 1130 software and gives you at least the same throughput (much more in disk work). All for as much as 40% less per month than you're paying now.

Us. Anybody who says they can do all this is worth talking to. Call Ron Doiron at (714) 778-4800. Or write him in care of General Automation, Inc., 1055 S. East St., Anaheim, Calif. 92805.

GENERAL AUTOMATION 18/30 DMS

COM can boost your throughput.

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

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

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

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



Take the important first step.

Write us for our new booklet, "The New Generation of Computer Output". Eastman Kodak Company, Business Systems Markets Division, Dept. DP595, Rochester, New York 14650.

Kodak: for better use of information.



Calendar

SEPTEMBER

International Conference on Computer Systems Evaluation, Sept. 17-19, Uxbridge, England. With sessions covering both technical and management viewpoints, the conference will examine tools and techniques for evaluating and controlling performance at all stages in the life cycle of computer systems. Topics will include performance specification, hardware and software evaluation, designing for performance, simulation methods, analytical methods, benchmarks and mixes, hardware and software monitors, and case studies in batch and realtime systems. Contact: ONLINE, Brunel Univ., Uxbridge, Middlesex, England.

Computerland for Time Travelers, Sept. 20-23, Berkeley, Calif. Sponsored by the Univ. of California Extension in cooperation with the Lawrence Hall of Science, this fair will represent a time when the computer will be as familiar an aspect of everyday life as the telephone. Visitors will be able to operate computers in "hands-on" exhibits; there will also be films, demonstrations, mini-seminars, and workshops. The first two days will be primarily for teachers and students at all levels; the last two for the general public. Contact: Univ. of California Extension, 2223 Fulton St., Berkeley, CA 94720.

IEEE Electronic Security Systems Seminar, Sept. 25-26, New York. Concurrent sessions will deal with the application of electronics to security problems in the fields of transportation, industry, business, data processing, and finance; there will also be a working electronics exhibit. Fee: \$45, advance; \$65, at door; partial enrollment available. Contact: J. Howard Schumacher, Jr., IEEE Convention Dept., 345 E. 47 St., New York, NY 10017.

OCTOBER

Symposium on Principles of Programming Languages, Oct. 1-3, Boston. Sponsored by ACM SIGACT/SIGPLAN, the program will consist of sessions on programming language semantics, parsing, program verification, data types, and code optimization. Proceedings will be available. Fee: \$40, members of ACM, SIGACT, or SIGPLAN; \$45, others. Contact: Michael Fischer, MIT—Project MAC, 545 Technology Sq., Cambridge, MA 02139.

Third Annual Symposium of the Gesellschaft für Informatik, Oct. 8-10, Hamburg, W. Germany. The symposium will survey the status of computer science with lectures on such topics as formal and programming languages, compilers, operating systems, data storage and retrieval, information systems theory, and special applications. Fee: DM 60, members; DM 90, others. Contact: E. Jessen, Institut für Informatik, Universität Hamburg, 2000 Hamburg 13, Schlüterstrasse 70, W. Germany.

New Zealand Medical Information Processing Conference, Oct. 11-12, Dunedin, New Zealand. The first of its kind in New Zealand, this conference reviews current projects and uses of computers in medicine in 12 papers on such topics as real-time laboratory systems, patient index systems, hypertension research, intensive-care unit handling, management science techniques in medical management, development of on-line patient information systems, and records systems for G.P.'s and health centers. Fee, including Proceedings: \$25.

Contact: N.Z. Medical Information Processing Conference, Univ. of Otago, P.O. Box 56, Dunedin, New Zealand.

DPSA Input/Output Systems Seminar '73, Oct. 16-18, Chicago. The theme of this conference, sponsored by the Data Processing Suppliers Assn., will be "The Role of Input/Output Systems in the Future Data Processing Environment." The program, with exhibits, will include discussions of new applications, and systems by end-users and peripherals manufacturers. Fee: \$150. Contact: Don Hrisak, DPSA, 1116 Summer St., Stamford, CT 06905.

Canadian Computer Show and Conference, Oct. 16-18, Toronto. This fourth annual event, sponsored by the Canadian Information Processing Society, will consist of a show with an expected attendance of 8,000 industry buyers and a conference with seminars on data bases, software, and minicomputers. Fee: \$45 (\$20 for one day only), for conference and show; \$3, show only. Contact: Industrial and Trade Shows of Canada, 481 University Ave., Toronto, Ontario M5W 1A7, Canada.

NOVEMBER

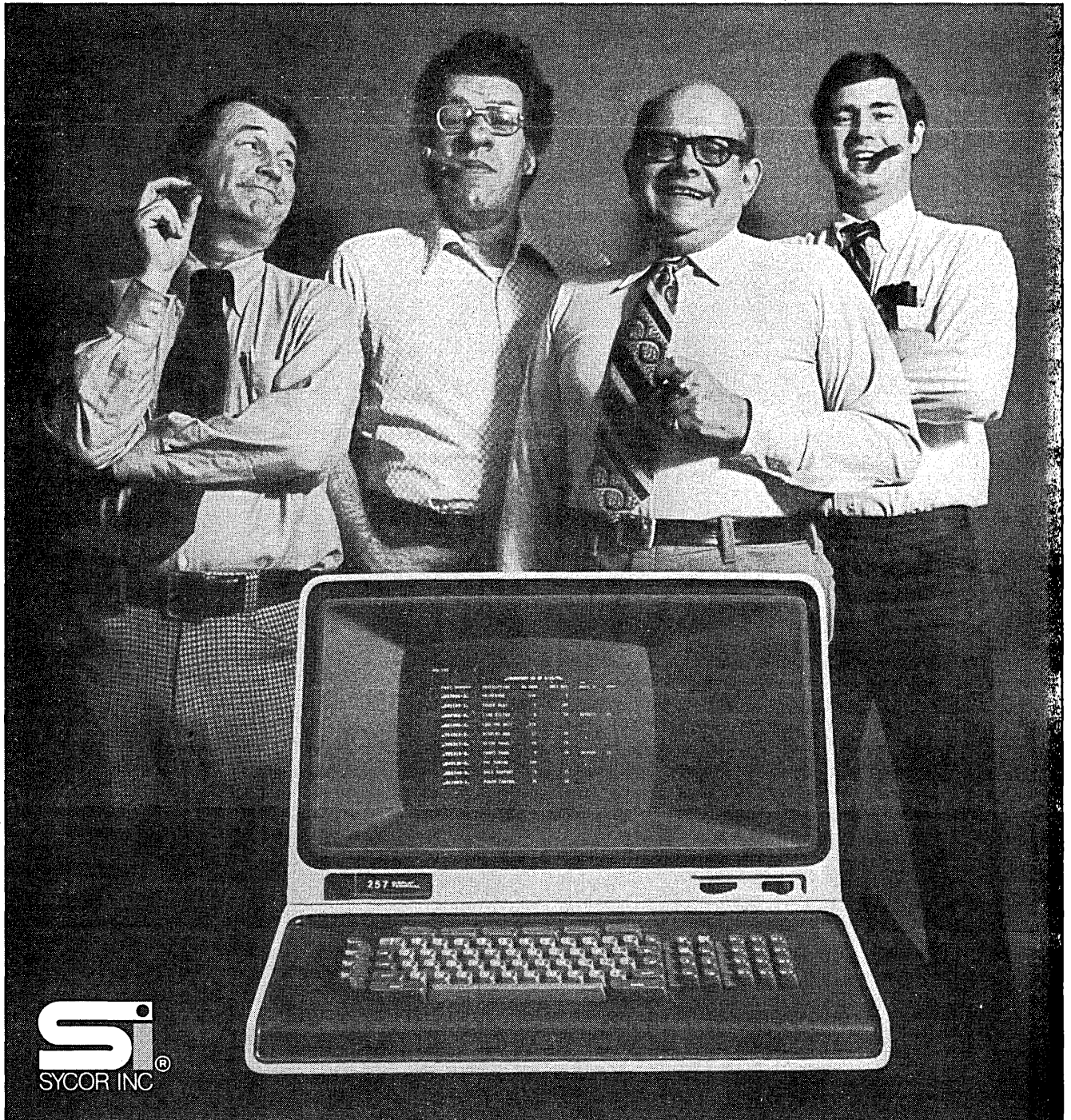
EURIM—European Conference on Research into the Management of Information Services and Libraries, Nov. 20-22, Paris. Approximately 20 papers will describe methodological investigations into problems rather than descriptions of operational or projected systems. The types of information systems to be examined include technical, commercial, public affairs, economic, management, and administrative (including data centers, data banks, abstracting and indexing services); libraries (including archives and museums); and information networks, interlending systems, and cooperative groups. Fee, including Proceedings: £47. Contact: Conference Organiser, Aslib, 3 Belgrave Square, London SW1X 8 PL, England.

TECHSPO '73, Nov. 26-30, Bangkok, Thailand. Sponsored by the U.S. Dept. of Commerce, this will be a 25-manufacturer exhibition with a series of technical seminars on the products displayed. The two types of equipment to be shown are 1) edp equipment, business and office reprographic machines, and 2) industrial and scientific test and measurement instruments. Types of equipment in the first category considered to have the most sales potential for Thailand include: computers, tapes, discs, punch card verifiers, accounting and bookkeeping machines, and calculators. Exhibitor fee: \$600. Contact: U.S. Dept. of Commerce, BIC-238, Washington, DC 20230.

CALL FOR PAPERS

National Computer Conference & Exposition, May 6-10, 1974, Chicago. AFIPS has issued a call for proposals to organize sessions, and a call for new papers of either a theoretical or a technological nature, on the use of information processing systems in industry, business, government, education, and human services. Deadlines: Sept. 1, proposals to organize sessions; Oct. 1, advance abstracts (150 words maximum); Nov. 15, completed papers (5,000 words maximum). Contact: Theodore M. Bellan, c/o McDonnell Douglas Automation Co., P.O. Box 516, St. Louis, MO 63166.

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In Canada: Sycor International Ltd., Toronto (416) 429-0883. **Service Centers in 80 cities.**

ON-LINE TERMINAL OFF-LINE TERMINAL AND INTELLIGENT "3270"

INTRODUCING THE SYCOR 250.

It's our new intelligent on-line terminal that's lower priced than IBM's 3270* and compatible in both hardware and software.

In fact, you can just plug it into any IBM network and let it go to work.

But, unlike the 3270, our Sycor® 250 has many of the intelligent features that have made our Model 340 remote batch terminal so popular.

Features that let the 250 check branch office key entry field-by-field instantly, providing clean

data to the computer and significantly improving operator efficiency.

What goes into the computer goes in clean (at up to 4800 baud)

— and you spend less time on the line. So, you can install more terminals per line, and probably end up needing fewer lines and ports.

NEW DUAL TRACTOR PRINTER

The 250 has some pretty impressive optional equipment, too. It's available with a badge reader, a light pen and a family of versatile printers.

The printers are our new 2580 series, with

40, 80 or 165 cps speeds. They feature dual tractors that handle two independent continuous forms simultaneously. So now you can combine your forms printing and administrative message traffic on one printer.

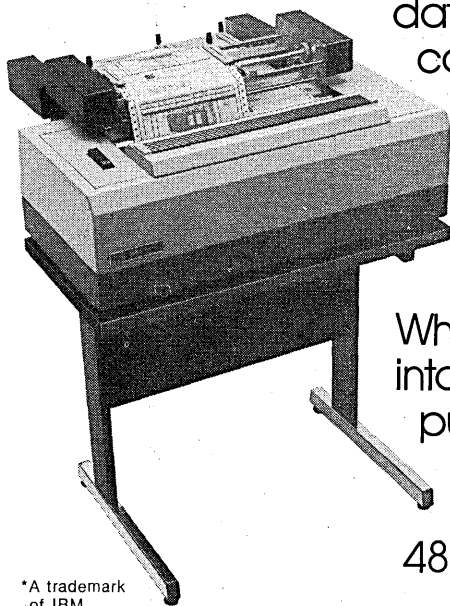
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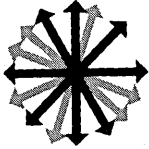
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We thought you'd like a sneak preview of this month's late-breaking news ... as it will appear in the August issue of Datamation.

We hope this timely, inside information will be of use to you.

Let us know if you'd like to continue receiving this advance copy of the hottest, best-read news section in the industry.

--Jim Morris
Publisher

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more. They budgeted \$250,000 for a study of registration problems and design of a system to solve them, and RFP's went out last month to some 200 firms, including IBM. Proposals are due back by mid-September.

Maricopa County is closer. Its supervisors have approved a system designed for the county by Howard Wilson Co., a Los Angeles software firm specializing in political and election work. At this writing, the design for the system, which would use an in-place Honeywell 6000 and H6000 keyboard terminals, was being reviewed by the county's registrar-recorder.

AND THEN THERE WAS ONE, MAYBE NONE

There was only one bidder left as the July 30 bid submission deadline neared for the state of California's \$40 million Teale Center, a consolidated dp center to serve 34 state agencies. But this could mean none, since the state's new budget bill requires that there be at least two "qualified bidders" before a contract can be awarded. From an initial field of 12 firms which bought the Invitation For Bid (IFB), only three, IBM, Honeywell, and Control Data, said they would bid. CDC pulled out early last month (see p. 74), followed in a couple of weeks by Honeywell. The Big H said it couldn't meet the mandatory conversion date of June 1974 for the Department of Motor Vehicles, and couldn't bid a fixed price for the conversion, because its subcontractor, Computer Science Corp., wanted it open-ended. Both Honeywell and CDC called the IFB fair and competitive but Univac protested it and the state was to respond Aug. 3. At this writing, the procurement had not been aborted. Vendors and officials were agreed that the next step depends on a legal interpretation of the term "qualified bidders."

SOVIETS DICKERING TO EXPLOIT VIRTUAL MEMORY

A 370/158 with "quite a few 3330 discs" was the system that recently won IBM a multi-million dollar reservation system contract from the Soviet Intourist Agency. So says a source with good contacts inside the ministry that negotiated the deal. The big question now is whether IBM can get a license to export the advanced technology it has offered.

Equally intriguing is the question of whether the Soviet government gave the U.S. government some political quid pro quo so that the U.S., in turn, would be more willing to let them exploit virtual memory and the other goodies in the IBM bid. In any event, if the license is granted, present export restrictions will almost certainly be relaxed considerably for all U.S. mainframers.

RUMORS AND RAW RANDOM DATA

The hush-hush Naval Weapons Laboratory apparently isn't using paper-shredders in its computer security procedures. It does the next best thing to dispose of tons of computer printouts: it gives them to the Boy Scouts. "Each month, a stack of computer output that's five feet tall and ten feet deep," said the laboratory's Herman W. Toombs in a deposition taken June 13, in Minneapolis, in connection with IBM's defense against the Justice Dept.'s antitrust suit...Ampex Computer Products, which makes the DS324 -- a double-density 2314 disc drive -- expects to offer a dual-density 3330, but hasn't set a date. Its first 3330 equivalent is to be shipped late this month or early in September.

DATAMATION

for October 1973

...surveys trillion-bit memories in a theme issue exploring "Toward Mass Memories" ... a supportive article warns that data stored on very old magnetic tapes may suffer error losses as high as 20%.

Also in October: a staff-written study of hardcopy terminals ... and suggestions for the protection of computer systems.

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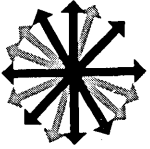
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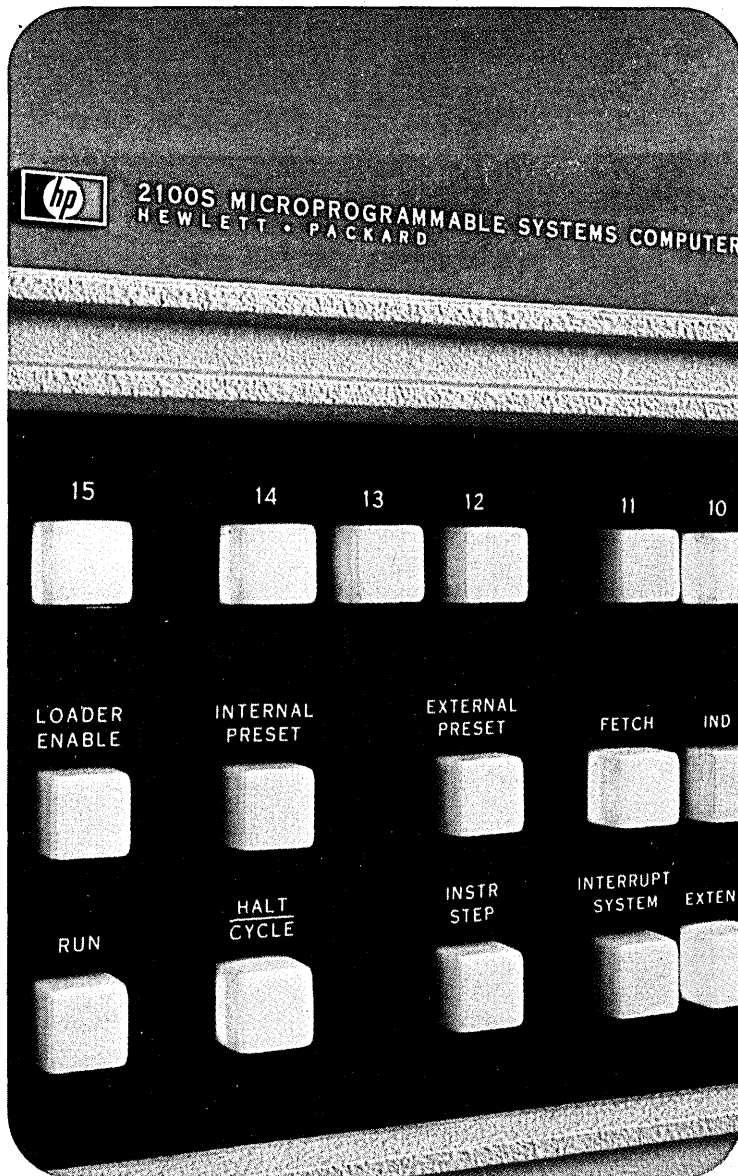
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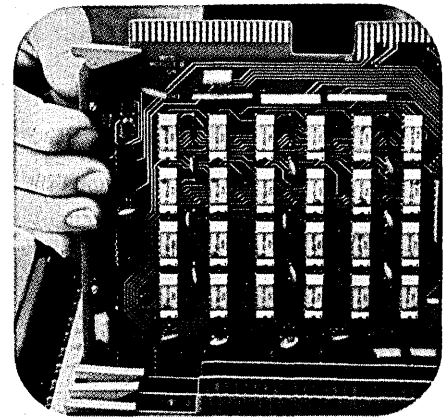
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(Continued on page 121)

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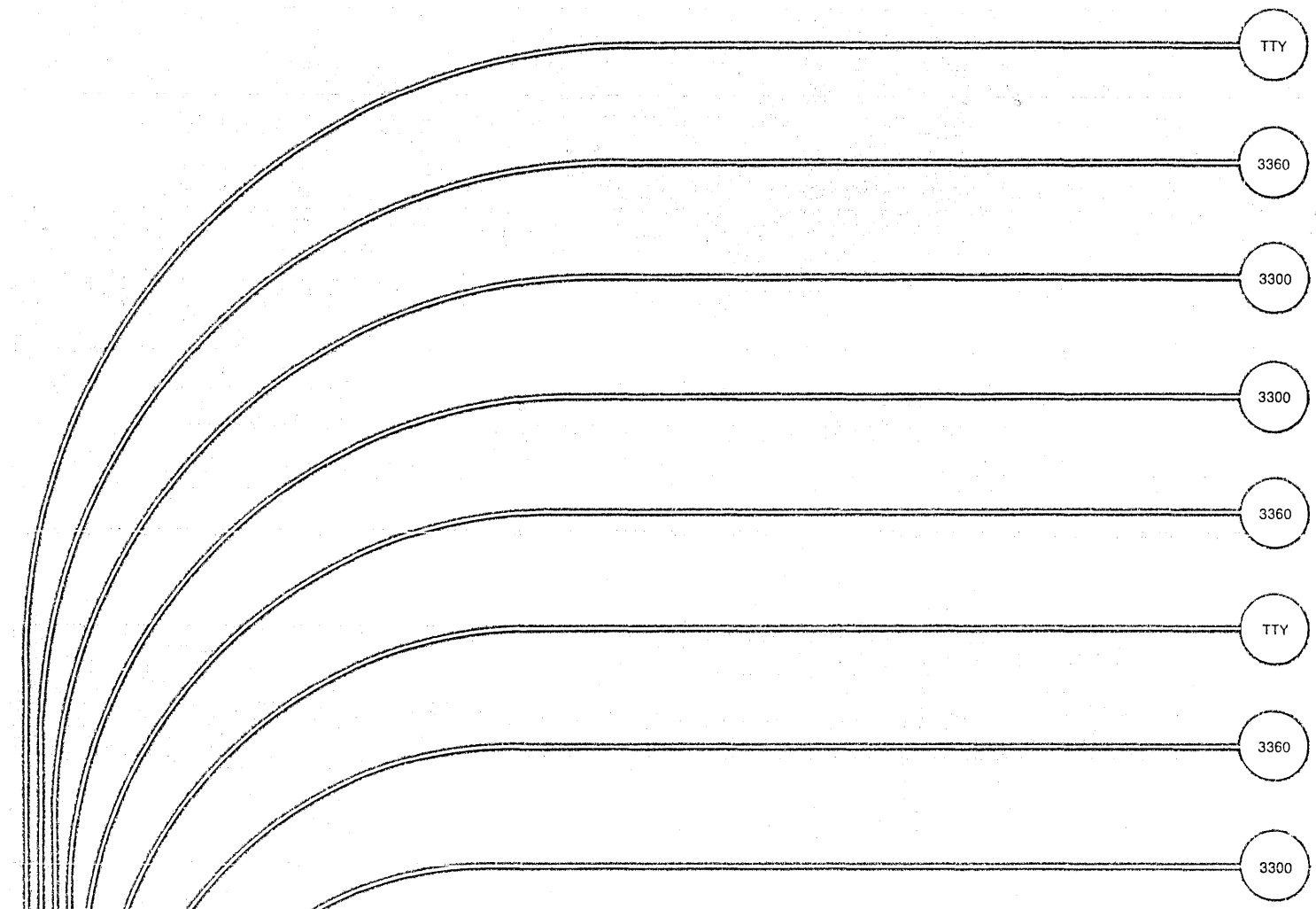
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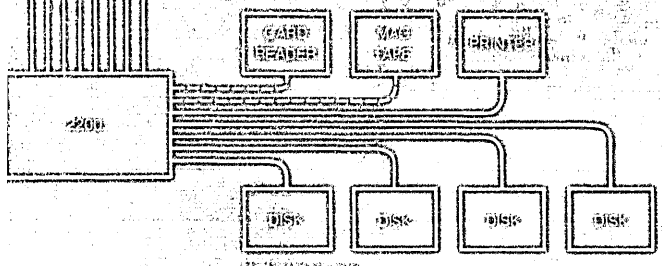
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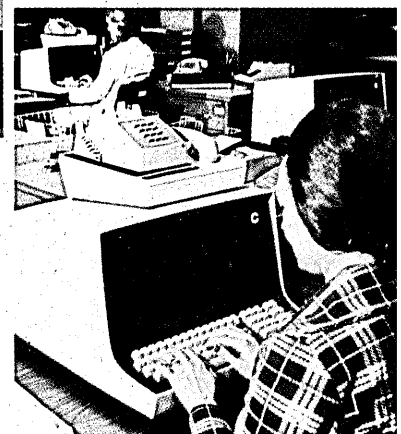
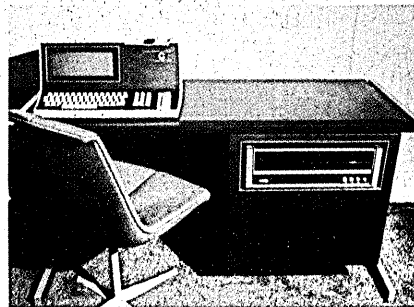
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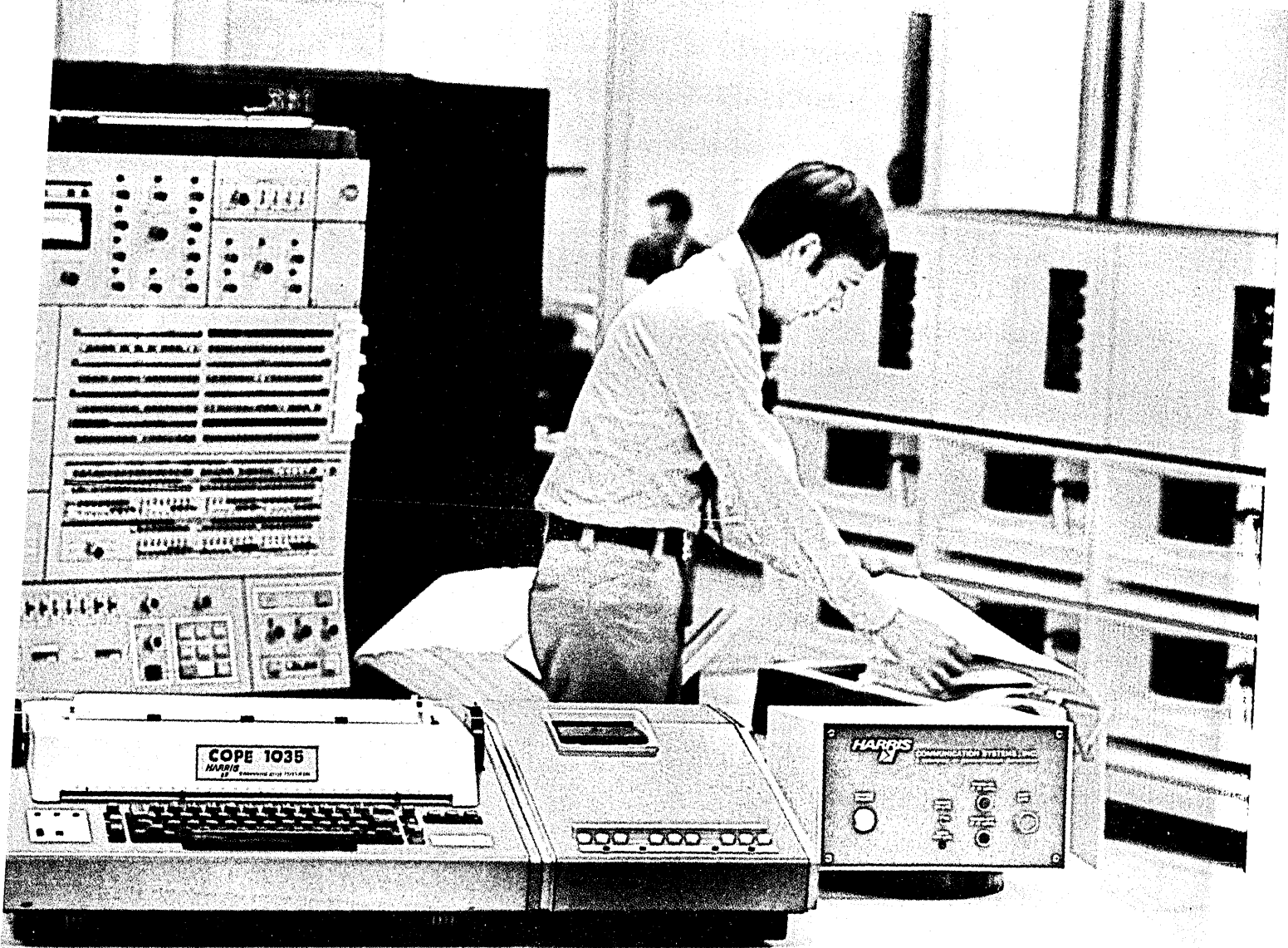
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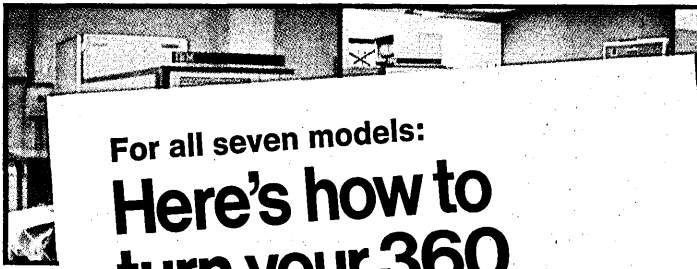


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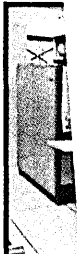
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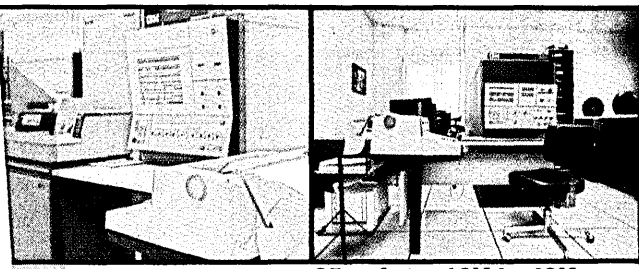
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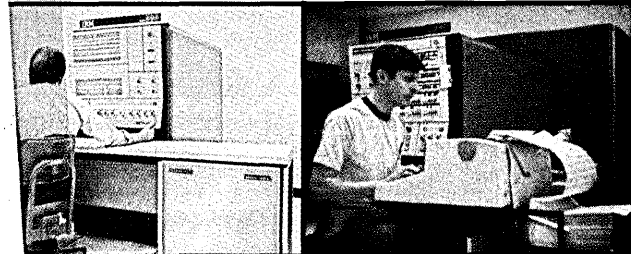
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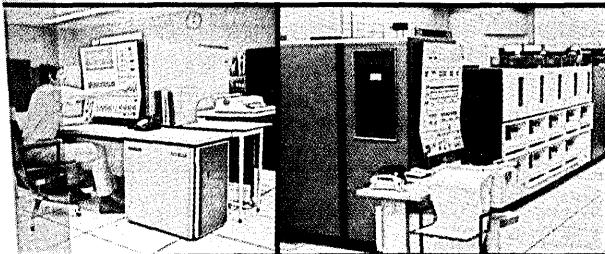
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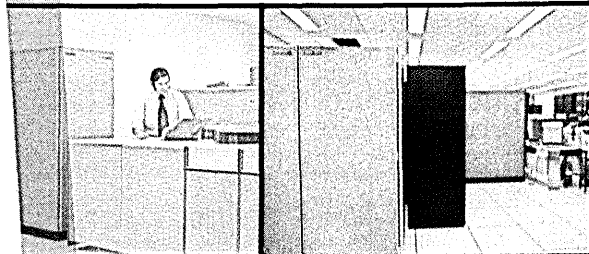
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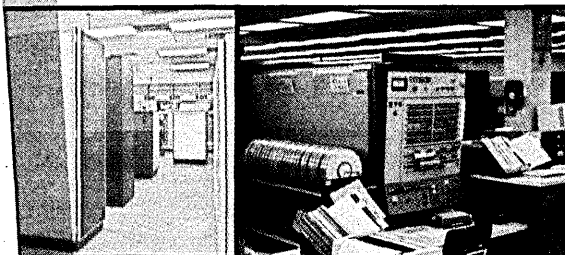
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Letters

Solution/dissolution

Dick H. Brandon's comments (April, p. 175) were quite intelligently drawn: having IBM broken up vertically, logically, or geographically may yield no advantages in fact to the user, the economy, or society at large. Mr. Brandon argues that the Justice Dept. may have asked for dismemberment as a ploy designed to produce motivation on IBM's part for agreement on a refurbished consent decree.

Mr. Brandon concludes:

"Thus, if a consent decree is indeed the target of the Justice Department, why not frame the parameters of such a decree and present it to the industry so that a meaningful contribution can be made toward a realistic solution?"

"This is no longer the time for ritualistic negotiation. A solution is possible, if properly approached. The alternative is economic chaos. . . ."

What solution? What are Mr. Brandon's grounds for believing that a solution is possible, practicable, or equitable? He argues admirably that present cries for dismemberment have failed utterly to weigh the consequences of the government's securing such a breakup; but he presents no reasons whatever why the reader should believe that a consent decree will solve the problem either.

WILLIAM LEE VALENTINE
New Orleans, Louisiana

Mr. Brandon replies: There is no more evidence of viability of a consent decree or the proposed trisection; however, one normally tries the more moderate (and reversible) solution first. Beheading a person to fix a headache appears terribly final—*aspirin* might work, and should be tried first. An intelligently constructed consent decree, compiled with industry participation, could do much to limit the operating boundaries of a quasi-monopoly. I, for one, would be happy to make my suggestions for the curtailment of operating practices which are detrimental to the industry at large.

Contention

In the June issue (p. 190) [is] a review of the Eames' book, *A Computer Perspective*. The reviewer, Lynn Stoller, particularly disparages the "philosophical viewpoint" of the book. He alleges that "IBM got Professor I. B. Cohen from Harvard to validate this history."

With regard to these assertions, may I make the following comments:

1. It is absolutely false to state that IBM got me "to validate this history." I am not to be "got" to "validate" anybody's history or philosophy, and I consider such a statement slanderous and requiring an apology.

2. With regard to the development of the "philosophy" and "history", IBM had nothing whatsoever to do with the formation of the point of view that illuminates this work. Rather, the historical perspective or "philosophy" emerged from many long and earnest discussions between the staff of the office of Charles and Ray Eames and myself and my academic collaborators and assistants, and over a number of years. This is quite the opposite of there having been developed a history and philosophy, which IBM then hired someone to validate.

3. Over a long period of time, before the exhibition on which the book is based was completed, Mr. Stoller himself worked closely with both myself and my collaborators and assistants as well as with the members of the staff of the office of Charles and Ray Eames, on matters of detail, and on the general historical point of view and philosophy. Since he was so active a participant in the planning and execution of this history, I find it more than a little odd that he now takes issue with it.

Nonimpact printers

We have noted with interest your article "Nonimpact Printers" (May, p. 71). In connection with the section on ink-jet machines, page 72-73, please note that the INKTRONIC printer was developed and is marketed by the Teletype Corp., not ITT as stated in your

Why, one wonders, did he never express such a point of view at a time when it might have influenced the eventual product?

4. As a practicing historian, I take exception to Mr. Stoller's assertion that "any researcher knows you can always discover a history to support a given philosophy." I am a "researcher" who does not know this. In any event, in this instance, the "philosophy" grew out of the research into "history," and so the comment is irrelevant.

I would have thought it an obligation to your readers to give them at the very least an idea of the contents of this book, however much a reviewer might have objected to its philosophy.

I. BERNARD COHEN
Professor of the History of Science
Harvard Univ.
Cambridge, Massachusetts

DATAMATION regrets any implication that Professor Cohen was hired by IBM to give credence to its theory. Reviewer Stoller was unavailable for comment at press time.

article. INKTRONIC is a registered trademark of Teletype Corp., referring to its brand of ink-jet printer. Teletype Corp. is a subsidiary of Western Electric, which in turn is a subsidiary of AT&T. There is no relationship to ITT.
J. L. LANDIS
Skokie, Illinois

THE ARTICLE ON NONIMPACT PRINTERS BY MR. RENN ZAPHIROPOULOS DOES A GREAT DISSERVICE TO THE XEROGRAPHIC TECHNIQUE OF PRINTING COMPUTER OUTPUT. THE U. S. ARMY ENGINEER MATHEMATICAL COMPUTATION AGENCY HAS SUCCESSFULLY USED THIS TECHNIQUE SINCE 1959 WITH TWO STROMBERG-CARLSON 5000 PRINTERS. THESE MACHINES PRINT AT A RATE OF 3600 LPM, 120 CHARACTERS PER LINE. WE HAVE AVERAGED PRINTING 3.5 MILLION TO 5 MILLION PAGES OF PRODUCTION OUTPUT PER YEAR AT AN AGGREGATE COST OF \$0.0166 PER PAGE. THIS OF COURSE EXCLUDES MAINTENANCE COSTS, WHICH HAVE INCREASED IN THE LAST FEW YEARS DUE TO THE SCARCITY OF PARTS AND THE AGE OF THE EQUIPMENT.

WHAT REALLY CONCERNS ME IS THE POSSIBILITY THAT MANY MANAGERS WILL READ AN ARTICLE LIKE THIS AND RULE OUT VARIOUS TECHNIQUES ON THE RECOMMENDATION OF AN INDIVIDUAL WITH SUCH IMPRESSIVE CREDENTIALS AS MR. ZAPHIROPOULOS. FURTHERMORE, IF, IN MR. ZAPHIROPOULOS' DRAWING ON PAGE 73, WE RAN OUR DRUM AND PAPER IN THE SAME RELATIVE DIRECTION, OUR PRINTER WOULDN'T WORK EITHER. OBVIOUSLY IF THE DRUM AND PAPER ARE GOING IN OPPOSITE DIRECTIONS AT THE POINT OF CONTACT ABOUT ALL THAT COULD HAPPEN IS A GOOD POLISH JOB ON THE DRUM.

PLEASE FEEL FREE TO FORWARD THIS LETTER, WHICH IS PRINTED FROM AN S-C 5000 PRINTER, TO MR. ZAPHIROPOULOS.

R. BRUCE ROWLAND
McLean, Virginia

Mr. Zaphiropoulos replies: Mr. Rowland has apparently misunderstood the purpose and message of the article. I was not concerned with all the feasible nonimpact printing techniques. I was trying to point out the ones which were most likely to succeed because of the fit between their fundamental nature and the charac-

teristics of the need for hard copy. I am not very familiar with the Stromberg-Carlson 5000 printer, but I can deduce from the lack of advertising, and its apparent absence from the marketplace, that it has not been a successful machine, commercially, for Stromberg-Carlson.

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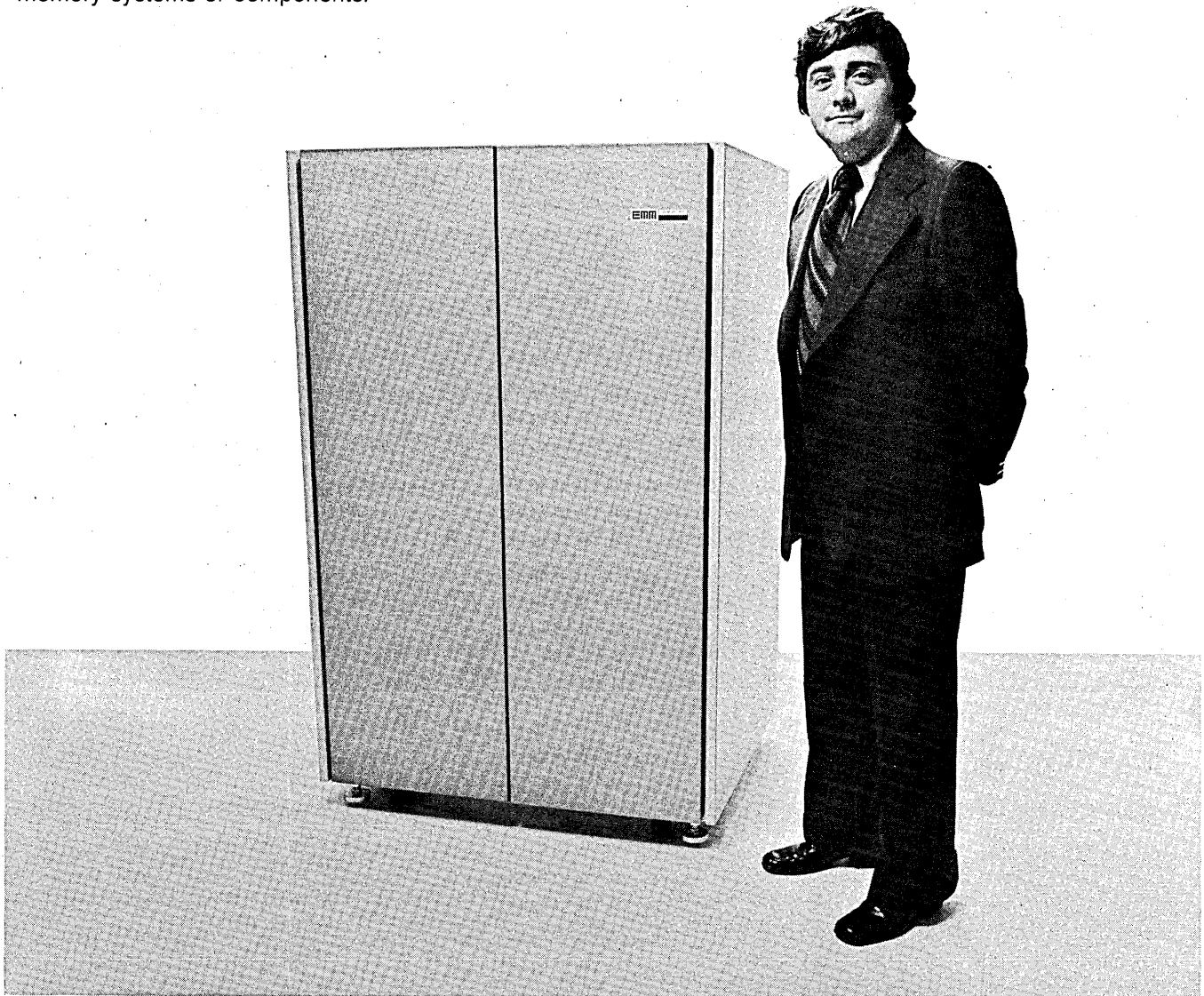
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letters

Hail and farewell

Your Look Ahead comment (June, p. 18) about Bruce Gilchrist doesn't state the case fairly for him, in my opinion. I was a member of the AFIPS Executive Committee at the time the search was being made for the first AFIPS Executive Director. It was the consensus of the Executive Committee that the job should be for three to five years for any one incumbent, and should not be a career position. In a largely volunteer organization, a headquarters staff can effectively take over control of the organization if in office for a long time. This was discussed with Bruce, and he agreed with it.

Your comment makes it appear that Bruce's departure was hastened. I would only say that he has been the AFIPS Executive Director for five years, which was the upper limit of the desired time period.

My own opinion, in working with him over the past five years, is that he has done a most commendable job. I wish him well in his new position at Columbia University. With Bob Recor moving into the position, the appropriate thing to say is: The Executive Director is moving to a new position—Hail to the Executive Director.

RICHARD G. CANNING
Vista, California

Congestion

In the case of the new automated mechanisms which are controlling the Los Angeles freeways (May, p. 127), your confidence in automation's ability to better the lives of human beings is sadly misplaced. The automated, metered on-ramps to our freeways are one of the poorest jobs of human engineering it has ever been my unfortunate experience to witness. The best they ever accomplish is to improve the flow of [freeway] traffic by distributing the queuing structure to the city streets where it is less visible from a helicopter...

Now you extol the virtues of the latest Highway Dept. boondoggle: giant signs on the Santa Monica Freeway to tell us what's going on. Unfortunately, however, most of us who drive the freeways regularly already know what's going on: either the traffic is moving in its normal pattern or it isn't. If it is moving in its normal pattern, who cares what the sign says?

A far less expensive and far more effective method of alerting drivers concerning traffic conditions would be to have a state-wide radio network on selected frequencies to which any driver could tune in and keep apprised

of freeway conditions far enough in advance to make intelligent, alternative decisions.

Traffic flow on Southern California freeways could be substantially improved with a little more human engineering and a lot less automation. However, since our community is probably stuck forever with the super-giant freeway signs, do you suppose they could hire a gag writer to think up some snappy one-liners (32 characters or less) . . . ?

GERALD H. LARSEN
Los Angeles, California

Our studies indicate the average wait time for the 6,000 cars using the metered ramps [at a selected location] . . . is four minutes. We anticipated a reduction in accidents from the ramp metering and freeway condition sign projects. If an accident does occur, however, the signs can so warn approaching traffic. A radio network such as Mr. Larsen suggests may very well be more effective and certainly less expensive. We have been unable to test such a system to date.

AL PERDON
*Special Ass't., Freeway Operations
California Div. of Highways*

Reminiscence

I was privileged to be a bright-eyed-and-bushy-tailed user of the ENIAC computer at Aberdeen. Your brief recounting of the history (June, p. 119) missed what was to me one of the sentimental reflections on the use of the ENIAC. Very early in the ENIAC history, the programming was done by a fixed set of 99 instructions. Since the machine lacked any stored program capacity, large panels, such as those shown in the picture, became the programming entry. By positioning 10 switches of 10 positions each, one could enter an instruction. Programmers entered the program by laboriously setting up all of the program entry switches (that is basically what is being demonstrated in the photograph). In those days it seemed to be a small price to pay for saving a great deal of desk computational time.

JERRY SVIGALS
Los Gatos, California

Codefinitions

The data dictionary approach to table maintenance, as outlined by Mr. R. David Guthrie, "A Data Dictionary Approach to MIS" (April, p. 91), should not pass quietly into the conglomeration of methods without comment from at least one avid fan.

In March, we of the County of Westchester EDP, implemented a data dictionary file known as the Code File. Our dictionaries contain, as the name implies, the code and the full definition of that code. It also includes an abbreviated definition and up to nine re-

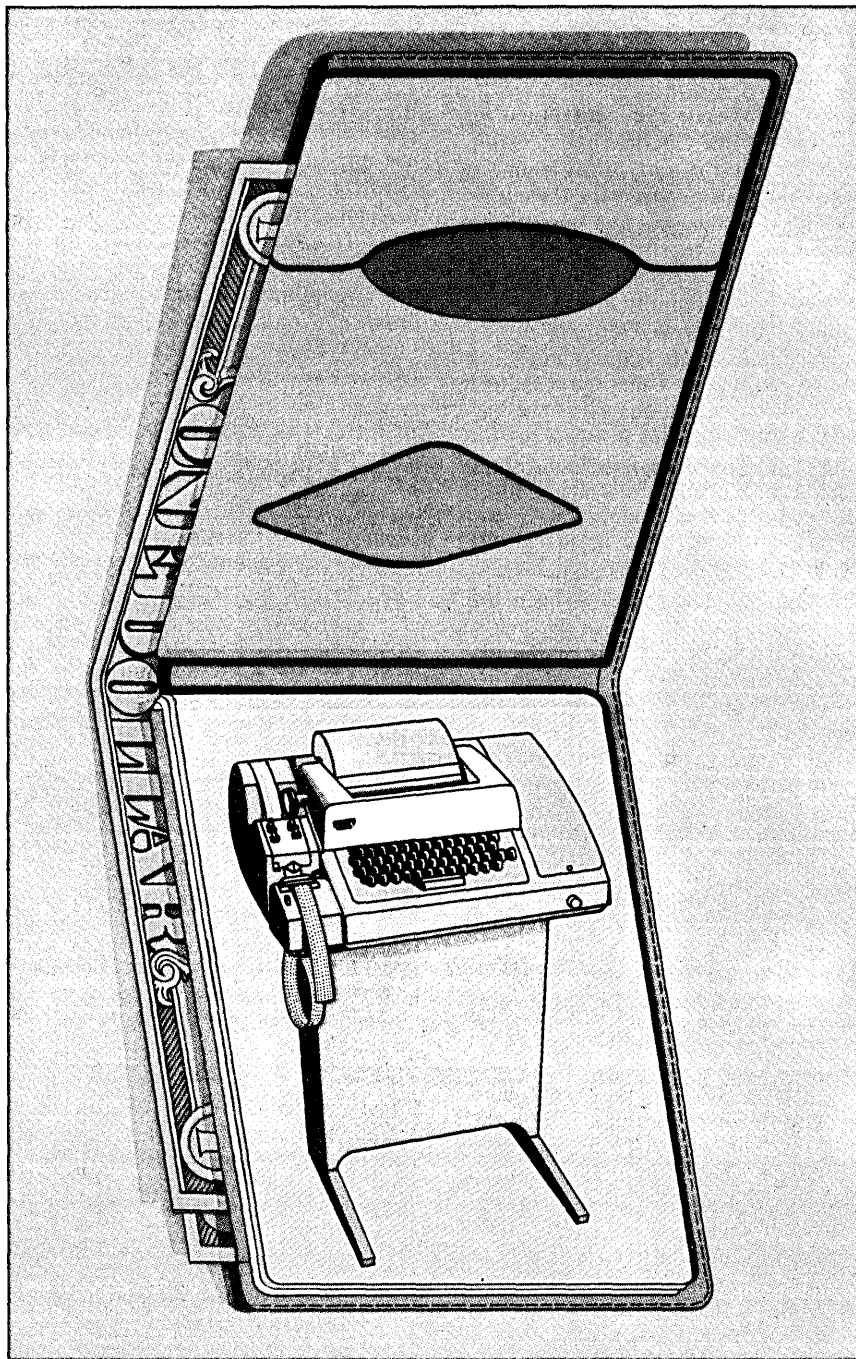
(Continued on page 117)

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DP DIALOG

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

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



A Sixty-Year-Old Forest Simulated in a Minute

How can you log a forest without causing soil erosion and dwarfism or destroying the atmosphere for campers, hikers and fishermen? Up until recently clear-cut answers have not always been available—not only because of the com-

plexity of forest ecosystems but simply because trees do not grow fast enough for controlled experiments.

Now with the help of a computer simulator one can "grow" a two-and-a-half-acre portion of a forest at the rate

We would like to hear from you...

As mentioned above in the masthead, DP DIALOG welcomes all contributions from readers. We would like to hear about your stories, your experiences with data processing people and computers. Perhaps you have a new computer application, are actively involved in some unusual community project, or even have a humorous data processing story to tell. Whatever the case, we would like to hear from you. The stories must be unpublished. If you are interested, just write: Editor, DP DIALOG, IBM Data Processing Division, White Plains, N.Y. 10604.

of a year a second and immediately see the effects of a wide variety of simulated conditions. This development, according to one of the originators, allows research studies to be made which would ordinarily require centuries in an actual forest.

The project developed out of a cooperative effort between the Yale University School of Forestry and Environmental Sciences and IBM's Thomas J. Watson Research Center in Yorktown Heights, New York. Dr. Daniel B. Botkin, a Yale ecologist and two IBM researchers—Dr. James R. Wallis, a hydrologist and Dr. James F. Janak, a theoretical physicist—worked together on a mathematical model for forest growth to simulate environmental factors and various properties of each of

(Continued on next page)

A New Idea in Programming: Debugging the Debuggers

A new approach to programming, which extensively organizes and disciplines the code design and implementation phases, has been evolving over the last six years at IBM's Federal Systems Division in Gaithersburg, Maryland. Developed by Dr. Harlan Mills, formerly manager of programming studies at the Federal Systems Center, the new discipline has already had positive results.

Joseph M. Fox, a vice president at the Federal Systems Division, reports: "Programmers here who are using Dr. Mills' ideas, can now produce code with a significant decrease in error compared to those using older methods. Because of the decrease in debugging and rework, productivity has markedly improved." Not surprisingly the new approach is being widely adopted throughout IBM.

A New Standard

Dr. Mills points out that many of his ideas have been used separately in the industry for years. What he has done is to bring these parts together to form a new standard for programming. He has spelled out procedures for writing and documenting programs and formed a new organizational approach to programming.

He explains: "My objective was to build a better technical foundation, which would allow a programmer to operate with more discipline and more creativity. This technical foundation also makes programming more systematic and thus more understandable."

Dr. Mills' prescription involves

three parts: structured programming, top-down programming and the chief programmer team.

- Structured programming permits the programmer to use three and only three logic structures, instead of a multitude of logic structures.

- Top-down programming allows continual integration and testing as a program is developed instead of from the bottom up—with each part individually designed and tested by different people, then finally assembled.

- The Chief Programmer Team restructures the programmer's work into specialized jobs with the chief programmer or most experienced one of the group performing the most critical part of the work. A programming librarian maintains the current status of the program and test data so that programmers can work more effectively and with fewer errors.

Chief programmer Terry Baker at the Federal Systems Center was the first to put these concepts into action when he and his team were assigned to develop the software to transform the back files of the New York Times into an online information bank. This would make news articles and background material readily available to reporters and researchers.

Baker developed the program system in the order in which it was going to operate—that is from the top down. He explains: "This enabled us to conduct an inquiry at any point in development, using the actual files and the actual programs as far as we had written the code at that point in time." Baker also notes with the use of struc-

ture programming his team was able to get superior results with practically an error-free operation.

More Satisfaction

Baker concludes: "The results of our efforts for the New York Times are typical of many projects we've worked on since. They show it is possible to reach greater manageability in programming projects by using better technical and organizational standards. Even more important, we are now getting practically unheard-of quality and high productivity in all programming projects, which creates more job satisfaction and less trauma when a job is completed." **IBM**

Forest Simulator...

(Continued from preceding page)

the tree species in one ecosystem, so that hypotheses about the interactions could be made and tested.

Dr. Botkin and others collected the original data at the Hubbard Brook Ecosystem site in the White Mountains of New Hampshire, which contains 13 different species from sugar maple and white birch to mountain ash and red spruce. They then worked up a number of relatively simple equations to represent many of the inter-related conditions which affect the growth rate of a tree—soil quality, climate, topography of the plot and competition from other trees.

These key equations were included in the subroutine, Grow, along with two other subroutines—Birth and Kill. These took into consideration the annual growth increment for each tree, random planting of new saplings and killing off of other species to reflect the cumulative effect of weather, plant succession and competition.

Dr. Wallis notes: "While the present simulator reflects conditions of a forest in New Hampshire, it is especially adaptable to many other ecosystems. This study is really the first of its kind and has already generated a great deal of interest among major lumber companies and ecology groups."

"One of the most interested users to date has been a consortium of western universities called the Coniferous Forest Biome, which is now adapting this model to the entire western region from Alaska to Southern California." He continues: "The beauty of the simulator is it is not only adaptable, but it is also simple and can be run on any small computer." **IBM**



Clippings from the New York Times morgue are entered into an online information bank of news articles and background material.

“Think of the Computer as Energy”

Normally, when people speak of energy, they mean physical energy—the kind man uses to help him extend his capacity for physical work.

The IBM Data Processing Division's new advertising campaign, which began appearing in May in several leading magazines, looks at energy in

a new light. Not as a way of extending man's physical powers, but as a way of increasing the productivity of man's mind by harnessing the power of the computer.

“As mental energy”

Just as the sun, pictured on the left, supplies enormous amounts of physical energy, the computer can provide man with *mental* energy. It can help man to multiply his ability to do mental work by vastly increasing the amount of information he can handle and his speed in handling it.

It is an abundant resource on which he can draw to speed solutions to the problems that confront him—in business, in industry, in science, in every field of human endeavor.

“Power to get things done”

By thinking of the computer as a source of energy, its extraordinary capacity for work is put into a vivid new perspective. **IBM**



Think of the computer as energy. Mental energy. Power to get things done. **IBM**

New Dimensions to Corporate Planning

Financial planning with the help of computers is already very much a part of the Pennzoil Company in Houston.

A financial planning model simulates the generation and movement of money in a corporate structure and expresses this in the form of the familiar financial statements. The forecast is enhanced because it is a synthesis of the plans and expectations of operating managers in all parts of the corporation. In Pennzoil's case this involves, among other things, three large oil and gas producing companies; two major gas transmission companies; refining and marketing operations; and a large mining subsidiary—Duval Corporation.

For other tasks

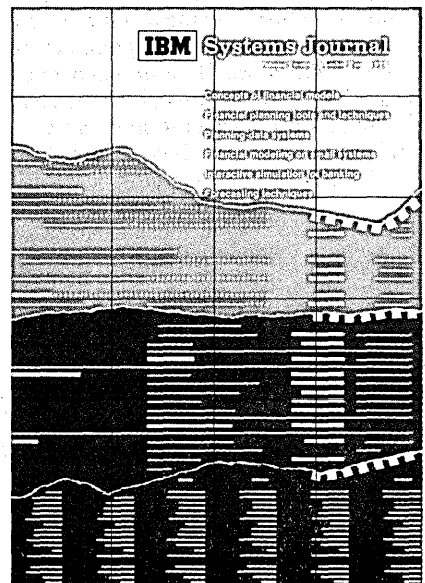
Apart from the obvious function of helping managers with their planning, the model is increasingly being used for other tasks. These include works in such areas as supply/demand balancing, distribution studies and supporting oil and gas exploration efforts.

The computer backing the new model is IBM's System/370, Model 155. It makes use of PSG, IBM's Planning Systems Generator, a program-

ming system to develop the model. Stephen Jennings, the man responsible for implementing the model and coordinating its use, explains: “The financial model is basically an information system dealing with the future. Our goal was to develop a system which would alert management to impending earnings developments in order to provide maximum leadtime for any corrective actions the forecast might indicate to be needed.”

While the model has many advantages, “one of the big ones,” says Henry Meyer, director of management science, “is that it has done away with our annual budget crunch. We now project our budgets on a continuous basis. The model also can be used to study the impact of tax and other considerations on operating plans and investment proposals.”

Meyer feels strongly that the model at Pennzoil “has added a new dimension to our corporate planning. In addition to having on hand a set of quarterly or annual figures which tell what has *already happened*, we have consistent forecasts of what is *going to happen*. It is now our corporate policy to present these forecasts along with our quarterly earnings reports.” **IBM**



To show you how you can use a financial planning model like Pennzoil's, the *IBM Systems Journal*, a quarterly magazine for DP professionals, will devote the entire third quarter issue this year to the subject of financial models. For further information contact your marketing representative or *Systems Journal*, IBM Corporation, Armonk, New York 10504.



Hugh Whyllie and Lou Durden leave Lou's office to start the day's rounds.



Here they talk to a Madison Avenue System/3 customer.

New Symbols of Success for Harlem School Children

Recently Hugh Whyllie donned a jacket and was off for a typical day on the job. His schedule included a visit to one of IBM's sales offices in New York, an appointment with a System/3 customer on Madison Avenue and later lunch with Marketing Representative Lou Durden.

Unlike his working counterparts, Hugh Whyllie is twelve years old and is a sixth grader from Harlem's P.S. 144. He and nearly two hundred other sixth graders and some seventh graders are part of a volunteer program at IBM designed to give Harlem schoolchildren a first-hand impression of blacks in the business world.

The Right Adult Models

The program had its beginnings in 1969 at the Manhattan Christian Reformed Church in Harlem, just around the corner from P.S. 144. Its pastor, James B. White, felt "it was important to find the right kind of adult models for youngsters—black professionals whose working lives are often invisible to them. Too often their symbols of success are not from the business world. They're from the street—the numbers banker, the drug pusher, the illegal operator."

To change all that, Reverend White enlisted the help of a friend, Dave Kreuger, manager of the IBM Informa-

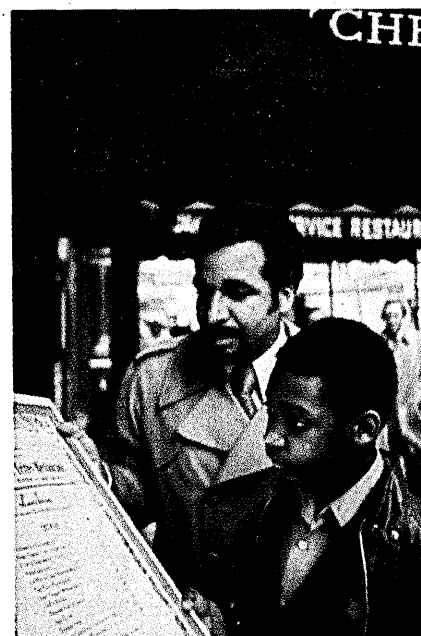
tion Records Division's New York branch. Kreuger then joined forces with Tom Leavey, manager of the Data Processing Division's Manhattan Metro office.

Since its beginnings the program has spread to other IBM branch offices in Manhattan with over 100 IBMers involved, including systems engineers, salesmen and administrators. "What we want to do," says Tom Leavey "is to give these kids a chance to relate to us on a one-to-one basis, to see us as friends. A lot of them have never been out of their own neighborhood, never been in a real business office, never seen a black man or woman in a position of respect and authority in the business community."

Tom's objective is to have each child experience an average day in the life of a branch office salesman or systems engineer. One of these days could vary from calls on existing accounts to sales presentations for prospective customers, a quick sandwich on the run or a leisurely business lunch.

Around Manhattan

On the day Hugh Whyllie spent with Lou Durden, he first had a chance to see the inner workings of the IBM Manhattan Metro office, across the street from Madison Square Garden. The two then hailed a cab for a quick



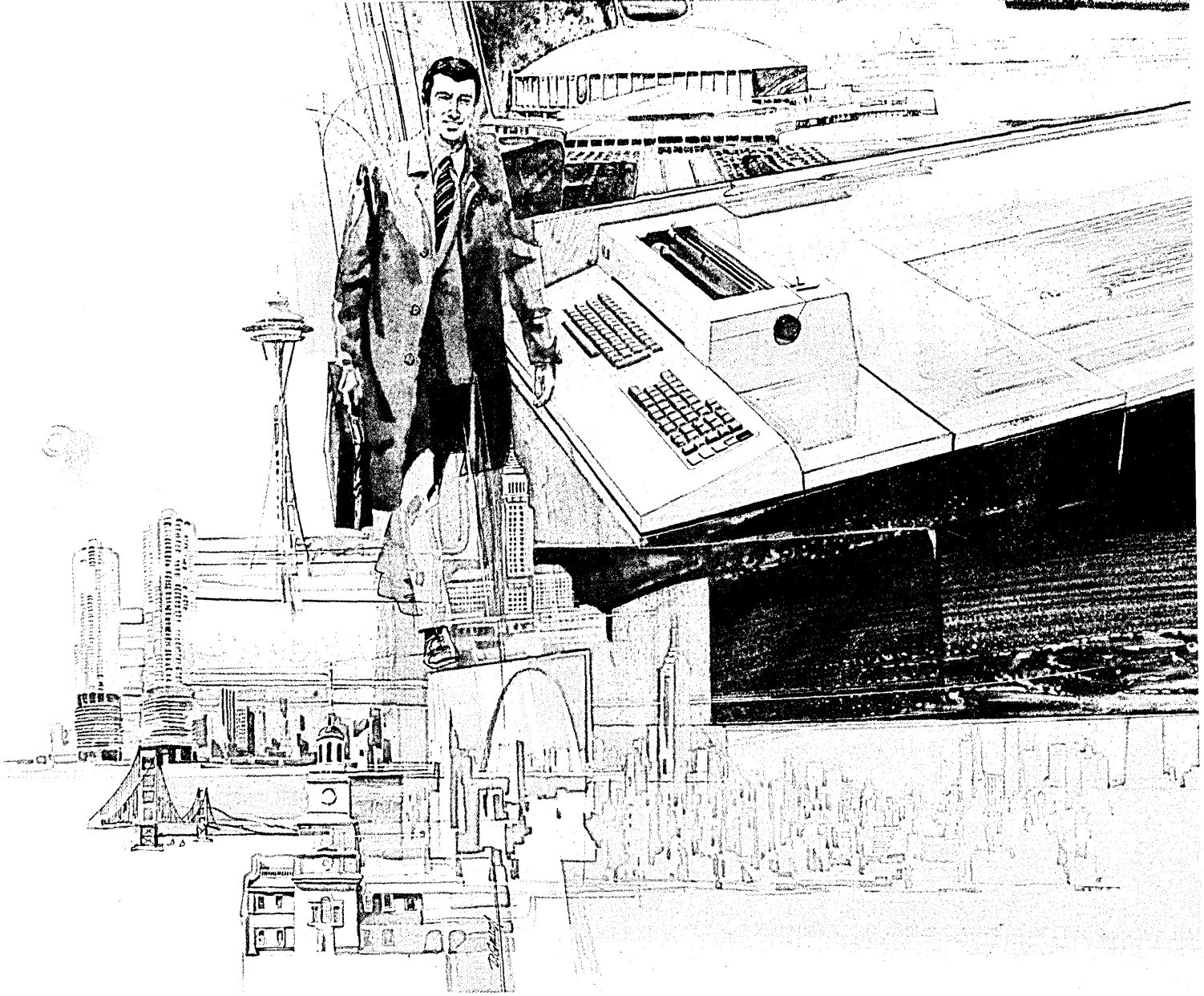
Later, they examine the menu at a nearby restaurant before enjoying lunch.

ride over to Madison Avenue to call on an advertising agency where Hugh had a close look at a System/3. Afterwards they stopped at a nearby French restaurant and then returned to the Metro branch.

Hugh, who has fun with just about everything from fieldtrips to basketball, thinks he might like to work with computers someday but right now he's mainly interested in his friends and school.

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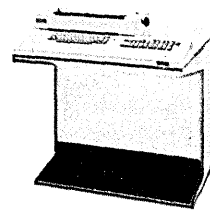
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Everybody's talking about the great things Honeywell's doing for big computer users. And not-so-big users.

Our newly announced Model 6025 system. It offers new technology including MOS memory. It's an easy, economical way for small-scale and medium-scale computer users to enter the large-scale systems environment.

Our other highly successful Series 6000 systems. They're designed for a broad spectrum of business-minded users, and now they're more appealing than ever because of important improvements.

Our recently announced Multics System. It's designed for research, academic, and network-oriented users who need unique security, programming, and centralized data base features.



New Low-Cost Entry to Honeywell Series 6000.

Regardless of the make of your present computer, if you're a small- or medium-scale user who wants expanded capabilities and long-range growth opportunities, Honeywell's new Model 6025 system is big news.

Easy Expansion. The Model 6025 is the new beginning system in Honeywell's Series 6000 family of large-scale computers. It competes aggressively in a lower range of processing capability, while retaining upward-compatibility features for significant future growth capability.

Easy Conversion. Particularly geared to the COBOL user, the 6025 system includes conversion packages for fast field-upgrade from less powerful and competitive systems, and Honeywell's traditional broad system support and training.

Easy-to-Use Software. The 6025 represents an inexpensive first step with Honeywell's General Comprehensive Operating Supervisor (GCOS) Executive System. GCOS is the software that automatically performs all Series 6000 data processing functions. It's widely acknowledged to be one of the best software products in the industry.

Multidimensional Processing. The Model 6025 can acquire multidimensional capabilities by adding a front-end network processor, and grow into a full range of multiprogramming operations. It can handle batch processing, remote job entry time sharing, message switching, and transaction processing, while maintaining constant access to a common data base.

Big Start on a Big Future. The Model 6025 can serve a company's far-flung operations by means of a nationwide or even worldwide communications network. You can achieve economies of scale to help your company stretch its data processing budget today... and for years into the future.

Our Series 6000 Computers. Now they run stronger than ever.

We've also made lots of important improvements in existing models of our large-scale Series 6000 systems—improving still further the multi-dimensional processing capabilities of Series 6000 and GCOS.

New Capabilities for Management of Network Processing

We've developed new software that provides improved control over the computer communications network. It's called Network Processing Supervisor (NPS)—a communications operating system resident in the 6000 system's DATANET 355 front-end network processor.

The DATANET 355 hardware is one of the many things that helps make Series 6000 so powerful. It performs the routine communications jobs associated with network management. Terminal and line control functions are transferred from the main computer to the network processor, thereby conserving the central system

resources, reducing system overhead, increasing reliability and improving system throughput.

Our new NPS software for the DATANET 355 lets the user monitor, analyze and control his network right at the main site—without interfering with the normal system activities. Advanced features include:

1. Statistical recording and reporting to provide current and historical information about network operation.
2. Supervisory control, making it easy to monitor and control the network events when necessary.
3. Complete system and data integrity, with automatic restart/recovery and support of fail-soft configurations.

4. Capability to journalize data for data integrity and information retention.

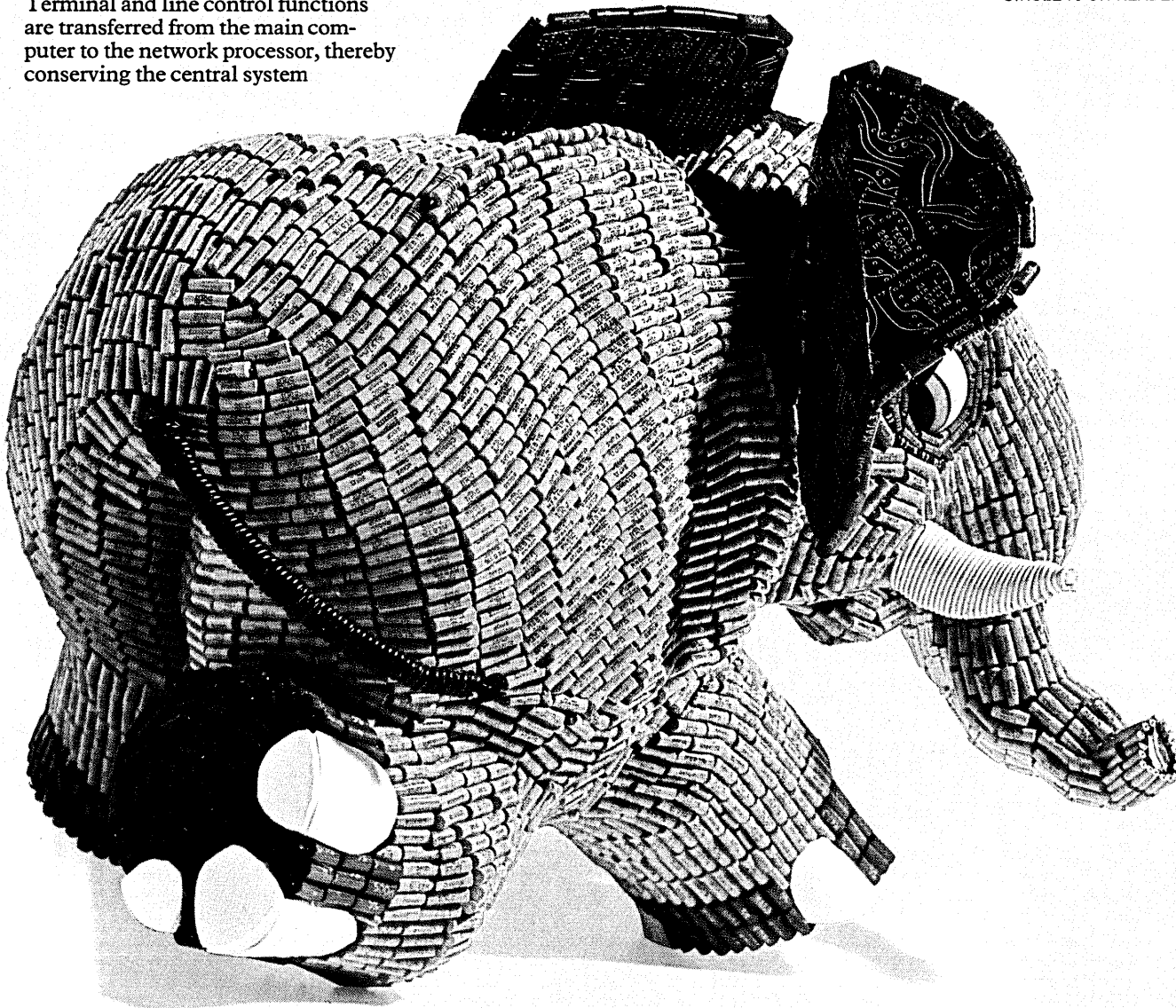
5. Customizing features to meet individual requirements.

6. A flexible and powerful message switching capability for terminal-to-terminal information exchange, completely integrated with the other NPS functions.

Satellite Systems for Regional Locations

Our new remote network processor doubles as a remote batch processor and as a remote message concentrator. You can place one of these satellite systems in each regional center of your computer network to handle local processing rapidly—at a low cost. At the same time, they tie in your regional centers to the central system.

CIRCLE 76 ON READER CARD.



Broader Fail-Soft Capability

We've made the fail-soft capability of the upper range of Series 6000 systems available on the smaller 6030 and 6040 models. Such a fail-soft system has at least two of every system module, all running under the control of a single operating system. Should any module fail, only that module ceases to operate. The system continues to operate, making optimum use of the available modules and still providing all of its multidimensional capabilities.

There are multiple benefits from such a configuration:

1. Total backup for every module within the configuration offers high system reliability.
2. A unique on-line test and diagnostic capability permits removing a module from the system for servicing while the other modules continue to operate, thus greatly improving system availability and up-time.
3. Enlarged multiprogramming and multiprocessing capabilities make possible system performance to match the workload—for better throughput.
4. The price/performance is significantly improved, compared to the cost of two separate systems with the same throughput capability, as only one operating system is required to schedule and govern the entire hardware resource.

Larger Memory Sizes

Expanded memory sizes throughout Series 6000 offer users more latitude for growing applications and services. As many as four million bytes of memory can be used to do more work at the same time. And bulk store capability offers supplementary memory for high-speed data input and output—to strengthen time-sharing and transaction processing performance.

More Peripheral Options

We've added new peripherals (including new types of magnetic tape drives, and a new card reader, card punch and printer) to increase the range of choice for matching input/output requirements with system performance.

GCOS Operating System Enhancements

We've added a number of features (such as the File Management Supervisor) to the GCOS executive system to provide more data security and make data management easier for your staff.



Our Multics System. A great new way to bring the resources of the computer to multiple users.

Honeywell's Multics System represents an innovative concept for generating, controlling and distributing computer power—a concept of computer usage so advanced that it redefines the meaning of time-sharing and interactive processing.

(Multics stands for Multiplexed Information and Computing Service.)

Multics is a unique combination of computer hardware, software, communications and supervisory techniques. We believe it's one of the most powerful and sophisticated systems in the world.

Maximum User Orientation

Honeywell's Multics System incorporates many of the most user-oriented programming and supervisory techniques yet devised. These techniques are available to all users automatically through the Multics operating supervisor. For example, the Multics System provides small amounts of service to small users, and large amounts to large users, within wide limits, on immediate demand, and with maximum efficiency. For billing and control purposes, it keeps track of the amount of service each user receives.

Advanced Virtual Memory

The Multics System offers the most advanced virtual memory capabilities available. Virtual memory was included in the design from the very beginning. The primary purpose of the Multics System virtual memory is to achieve controlled sharing of information among the system's users.

Information is organized into *segments*. A segment may contain programs or data, or may be a directory of segments. Segments and their directories are organized into a single "tree-structured" hierarchy which forms the storage system for users, for administrative and accounting information, and for the software system itself.

The movement of this information from the main memory back and forth to secondary storage is completely automatic. Programs and data are *paged* through main memory. Only the currently active pages are held in main memory, with the Multics System fetching additional pages as required.

Increased Programmer Productivity

Explicit paging and segmentation techniques are automatically applied to the operating system, to all programs, and to data bases within Multics. The laboriously detailed programming typically needed to manage file inputs and outputs to and from memory is thus eliminated. A programmer may extract, revise and reorder at will from existing programs, just as though he were combining photocopies of paragraphs and chapters from a number of different books in a library. And just as in photocopying, the programs are not affected but remain intact and accurate.

Flexible, Easy-to-Use Programming Environment

The system has been implemented in PL/I, which is also one of the user's main programming languages. This lets him interface his application to the system on a module-by-module basis rather than through a single applications/system interface as provided by conventional systems. The use of the PL/I language enforces a modularity and consistency of programming style which makes possible the continuous evolution of software.

Open-Ended Growth Capabilities

The combination of the most powerful virtual memory system available and the advanced hierarchical memory "tree" concept, both of which encompass main and secondary storage, provide the Multics System with an essentially open-ended capability. Huge quantities of symbolically addressable secondary storage can be added to accommodate almost any requirement. Processors and memory can be added or removed from the system without interruption to users. And there is no need to shut down for system update, for accounting or management functions, or for user errors.

Decentralized Administrative Structure

Unique administrative monitoring and control features are used to allocate resources so that even a small user is protected.

Multics defines three distinct levels of administration: system, project and user. The system administrator allocates resources and memory to projects; the project administrator allocates the assigned resources among the users on his project. Each user, in turn, can allocate his assigned resources among other users.

Sharing of Information

Multics permits controlled sharing of programs and data through the use of the access control mechanism. The majority of segments on the system such as compilers, library routines and user procedure segments are pure procedures. Only one copy of them is needed regardless of the number of users who may be executing them. Having only one copy provides that 1) information never loses its identity in a system-wide sense, 2) the out-bound portion of system traffic is reduced, and 3) use of main memory is greatly reduced.

Dynamic, Multiple-Level Security Control

Privacy and security for protected data and files were a primary Multics design consideration, and were implemented into the Multics hardware, resulting in superior security provisions.

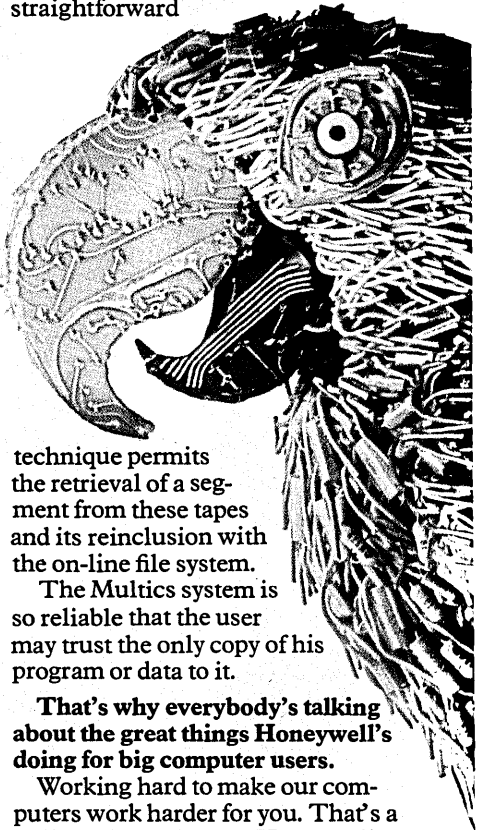
A uniquely effective concentric-ring security structure controls individual user access to selected programs and data—in addition to the more traditional privileges of read, write, and/or execute access.

The user may define the names of persons who may have access to each segment and the type of access they may have. Consequently, access to data may be precisely tailored to the application—rather than being restricted by the system.

The ring protection features, and paging and segmentation techniques provide close to ideal on-line system characteristics for security control.

A Reliable File System

Information which is stored on-line is protected by an incremental backup system. This system copies onto magnetic tapes every segment whose contents have been changed during the backup interval. A straightforward



technique permits the retrieval of a segment from these tapes and its reinclusion with the on-line file system.

The Multics system is so reliable that the user may trust the only copy of his program or data to it.

That's why everybody's talking about the great things Honeywell's doing for big computer users.

Working hard to make our computers work harder for you. That's a philosophy we have at Honeywell.

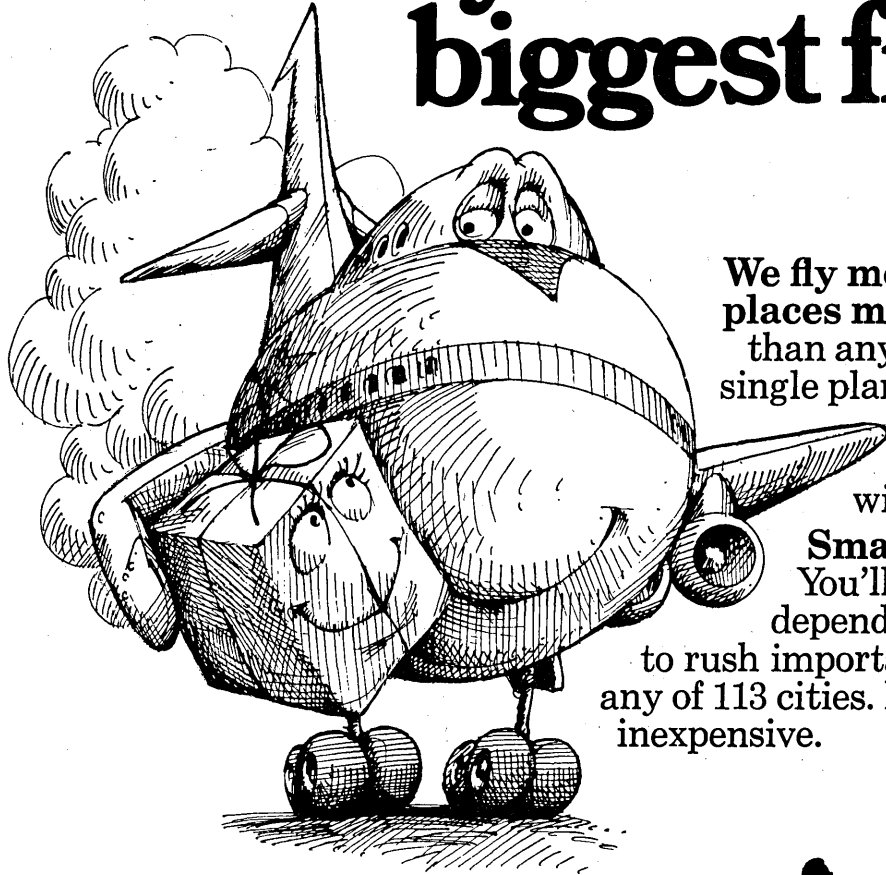
And we've found that philosophy pays off. So far, customers have ordered more than 250 hard-working Series 6000 systems.

If you'd like to see Multics or Series 6000 demonstrated, arrangements can be made through your nearest Honeywell office. Or for more information write: Honeywell Information Systems (MS 061), 200 Smith Street, Waltham, Massachusetts 02154.

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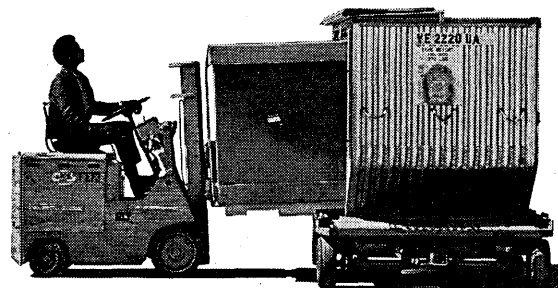
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Now about those people headaches. Like local managers losing control of their data. Like firing trained key operators in one city, only to need new ones in another.

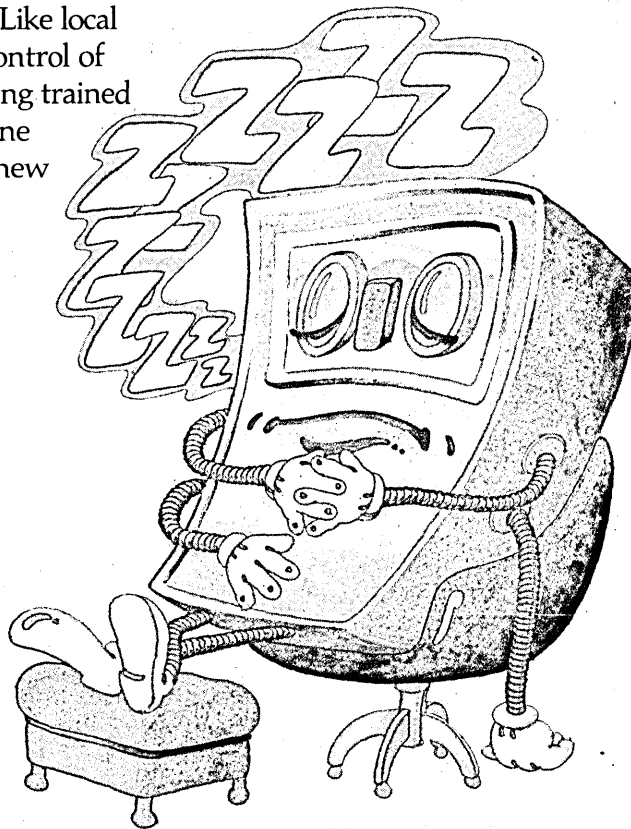
System 2400 is the one communicator that can combine volume data entry through System 2400 key display. What's more, System 2400 can also off-load the mainframe and keep local work local, by combining editing and sorting and printing.

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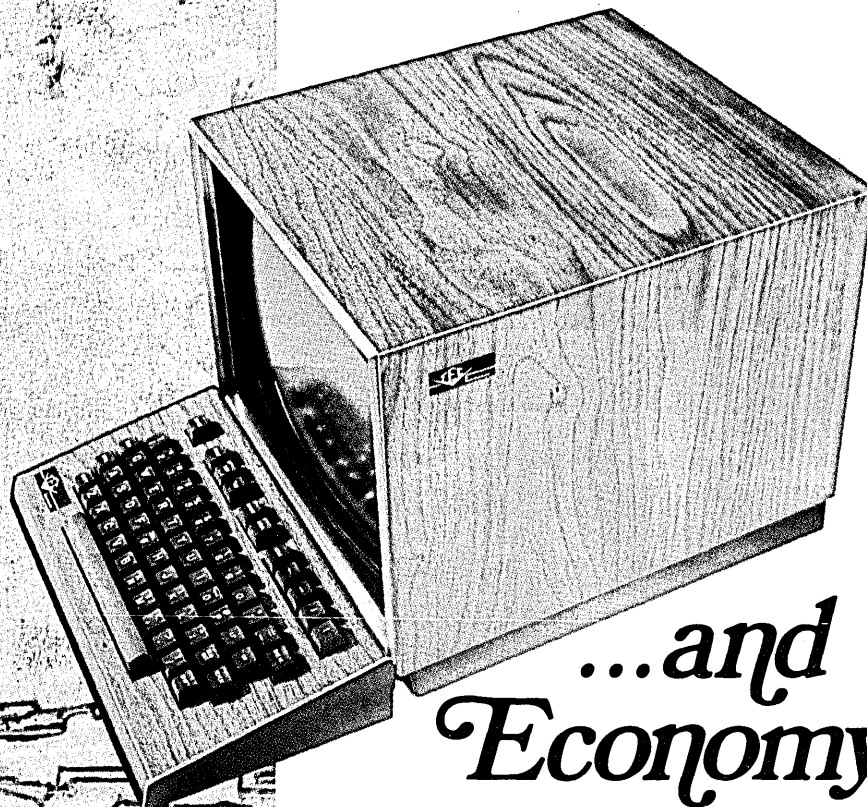


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Since 1963 we've been designing and manufacturing crt terminals called DATA-SCREEN™ Terminals — that's *age* in a young industry.

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- Experience and reliable service. Each Data Center is backed by NCR's more than 85 years business experience.
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Data Centers

August, 1973



Penetrating the private line market and establishing a position

Specialized Communications

"It must be remembered that there is nothing more difficult to plan, more uncertain of success, nor more dangerous to manage than the creation of a new order of things. For the initiator has the enmity of all who would profit by the preservation of the old institutions, and merely lukewarm defenders in those who would gain by the new ones."

—Machiavelli
The Prince (1513)

For nearly ten years, over the strong opposition of the established carriers (AT&T and Western Union), several U.S. companies have taken steps to enter the business of providing private line communications, a business that currently produces over \$1 billion of revenue for AT&T. These companies, known as specialized common carriers (scc), have been attempting to finance and construct microwave radio networks linking major U.S. cities.* As of the time this article was written, only Microwave Communications, Inc. (MCI) and Western Tele-Communications, Inc. (WTCI) were providing customer services—MCI between St. Louis and Chicago, and WTCI between El Paso and Los Angeles. However, six scc's have networks under construction and expect to offer private line services starting this year and next.

*The reader who is interested in a more complete history of the specialized carrier concept and the early plans of the scc's is referred to "Data Transmission in Transition", DATAMATION, October 1, 1971, and "Specialized Common Carriers", Telephone Engineer & Management, October 15, 1971, and "Computer Communication Networks", Prentice Hall, Editors Norman Abramson and Frank Kuo.

During the next two years, the scc's will have to not only penetrate the private line market, but they will also have to establish a position in it. After 1974, they must expect to be faced with strong competition from several new directions: AT&T and Western Union will each be offering end-to-end, all-digital transmission services, which will be very attractive to data communications users; domestic satellite systems will be available, which will probably result in lower prices for long-haul bulk transmission; novel store-and-forward transmission services will be offered by "packet switching" carriers, another service tailored to data communications users; and AT&T and Western Union are expected to revise their tariffs, to be more directly competitive on specific routes.

Without dwelling on history, how successful have the specialized communications common carriers been in penetrating the private line market? What services can data communications planners expect the scc's to offer this year and next, and over what routes? It is the purpose of this article to answer those questions.

Highlights

Two types of specialized carriers plan to operate communications facilities in the U.S.:

- Carriers offering private line service for voice, teleprinter, data and facsimile usage; entrants include the MCI regional affiliates, plus a dozen or more other prospective carriers.
- Carriers offering only switched digi-

1963	MCI filed with FCC for authorization to construct Chicago-St. Louis common-carrier microwave system.
1967	FCC hearing examiner issued Initial Decision approving MCI's application. Established carriers appeal to the full commission.
1969	(August) FCC issued decision granting MCI construction permits. Established carriers petition.
1969	(November) Data Transmission Corporation (Datran) filed application for nationwide common-carrier system designed exclusively for data transmission.
1970	(February—June) 30 more firms filed specialized carrier applications.
1971	(May) FCC, in Docket 18920, gave overall policy approval of the specialized carrier concept.
1971	(July) AT&T and Western Union withdrew their court appeals of the FCC's 1969 MCI decision.
1971	(August) MCI completed construction and system acceptance testing of their Chicago-St. Louis microwave system.

Table 1.—Chronology of specialized carrier concept.

Common Carriers 1973-1974

By Edgar A. Grabhorn

tal transmission services. At present, the only specialized carrier planning to provide this service is Datran; however, RCA, in its application for authorization of a domestic satellite system, also indicated that it might provide common carrier switched digital communication services. Some of the milestones that were

passed by the specialized carriers between 1963 and 1971 are shown in Table 1.

The recent progress of these carriers toward establishing facilities over which the above services can be provided is shown on Fig. 1, and described by region in Table 2. Several aspects become apparent when the scc net-

works that are planned are overlaid:

- The actual 1973-1974 construction will only be a fraction of the facilities that the scc's originally planned.
- Coast-to-coast service from the scc's will not be available until 1974, and then only if MCI achieves its plans.
- The initial scc networks are concentrated in the central states, between

Region	1973	1974
East Coast	MCI: Wash. DC-Phila.-NYC	MCI: Extends network to Hartford-Boston UV: Atlanta to Miami
Chicago-East Corridor	MCI: Chicago-St. Louis link connected to NYC via Detroit, Cleveland, Pittsburgh	MCI: Extends network to Columbus, Dayton, Milwaukee
Central	MCI: Chicago-St. Louis to Dallas via Kansas City and Oklahoma City NCCC: Omaha to: Chicago, Minneapolis-St. Paul, Western Nebraska, and Houston (via Austin, Dallas, Oklahoma City, Kansas City, and St. Louis) UV: St. Louis to Dallas with connections to Kansas City, Oklahoma City, and Tulsa	MCI: Extends network to Milwaukee, Minneapolis-St. Paul, Ft. Worth, Houston Datran: Initial digital network between Houston, Austin, Dallas, Kansas City, St. Louis, Minneapolis-St. Paul, Milwaukee, Chicago SP: Extends network to Houston from West WTCl: Extends network into Nebraska
Central-West	WTCl: El Paso to Los Angeles link	WTCl: Denver to Salt Lake City link MCI: Extends network to West Coast via Phoenix, Tucson. SP: Extends network from Los Angeles to San Diego, Tucson, El Paso and Houston
West Coast	SP: Los Angeles to San Francisco link	WTCl: San Francisco to Seattle link MCI: Los Angeles to San Francisco link

Table 2.—Cities served by SCC's

Common Carriers

Texas and Minnesota; in several cases they parallel each other and serve the same cities.

- The only SCC service in the southeastern U.S. will be the single route of United Video, planned for late 1974.
- The services of Datran, the specialized carrier that is oriented exclusively to data communications, will not be available until 1974, and will

September 1973	November 1973
St. Louis	Washington, D.C.
Chicago	Baltimore
South Bend	Tulsa
Cleveland	Oklahoma City
Toledo	Dallas
Detroit	
Newark	
NYC	
Pittsburgh	
Philadelphia	

February 1974	April 1974
Ft. Worth	Sacramento
Phoenix	San Francisco
Albuquerque	Oakland
Los Angeles	San Jose—Sunnyvale
Kansas City	Akron
	Columbus
	Dayton
	Cincinnati
	Minneapolis—St. Paul
	Houston
	Milwaukee
	New Haven
	Hartford
	Boston

Table 3.

be on a point-to-point (non-switched) basis until 1975 when their initial switch site, in Virginia, is expected to be linked into their network.

Specific service plans of the SCC's

Although the specialized carriers will all provide private line channels, certain features of each of their services will be distinctive—in the way they are packaged and priced. To summarize the specific service plans of the major SCC's, particularly as they relate to data communications:

MCI. The MCI affiliates, operating under the MCI Telecommunications Corporation, have two offerings: (1) inter-city transmission service of raw bandwidth between MCI terminals, where the customer arranges with the local common carrier for the circuit to the MCI terminal, and (2) "4K Plus", end-to-end data transmission service at a variety of bit rates (up to 9600 bps), where the MCI Leasing Company provides equipment as needed. The latter service features MCI-provided line quality monitors and system clock.

MCI expects to be able to provide service to the listed cities by the dates shown in Table 3.

According to MCI's published 4K Plus tariff, they will charge approximately \$1.10 per mile for a single point-to-point voice channel from Chicago

to New York, or Chicago to Dallas. A variety of options are offered (e.g., full-duplex or half-duplex).

Southern Pacific Communications Company. SPCC, the wholly-owned subsidiary of the Southern Pacific Company, will be offering a range of bandwidths, and also plans to provide service on an end-to-end basis. As with the other specialized carriers, SPCC will have to rely to a certain extent on local carrier circuits. However, since Southern Pacific's right-of-way passes through many industrial parks, they may be able to serve many customers using SPCC facilities entirely.

For data communications customers, SPCC is willing to purchase the necessary transmission equipment (such as modems) to provide the end-to-end service.

The price for SPCC service is on a per mile basis, but the price per channel decreases as the customer buys more channels.

As a subsidiary of an established and solvent company, SPCC may have fewer problems in financing network construction than some of the other SCC's, allowing them to proceed as fast as they can in establishing markets for their services.

Datran. Of key importance to the successful development of specialized data communications services is the progress of Datran. Datran's goal of

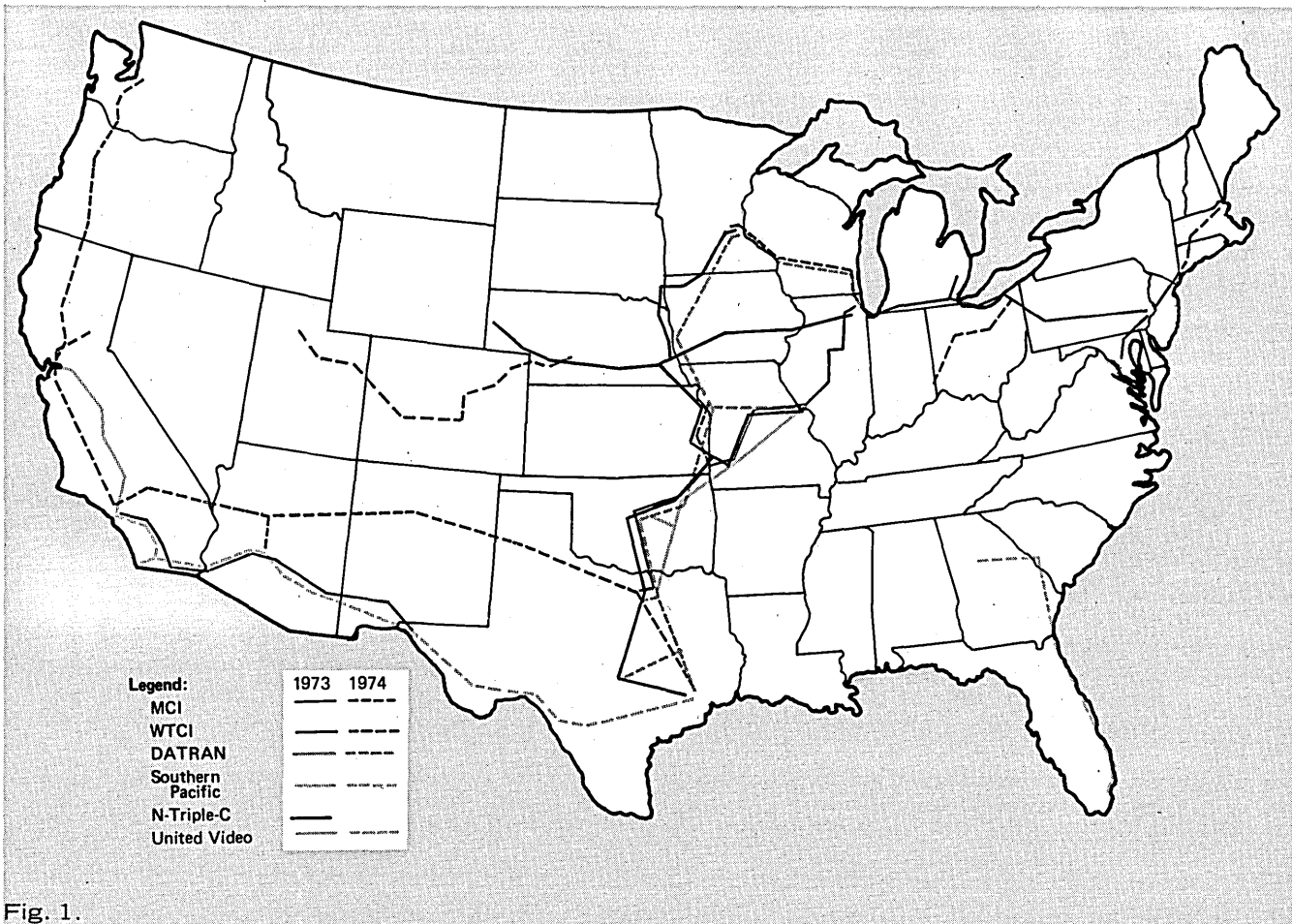


Fig. 1.

creating an all-digital, switched data communications system remains unique among the specialized carriers. However, as mentioned earlier, Datran has been forced to compromise their plans for a nationwide network. Whether they will be able to eventually finance and construct an all-digital, switched network in the face of competition from low-cost, point-to-point private line service, "packet switching" carriers, and the established common carriers' digital systems, remains uncertain.

Looking at the near-term, the links that Datran plans to have operational from Houston to St. Louis in February 1974, and to Chicago by August 1974, will provide the data communication user with point-to-point 4.8 kbps channels in a bi-synch transmission mode, with the standard EIA interface available for 2.4, 4.8, and 9.6 kbps service. The Datran system is designed for high reliability, and fast diagnosis and repair for the few failures they expect with 99.98% uninterrupted service.

Another aspect of change in the Datran network is also significant: Originally, Datran planned to install the local distribution plant for its network, claiming that use of telephone company local loops would in many instances substantially degrade the end-to-end performance of its system.

Now, however, Datran will lease local lines, and will have to employ modems in some cases to bring the user's data transmission into the network.

Datran is proposing "postalized" rates for their services, that is, prices based on usage rather than on distance of transmission. Firm prices will not be announced until Datran nears completion of their first links later this year; however, a price of \$10 per hour for a 4.8 kbps channel appears possible.

Nebraska Consolidated Communications Corporation. N-TRIPLE-C, as the Nebraska Consolidated Communications Corp. is called in its prospectus, has ambitious plans for a midwestern communications network. Successful accomplishment of those plans depends to a large degree on long-term debt financing.

As Fig. 1 shows, by the end of 1973, NCCC expects to have an operational network extending from western Nebraska eastward to Chicago, Minneapolis-St. Paul southward to Houston, and with an extension to St. Louis off of the north-south route. Although construction permits have been filed by NCCC for other links, it would be optimistic to expect that they would be operational in 1974.

It is NCCC's intention to emphasize high-speed data communications (up to 9.6 kbps) and facsimile transmission services, with performance equal

to or better than the Bell System. Since the subscriber's equipment will be connected to the proposed NCCC network through local telephone systems, the above statement of expected performance is understandable. Eventually, NCCC may provide the entire system; however, at this stage of the game their plans are to be system managers, serving the customer as a single point of contact for communications transmission services.

The prices NCCC charges for transmission service is on a per mile basis, but is at a lower per channel price with the purchase of wider capacities. For example, the per mile price for a single 4kHz channel is \$.80 per month (for mileage only) and for 12 channels is about \$.70 per month. For less than 2.4kbps data service, approximate prices are \$.20 per mile for 140 bps or slower, and \$.40 per mile for 300 bps.

United Video. The end-to-end data communications services that will be offered by United Video over their initial St. Louis to Dallas network in September will be voice bandwidth private line channels, or combinations of voice channels, derived from their video transmission (microwave) system. The local communication loop will be either customer-owned or provided by UV through arrangements with the local common carrier.

In transmission they intend to guar-

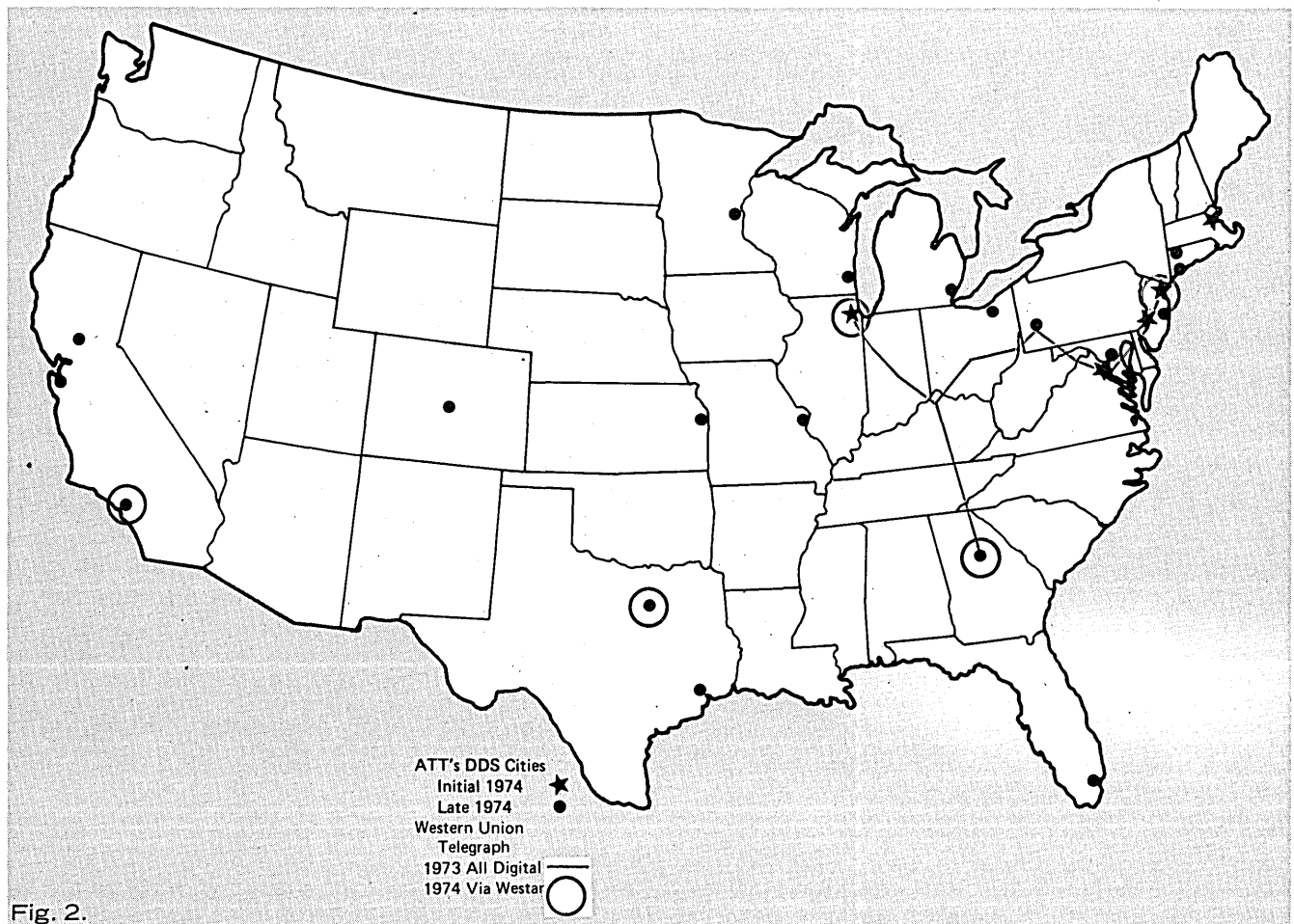


Fig. 2.

Common Carriers

antee performance that equals or exceeds the Bell System's. It will be difficult for UV to better the Bell System's performance if they use telephone company local loops; however, they will be providing extra line testing to assure the best possible continuous operation.

Concerning their tariff, UV's approach is to offer price reductions for long-term contracts. For example, their monthly charge for service from Dallas to St. Louis on a three-year rate is about \$465.

Western Tele-Communications. WTCI's El Paso to Los Angeles link was ready for specialized carrier private line service in July. Local interconnect service for WTCI's specialized carrier operation is provided by the Bell System. They are now providing high-speed data communication service on that route at an error rate better than 1 in 10^7 , at prices somewhat under the AT&T private line tariff.

By mid-1974, WTCI expects to have a private line data capability on their system from Denver to Salt Lake City, and from Denver into Nebraska. They also plan to open for data communications service the link from San Francisco north to Seattle in 1974.

Interconnection of these links may have to be accomplished using telephone company leased lines, since WTCI has no 1974 construction plans beyond those discussed here.

The competition

AT&T and Western Union Telegraph are reacting to the specialized carriers' penetration of the lucrative private line market, both in their tariff structures and in the technology of their networks. To briefly mention the most significant actions to date:

- Western Union has "matched" MCI's rates for the most popular services on the Chicago-St. Louis link. Under the new rates, if determined to be compensatory by the FCC, Western Union could be considered as another specialized carrier.
- In addition to Datacom service—time-division multiplexing of low-speed data channels, which they have expanded to 56 cities since 1971—Western Union is in the process of completing an all-digital transmission system. They have completed the Atlanta to Cincinnati link, and have scheduled for completion in 1973 routes connecting Chicago, New York City and Washington, D.C., as shown in Fig. 2. Since well over half of the traffic carried over Western Union's facilities are digital in nature (telex, telegrams,

and data), the company is firmly committed to a digital approach.

- Although they have not announced their plans in detail, Western Union has a Multipoint Data Service offering in process, involving digital hubbing of synchronous, medium-speed data channels.
- Western Union's interconnected digital system will extend to Dallas, Los Angeles, New York City, Chicago, and Atlanta as a result of the upcoming Westar satellite service in 1974.
- In November 1972, AT&T filed application with the FCC to commence construction of a Digital Data System (DDS). AT&T expects the DDS to reach 24 cities by the end of 1974, as shown in Fig. 2, providing digital transmission on a two-point and multi-point basis—synchronous transmission at 2.4, 4.8, 9.6 and 56 kbps.

The DDS service will be provided at a monthly rate. In some examples of estimated rates, at 2.4 kbps mileage charges will be about \$.50 per mile per month on long-haul routes. Added to transmission costs will be the rental of Data Service Units, and service terminal charges. No doubt, AT&T will react very competitively in pricing the DDS service.

In another competitive response, AT&T has proposed a new private line "high and low density" rate structure under which inter-exchange voice channels will be priced at 85 cents per mile per month on routes between 370 cities. Although the proposed rate reduction has not been approved by the FCC, it probably will be. Thus it will be difficult for the SCC's to maintain price levels at \$1 per mile per month.

AT&T has also filed an application to permit "hybrid service vendors"—such as Bunker Ramo with its stock quotation network—to use AT&T's private line services without the joint use provisions of the tariff applying. Using that same approach, to discourage construction of competitive facilities, AT&T may offer bandwidth to the SCC's at a discount.

Meanwhile, across the border, the Trans-Canada Telephone System has commenced commercial operation of a nationwide digital data system, Dataroute. This is an end-to-end service, from business machine interface to business machine interface, covering a complete range of speeds from 110 bps up to 50 kbps. The local loops and the digital data sets (i.e., modem equivalent) are part of the Dataroute itself.

Dataroute charges are based on the speed of transmission and the time period of the usage transmission (day or night), and are less dependent on distance. Long-haul charges have been

sharply reduced with the Dataroute service. For example, low-speed transmission dropped from \$3500 per month for a 2000-mile circuit to about \$350.

"Value-added" communication services

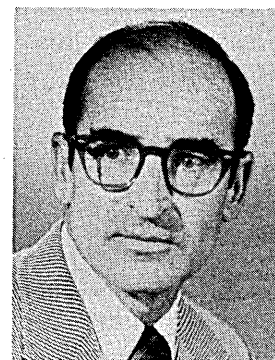
Several companies have either filed application with the FCC, or are planning to file, for authorization to offer communication services using transmission and switching facilities leased from the established carriers, augmented by their own equipment to create end-to-end networks. These new companies have been referred to as "value-added companies", "hybrid service vendors", and "packet-switched carriers." They are proposing to provide nationwide data communication services for initial customers in 1974, and will be in direct competition with the specialized carriers. As evidence that they recognize the fact of competition, MCI has formed a new subsidiary, MCI Data Transfer Corp.

The subject of "value-added" carrier developments will be covered in more detail in a future DATAMATION article.

Conclusion

In summarizing the developments to date, and what they imply for data communications, these points stand out:

- Many SCC transmission facilities will be built over the next two years, although not as many as have been advertised.
- Competition among common carriers will continue to increase, and as a result private line rates will fall.
- Whether or not SCC operations can be profitable in this competitive environment is questionable.
- The overall effect of these developments should be beneficial to communications users. □



Mr. Grabhorn is a senior staff member in the telecommunications group at Arthur D. Little, Inc. He was director of ADL's comprehensive World Telecommunications Study, which analyzes and forecasts worldwide markets, technology and regulatory developments. He is currently performing a similar role on a study of mobile telecommunications. Before joining ADL, he completed 25 years as an officer in the Air Force.

The only certainty is that FCC attorneys will be busy

Trends in Data Communications

by Lynn Hopewell

An increasing number of computers being installed have a communications capability and this interaction of the powerful computer industry with another large industry, telecommunications, has produced dramatic changes in both.

The data communications world is in particular ferment. The past few years have seen major changes in regulatory policy which, compounded with rapid technological changes, make the future difficult to predict.

This article will present a conceptual framework for analysis that will provide the basis for developing some insight into events as they develop. In my opinion, the best a system user or manager can do today is to understand the "environment". This understanding can begin by examining three areas: the growth of systems, the change in technology, and the change in communications regulatory policy.

Growth of computer systems

In 1972, shipments by U.S. computer mainframe manufacturers jumped from over \$7 billion to over \$9 billion, an increase of about 25%.¹ The years 1973 and 1974 will also see rapid growth, with an expected yearly increase of at least 15%.

A great increase is also expected in on-line, remote terminal-oriented computer systems. Fig. 1 shows that the number of general-purpose computers will increase threefold, and the percentage using communications, which has risen from 25% in 1970 to 37% in 1972, is expected to increase to 70% by 1980.² Over a tenfold increase in the number of terminals is expected during

the same time period, growing from 300,000 to 40,000,000.

The total data communications revenue of the common carriers is predicted to grow to over \$5 billion by 1980. The present data communications revenues represent about 3% of a \$25 billion total, and will grow to be about 10% of a \$50 billion 1980 total revenue.

The hardware used in transmitting data on the common carrier facilities are modems, multiplexors, and communications processors; this equipment is expected to comprise a \$4 billion market by 1980. Remote terminal equipment is expected to be about half of the total peripherals market of \$7-8 billion by the same time.

The economic importance of data communications costs to users is indicated by the results of a recent Diebold Group, Inc., study which shows that the average data communications system user spends 50% of his budget on lines, 35% on hardware, and 15% on his staff and overhead. Data communications represents 8% of the total dp budget for the average user, according to the survey.

LSI. The term "large-scale integration" (LSI) is generally reserved for circuits that carry out 100 or more individual functions (100 or more gates), and that are manufactured as a whole, having a density greater than about 50,000 components to the square inch. When the term "microelectronics" was first used, a chip of silicon one-tenth of an inch square might have held about 10 transistors, along with many resistors, diodes and capacitors. Now such chips can contain over 4,000 transistors.

The significance of cheap, reliable, mass-produced logic circuitry is twofold. First, it has affected data processing technology. Second, in telecommunications, the transmission and switching of signals can be done in a digital rather than an analog fashion. Because inexpensive and reliable logic circuitry is available, the telecommunications industry is rethinking its use of multiplexors, concentrators, repeaters, switching offices, storage and processing of signals. In the years ahead, we will see an increasing commonality of computer technology and telecommunications technology.

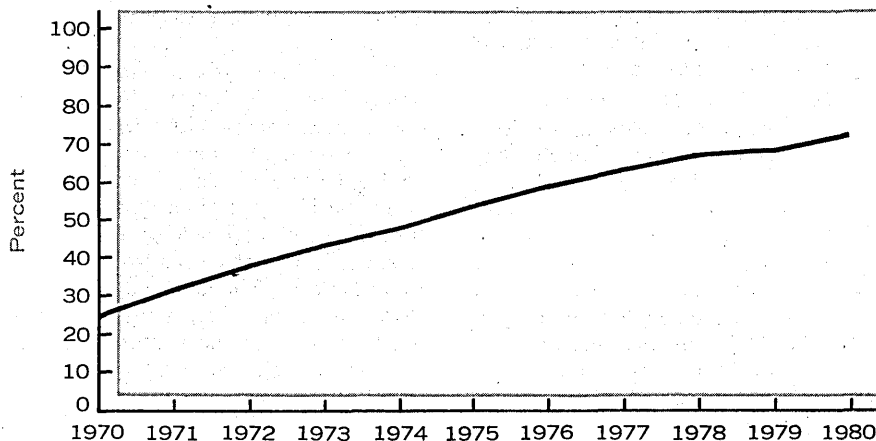


Fig. 1. Percentage of computers with terminals.

¹ *Computerworld*, Jan. 10, 1973.

² Unless otherwise noted, all hardware market projections are from "The Data Communications Market: Modems, Multiplexors, and Communications Processors," a Frost & Sullivan, Inc., survey.

Trends

The cost of digital circuitry, in terms of millions of computer instructions executed per dollar, is decreasing. This relates only to the cost of logic circuits, not to costs such as programming, I/O devices, or printers. In 1955, about 100,000 program instructions could be executed for one dollar. In 1960, the same dollar bought one million . . . and by 1970, it bought 100 million.

Memory. Within a few years, LSI will make possible core memory at 2¢/bit, with higher performance. Fig. 2³ shows a forecast of random-access mass storage with average access times of tens of milliseconds.

The effects of digital technology will be dramatic at the system component level. The following is a brief look at trends for major data communications system components.

Central processor. Fig. 3⁴ is a forecast of the cost of central processors with basic memory for the '70s. Large computers, costing today about \$1 million, will drop in price by a factor of 10. Smaller computers will decline by a factor of about five. For example, a minimum 4K memory minicomputer costing today about \$4K, will drop to about \$800. (Computer Automation, Inc., has announced a 4096-word "computer on a card" which is supposed to sell for \$990 in quantities of 200.) The greatest impact on data communications will probably come from the minicomputer as it makes its ubiquitous appearance in concentrators, front-ends and intelligent terminals.

Modems. The number of modems in service is expected to increase by a factor of 10 during the '70s, reaching about 4.8 million units. However, a growth in numbers will not be matched by a corresponding growth in the dollar market. This is because the modem market is one of the first to begin to show the economic consequences of declining component prices and competition. Since the Carterfone decision, the modem market has been entered by firms attempting to exploit the cost gap between what was economically feasible and what AT&T typically charged for modems. The 15 leading firms have captured about 90% of the independent market, and the remaining 80 or so firms are fighting for the remaining few million dollars.

Price erosion has been furthered by the purchase of large quantities and the resulting competitive procure-

ments. The large quantities have resulted in \$400 unit prices for modems that list at \$1,200.

Finally, AT&T is meeting the challenge of the independents. Recently, AT&T announced the 208A data set at about \$100, a price considerably less than independents in a speed range where the independents felt most secure. Even Milgo was forced to cut its prices at 4800 bps by as much as 17% on sales and 50% on leases.

In 1975 and beyond, low-speed modems are expected to sell for \$50, medium-speed modems for \$400, and the high-speed units for \$600. At these prices, they will probably be integrated into terminal hardware at an even lower oem cost, especially since manufacturers could not afford to offer separate modem service at such low prices.

Multiplexors. In comparison to modems, multiplexors have exhibited greater price stability. Multiplexors are more complicated devices and market entry is not as easy. This has contributed to the stability of prices. On a cost-per-channel basis, average prices per channel end are presently in the \$250-300 range.

Trends in multiplexors are to incorporate more diagnostic and control features with no cost increases. The resulting lowering of profit margins will probably eliminate smaller producers. A much greater threat to the multiplexor market is the increasing use of minicomputers as data concentrators. Multiplexors, although lowering per-channel costs, still allocate a fixed channel to an information source, even if the channel is inefficiently used (such as in time-sharing applications where channel occupancy may be only 2%). Concentrators take advantage of the statistical nature of data traffic, and usually can effectively connect many more terminals to a cpu than multiplexing. As minicomputer prices fall, the multiplexor market will become increasingly vulnerable.

Telecommunications technology

Telecommunications costs⁵ divide into four areas:

1. Long-distance transmission: the carrying of signals between offices.
2. Switching.
3. Local loops: the cables between the subscriber terminal and his local switching office.
4. Terminals.

In the Bell system, these costs break down as follows:

Long-distance transmission	17%
Switching	45%
Local loops	15%
Terminals	23%

New technology is changing these costs. The fastest change is in long-distance transmission. The capacity of such systems is increasing greatly without a proportionate increase in cost. The investment cost of adding a circuit mile to the high density routes in the Bell system now averages \$11, and this figure is expected to drop to \$1.50 by 1979. Low density route costs are as much as four times higher. Other estimates suggest that the long-distance bandwidth of new facilities will drop to one-tenth of its present cost in the next ten years.

The other costs are not dropping as fast. The largest portion of the telephone cost is that of switching, which contributes 45% of the cost of an average telephone call; the figure is 54% for long-distance calls. Only 28% of the cost of an average call is in the switching equipment; the remainder is in operator salaries. The key to switching economy lies in computers. If used fully, they can reduce the cost in operator salaries. Computers are beginning to replace electromechanical telephone exchanges. The cost of computer circuitry is decreasing, and its maintenance costs will be much lower than those of the vast array of electromechanical switches. Unfortunately, electromechanical exchanges presently rep-

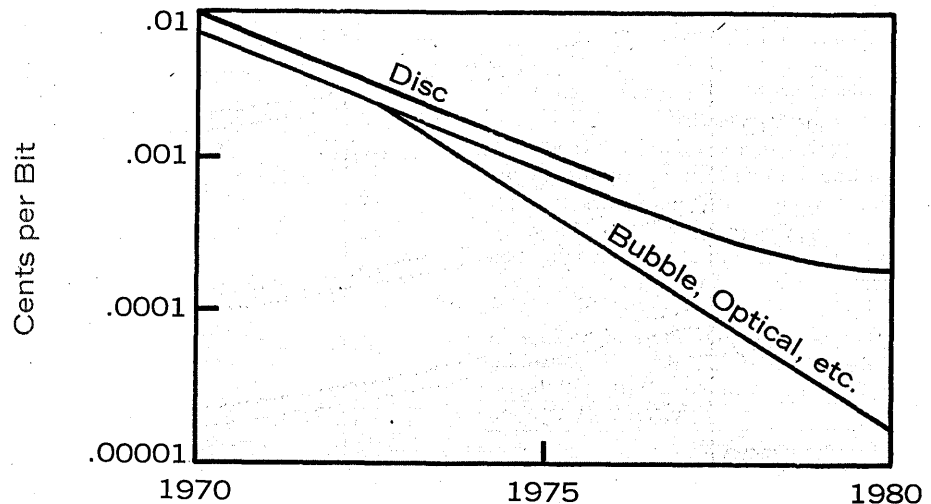


Fig. 2. Cost of mass storage.

³ Withington, F. G., "The Next (and Last?) Generation," DATAMATION, May, 1972, p. 71.

⁴ Ibid.

⁵ Martin, J., *Future Developments in Telecommunications*, Prentice-Hall, Inc., N.J.

resent billions of dollars of investment and, consequently, will not be replaced quickly. The Bell system, however, estimates that it will be installing computerized exchanges at the rate of one per day by the mid-'70s.

The local loops in the telephone network are unlikely to come down much in cost, although the use of concentrators may drop their cost somewhat.

Telecommunications market

Between October 1970 and October 1971, AT&T's estimate of its 1980 data communications revenue was increased from \$2 billion to \$5 billion. When this change was announced by H. I. Romnes, then president and chairman of the board, AT&T's concern with the market was reflected in other information released in the same statement. It also announced accelerated implementation of a planned nationwide digital-data network and development of the "data-under-voice" techniques to increase the data transmission capability of Bell's existing long-haul facilities.

If, as is stated in other AT&T analyses of data communications activity, only about 3-5% of transmission time on the Bell network is devoted to data, why should this part of their expanding market be getting so much attention? A variety of answers are available, from AT&T and from other organizations that aspire to compete with the Bell system in providing specialized common-carrier services.

One obvious answer is that the data communications market is expected to grow at a faster rate than the general average of communications activity. An AT&T estimate predicts that the size of the data market, relative to its total business, may increase fourfold by 1980.

The real answer, however, is that the data communications market has posed a threat to the established conduct of the communications industry.

The potential of this market was large enough to justify the effort for other suppliers of communications services to try to compete with the established monopolies in limited areas. Whatever the merits of competition might be in the long run, this development would complicate life in the communication common-carrier business. A defense, then, was to speed up the availability of data communications services from the Bell system, thus making it more difficult for an aspiring common carrier to propose a service sufficiently unique to justify the granting of a license, or of gaining an economically viable market share.

In any event, it is clear that the FCC decisions to allow interconnection of foreign devices, via the Carterfone decision, and to allow competition by specialized common carriers has been a stimulus to AT&T's innovative efforts, as predicted by the FCC.

The specialized common carriers

The growing interdependence between the unregulated computer industry and the regulated telecommunications industry has created great pressure for fundamental changes in public policy. The pressure has increased because of the growing gap between what is being provided and what could be provided in the way of services which would use both computers and communications. The appearance of the specialized common carriers signifies the beginning of a major shift in regulatory policy focus from a monopoly firm in a closed market approach to competitive firms in an open market.

The specialized common carrier scene is now crowded with organizations seeking to enter the new markets opened up by changes in regulatory policy. However, it is possible to identify several issues which, when resolved, will significantly affect the user community.

A question on every user's mind is:

how successful will the new common carriers be? Will they allow me to achieve lower communications costs?

AT&T's announcement of new "high-low" private line tariffs to obtain a rate structure that "has a more direct relation to costs" immediately created the situation of the specialized common carrier pot calling the AT&T kettle black. The specialized common carriers have reacted to Bell's attempt to remain competitive with the same repertoire of protective arguments that they earlier accused AT&T of using.

However, the FCC has said that it will allow Bell to compete on an equal basis. This presumably means that selective pricing on a route basis will be allowed. But this will open the enormous regulatory problem of insuring that Bell does not cross-subsidize its data communications service by underpricing. Given the complexity of determining such cost allocation, it is safe to predict upcoming battles over the tariff question.

Some observers believe that the FCC's denial of permission for AT&T to even file the new private line tariffs are evidence that the FCC is attempting to shelter as long as possible the new fledgling competitors. This unprecedented move is being contested by AT&T in court.

This author is pessimistic about the long-term survival of the specialized common carriers as long as they attempt to compete "head-on" with AT&T in the area of basic transmission services . . . or, if they do survive, of their ever being a dominate market force. With the enormous resources and economies of scale in manufacturing and facilities, AT&T will surely dominate the transmission market. In the long run, only mergers or some other type of consolidation will enable the MCI's and Datrans to efficiently compete in this area.

It is clear, however, that competition is forcing a pricing strategy that will result in private line rates more reflective of actual costs.

Another issue which is likely to have a more important impact on the long-run structure of the computer-communications industry is impact of the "hybrid" or "value-added" carriers. These organizations have chosen a strategy of not competing with AT&T in areas of its major strength, e.g., transmission, but have instead attempted innovation in an area where natural economies of scale do not already exist, e.g., specialized switching. Packet Communications, Inc., the first firm filing to offer a value-added service proposes to use the specialized "packet" switching techniques originally developed by the Advanced Research Projects Agency (ARPA) for its computer resource sharing network, AR-

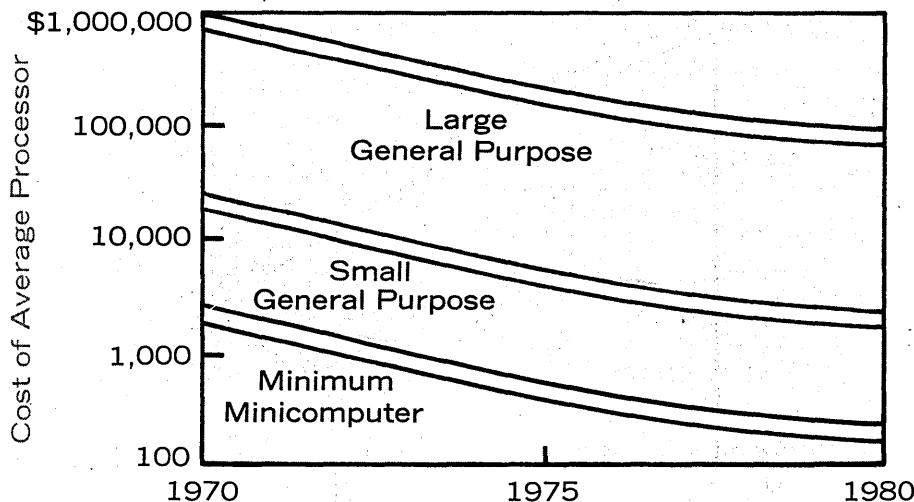
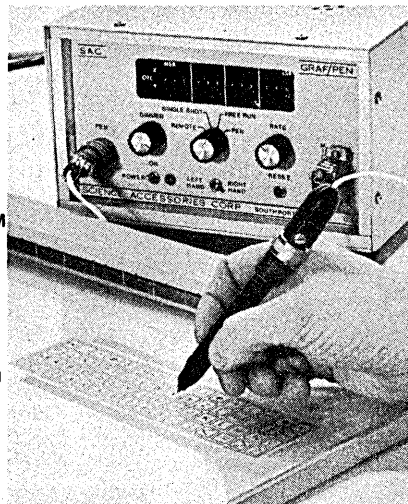


Fig. 3. Cost of central processors.

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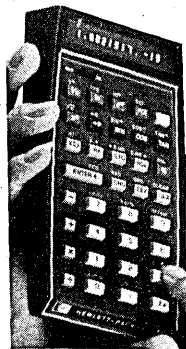
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Trends

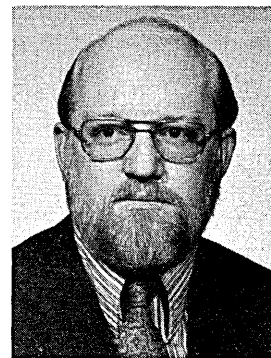
PANET. One value-added applicant, Graphnet, has proposed a network specializing in facsimile services. To accommodate the value-added approach AT&T has seen the handwriting on the wall and has proposed liberalizing the sharing provisions of its tariffs, which may eventually lead to almost unrestricted opportunities to share AT&T's basic transmission facilities.

The ability of imaginative entrepreneurs to freely mold basic communications transmission facilities with computer technology will open the door to a whole new world of specialized services.

Summary

High communications costs have been a major barrier to the development of networks. However, the falling price of transmission, modems, multiplexors, concentrators, and front-ends are making it increasingly possible to reduce communications costs so that national networks become feasible. The resurgence of the remote computing industry has been due largely to their ability to consolidate the communications requirements of firms who need geographically extended computing systems, but who, individually, could not afford the high costs of a nationwide communications network.

The message, then, is that systems designers should test the sensitivity of their architecture to changes in hardware and communications costs. I, personally, would be wary of any procurement which exploited an existing tariff, i.e., independent modems, unless a rather short payback period resulted. Any organization with a large continuing investment in on-line systems would be well advised to stay on top of these developing trends. About the only certainty in the future is that the opportunities for FCC regulatory attorneys and data communications consultants will be plentiful. □



Mr. Hopewell is vice president of Network Analysis Corp., a Glen Cove, N.Y. consulting and R&D firm specializing in computer communications systems. He has a BS from Virginia Polytechnic Institute, and an MBA from Harvard.



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Problems and Promises of Regional Computing

by James C. Emery

Like educational institutions in several other geographical areas, a number of colleges and universities in the Delaware Valley have banded together to form a regional computer facility. The Univ. of Pennsylvania now obtains much of its computing services from a not-for-profit organization named UNICOLL. After nearly a year's experience we are now in a good position to assess the problems and promises of regional computing.

UNICOLL was formed in the summer of 1972 from the computer center of the Univ. of Pennsylvania. Prior to this, the university had pursued a conventional approach to computing. Most academic computing was obtained from a university-run computing center. A separate center was operated for administrative data processing, and several research facilities had their own computers. We had gone through several successive upgradings of machines. Each new machine brought a significant increase in capac-

ity to meet a growing demand; it also brought higher and higher budgets.

In the mid-sixties the main academic center began to perform an increasing amount of work for non-Penn users at nearby colleges and universities. These users were charged at the same rates levied against internal users. This arrangement offered useful services to the other institutions and provided incremental funds to support the center. In the early seventies we began to explore ways in which we could expand the concept of shared computer facilities.

The motivation for such sharing was primarily the desire to gain greater economies of scale in hardware, software, and operations. It was felt that a regional center, operated by professional managers with clear-cut revenue and cost goals, would provide cost-effective computing that could not be matched by each institution's own facility. By separating the center from the control of any single institution, each school would be encouraged to divert an increasing share of its computing dollars to a powerful computer utility. Each institution could then concentrate on the effective use of computers in educational programs and administrative applications, rather than getting caught up in the day-to-day problems of running a computer center.

In several ways the operation of UNICOLL has met our expectations. The new organization has encouraged increased professionalism and attention to good business practice. The accounting for costs and revenues has become much more explicit than it was before.

We were not, of course, naive enough to think that the new organization would solve all problems of providing computer services. We were therefore not surprised to find some difficulties in moving toward shared computer facilities. It might be useful to describe some of the problems we encountered, since they are probably common to most such regional centers.

Cooperation among independent organizations. Perhaps the central difficulty stems from the very nature of the relationship that exists between UNICOLL and its institutional members. Each is a separate organization with its own goals. It is naturally the goal of each user to get high quality services at as low a price as possible (or, alternatively, get the best possible level of services at a given level of expenditure). UNICOLL, on the other hand, must concern itself with its financial stability, the avoidance of unessential costs, and increasing its revenue. Some conflicts between supplier and user inevitably arise, at least in the short run. For example, a change that

This article is based on a paper given at the second EDUCOM workshop on computer networks and the author notes that the opinions expressed are his own and not necessarily those of the Univ. of Pennsylvania. The article will also appear in a book scheduled to be published by the M. I. T. Press in October 1973. The title will be *Networks for Research and Education: Sharing Computer and Information Resources Nationwide*. The content will cover the series of three general working seminars conducted by EDUCOM in November, December 1972, January 1973, and September 1973.

Regional Computing

improves efficiency for users may lower revenue for UNI-COLL.

Pricing. The setting of prices for computational services raises an obvious potential conflict. The intent of UNI-COLL management was to set prices so that the average job would be charged the same on the present IBM 370/165 as was charged on Penn's previous computer, a 360/75. Thus, none of the technological advance from the 360/75 to the 370/165—a reduction in cost per calculation by at least a factor of two—was made available to users in the form of cost reductions (although benefits in the form of faster turnaround have certainly been passed on to users). In fact, some jobs now cost more than before because they have special characteristics that do not take advantage of new 370/165 features. UNI-COLL has not yet reached the financial break-even point, and so its management feels that it cannot afford to lower prices. Many users, on the other hand, feel that lower prices would encourage a sufficient growth in use to offset the reduction in rates. In the absence of any hard evidence to support the case for lower prices, the view of UNI-COLL management has prevailed.

Use of idle capacity. A problem that plagues all computer centers, but especially those that exist as independent cost and revenue centers, is the question of marginal pricing of unused capacity. The replacement of the 360/75 by the 370/165 resulted in an increase in capacity by a factor of almost three. Demand has not grown nearly to this extent, and so we find ourselves with a machine having considerable unused capacity. At the same time, we have a number of worthwhile applications that could use this available capacity—but not at full average cost. Everyone would be better off if somehow we could use this capacity at a price something modestly in excess of marginal cost. So far we have not found a way to get around accounting conventions, government regulations, and UNI-COLL's reluctance to disturb its revenue base.

Commitment to UNI-COLL. Still another common problem to be resolved is the extent to which each participating institution should be committed to support UNI-COLL. In order to gain economies of scale for all institutions, it is desirable that each member funnel most of its computing funds into a single large facility. On the other hand, individual schools or faculty members may find it advantageous to meet their particular needs through

services other than UNI-COLL. The trick is to establish services and set prices so that individual users will be motivated to behave in a way that enhances the interests of the community as a whole. UNI-COLL, like most other computer centers, has not yet solved this problem.

Gaining agreement among many organizations. Each participating institution, as well as UNI-COLL, has its own set of objectives. These tend to differ somewhat. Differences ultimately come down to the question of which services should be offered, what price should be charged, and what priorities should be assigned to alternative uses of resources. Conflicts can arise regarding the relative importance to assign to academic versus administrative computing, interactive versus batch processing, large jobs with setups versus short jobs without setups, sophisticated versus neophyte users, and low prices versus extended services. These problems certainly exist within a single organization, but they tend to compound when a common facility serves a variety of institutions. It is often difficult to obtain a consensus on an important issue, and so UNI-COLL may be forced to make a decision that satisfies no one completely.

Some problems have been experienced in deciding which services should be offered by UNI-COLL and which should be provided by the separate institutions themselves. For example, the operation of remote terminals, the provision of consulting services, or the technical evaluation of alternative terminal and communications configurations could either be centralized at UNI-COLL or decentralized to the individual institution. Even after a year's experience we have not fully resolved these questions.

Problems of transition. Finally, transitional problems always arise when institutions attempt to change their mode of operation. The intent in establishing UNI-COLL was to get most of the colleges and universities in the area to use UNI-COLL as their primary source of large-scale computing power. This has not happened to the extent hoped. Penn continues to provide well over half of UNI-COLL's revenue, and no institution has made a major reallocation of its computing funds from its own facility to UNI-COLL.

There are nearly always technical problems in moving from one machine and operating system to another, even when the facilities are quite similar. Furthermore, the very persons who must be relied upon to implement the change often see the transition as impacting them unfavorably by threatening to reduce the control they exercise over their own computer. They can almost always delay the move by argu-

ing against it on technical or operational grounds. Even the simplest move, with the best will on the part of everyone concerned, is never painless; under less than ideal circumstances, grounds always exist for an institution to drag its feet in converting to a shared resource.

With hindsight, at least, it appears that the large increase in capacity that was installed in anticipation of fairly rapid growth is, for the time being, in excess of our combined requirements. Costs have thus been higher than justified by revenues, and so users have not been able to enjoy the full fruits of either technological advance or economies of scale.

Future of regional computing

The problems that we have experienced are not unique; they are probably common to any new regional center trying to evolve toward a shared facility that serves a wide variety of users. There is little doubt that the concept of regional computing is firmly established in the Delaware Valley. The task that faces us is to determine the best means of sharing common facilities and providing responsive services to users. Based on our recent experience a pattern of regional sharing begins to emerge.

Hierarchical network. It appears to me that we will evolve toward a hierarchical computing network. At the bottom of the hierarchy will be specialized computers and intelligent terminals serving each of the separate institutions. These local computers will provide specialized services such as interactive computing for the small user who does not need the powerful resources of the centralized computer. They can also serve as communications concentrators for local keyboard terminals, provide remote access to the batch processing capabilities of the central computer, and handle on-line monitoring functions at the local level. The simplifications and economies of specialization offered by minicomputers often far outweigh any lost opportunities for economies of scale brought about by the diversion of resources from the regional center.

At the intermediate level in the network hierarchy will lie the regional facility. Primary emphasis should be placed on achieving great economy and effectiveness in handling batch processing jobs. The regional center can also provide services to the relatively small population of users who require—and can pay for—the powerful hardware and software resources that can only be made economically available on a shared facility. Since many of the small specialized jobs will be handled locally and never reach the regional center, the central computer

need not divert much of its attention from its primary purpose of providing a powerful generalized system. By combining the requirements for such a capability over the entire region, significant economies of scale can be realized.

At the top of the hierarchy will stand a national computing network. It will be especially useful in providing specialized hardware and software services that provide substantial economies of scale. For example, one of the computers on the network might be specially designed to handle very large matrix manipulation problems. The fact that the computer can draw from the entire national market for this service permits it to exploit economies of scale; the fact that it is tailored for matrix manipulation provides economies of specialization.

Ideally, the hierarchical nature of the computer network should be largely transparent to users. It should be simple for a user to transfer a job from one level in the hierarchy to another; this could even be done automatically in some cases. A program might thus be developed locally on an interactive terminal, and later transferred to the regional center for routine batch processing.

Distribution of operating functions. The assignment of functions will follow a hierarchical structure similar to the hardware. Each institution will provide local services that fall within its field of expertise. The operation of the local terminals and minicomputers, the provision of consulting services at a relatively elementary level, and the determination of the local hardware and communications requirements will largely be administered by the individual institutions. In this way these services can remain responsive to local needs. Decentralization also allows each institution to make decisions that recognize its own set of objectives and priorities without having to coordinate closely with all the other regional institutions. In general, the bias should be in favor of handling a function at the local level unless a strong case can be made for handling it at the regional or national level.

The case for regional sharing can be made for a detailed service not specific to a given institution and not economical to support at each separate institution. Expertise in systems software is better provided at the regional center than at any of the individual institutions. Other examples of functions that should be provided primarily at the regional level are the evaluation and programming of generalized software, consulting assistance in hardware evaluation and selection, and consulting services for the smaller institutions that cannot justify maintenance of their

own professional staff. Ideally, the regional center should provide a common link to any external suppliers (including the national network), thus presenting local users with a single source for all services.

Price structure. The pricing of computational services is extraordinarily complex. The intent of any rational pricing scheme is to allocate available resources in a way that leads to the greatest overall efficiency. To the extent possible, users' behavior should be motivated by the pricing mechanism rather than by artificial constraints (such as forcing them to spend their computational dollars on internal services).

A number of principles should govern the establishment of the price structure:

1. Users should pay for the individual resources they employ (cpu, primary memory, auxiliary storage, I/O channels, specialized software packages, consulting service, etc.).

2. Rates for each resource should vary depending on the level of service the user requires and is willing to pay for. For example, a user wanting ten-minute turnaround should pay more than someone willing to accept overnight turnaround (or even totally interruptible service, with no guaranteed turnaround).

3. Prices should be set to motivate users to impose a relatively even load on the system—for example, by charging less for off-peak use and by charging a disproportionately high rate for a large program that seriously impacts other users during peak periods.

4. Prices should reflect true economic costs, so that one class of user does

not subsidize other users. Thus, for example, a specialized software package should be charged on the basis of use rather than being added to general overhead.

5. Users with specialized needs (e.g., elementary BASIC or very large compute-bound FORTRAN calculations) should not pay the full price of systems generality (e.g., consulting services, an extensive program library, etc.).

6. If the incremental cost of providing a service exceeds the cost of a similar service offered by an external supplier (including a consideration of reliability and continuity), the service should not be offered internally.

7. Prices should reflect any risk-taking transferred to users. For example, if an institution guarantees to provide a given level of revenue to the regional center, it should receive lower prices (or additional services) for bearing the resulting financial risk.

8. Users should be kept informed of prices and levels of service so that they can make intelligent tradeoff decisions (e.g., between price and turnaround time).

9. Prices should remain relatively stable over time, perhaps being adjusted every six to twelve months to reflect changes in demand or technology.

10. Prices should reward efficient use of a shared resource. For example, a user who supplies accurate predictions of resource requirements (cpu and channel time, say) should be rewarded, since this allows the job scheduling algorithm to achieve greater efficiency in a multiprogramming environment.



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11. Each institution should be permitted to set the prices charged to its own internal users, irrespective of the rates paid to the supplier. Thus, a local institution may add a "retail" markup on services obtained in bulk from the regional center; by this means it can defray the cost of providing local support services. In some cases a mark-down may be made in order to motivate users to take advantage of bulk capacity obtained under a revenue guarantee to the regional center.

No one has developed a pricing scheme that best meets all of these criteria. It is clear, however, that any satisfactory scheme is bound to be complex. A great deal of research needs to be done on this topic, particularly in dealing with the special characteristics of network pricing.

Financial commitment of users. Closely related to the pricing issue is the question of the financial commitment each user has with the regional center. Any contractual arrangement between user and regional center should recognize the following considerations:

1. Costs are almost completely fixed in the very short run, but become variable after the expiration of an appropriate lead time associated with a given form of capacity adjustment. For example, changing shift schedules of computer operators can be done weekly, while making a major adjustment in the hardware might take a year or more.

2. Computational capacity is completely perishable: if it is not used when it is created, it cannot be stored for later use.

3. Risk should be transferred to the party most able to control it or to bear it.

A form of revenue guarantee appears to me to be the most practical arrangement for responding to these considerations. An annual guarantee would probably be quite adequate, since capacity changes over a fairly wide range can usually be made within this lead time. The scheme might work as follows:

Each year an institution could contract in advance (recognizing necessary lead times) for a given level of services. The regional center then sets its capacity on the basis of the aggregate guaranteed demand. Modest surplus capacity should be made available in order to provide flexibility in meeting unanticipated demand and to handle variations in load over short time periods. The guaranteed revenue should cover most expected costs, however.

A user should be given two primary incentives to guarantee revenue support. First, he should be granted a fairly substantial price discount for assuming the financial risk; a discount of 25% is probably sufficient to motivate users to set the guarantee at as high a level as they can reasonably be expected to need. The second incentive is the assurance that a guaranteed user will obtain the capacity he requires. The scheduling algorithm on the regional computer should be such that a user receives a high priority in obtaining his guaranteed level of capacity. Beyond that level no guarantee is given; it depends solely on whether capacity can be provided without undue deterioration in service to guaranteed users. Thus, each participating institution has both a price and a service incentive to set an adequate level of guarantee. It should be noted that these are precisely the same incentives (and entail the same risks) that each separate institution would have to face if it operated its own independent computer center.

The regional center should, of course, be allowed to sell surplus capacity after it has met its guaranteed commitments. The surplus can exist because of planned excess capacity or because an institution fails to use its guaranteed level of capacity. The revenue from the sale of such surplus capacity should be shared on the basis of each institution's guaranteed support and the amount of its guaranteed capacity that it failed to use.

The funding of services obtained from the national network raises some important financial questions. Costs at the local and regional levels are largely fixed, whereas an expenditure outside of the region constitutes an incremental cost. Such a cost can be offset by revenues obtained outside of the region from other members of the national network. Even if external costs and revenues are required to balance (through some sort of barter arrangement, for example) users can still benefit substantially by exploiting the comparative advantages offered by each computer in the network. The financial arrangements for encouraging greater exchange of services is a topic that deserves considerable research.

Payments to the regional center should depend in part on the quality of service provided. Payments should be reduced if, for example, turnaround falls below a given level for a given priority of service. Since the managers of the regional center are best able to control reliability and service, they are the ones who should bear most of the risk. Their incentive to provide quality service can perhaps come through a bonus scheme or the freedom to spend any surplus revenue on discretionary

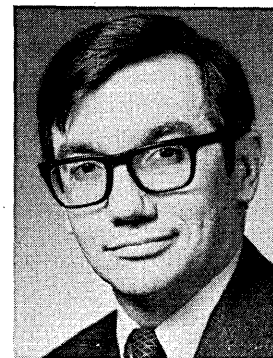
projects of their own choosing.

Price and quality incentives should be the primary means of motivating use of the regional center. Each institution—and probably its various organizational subunits—should normally be allowed to spend their computational dollars anywhere they choose (recognizing, of course, any short-term obligation assumed through a contractual guarantee). After suitable time lags, then, the dollars will flow toward the most cost-effective sources of services. The major exceptions to this freedom should be when one user interacts strongly with other users. This would tend to apply most strongly to administrative data processing applications that share a common data base or are closely coupled with other subsystems.

Conclusions

There is little doubt that regional computing offers substantial advantages. The time is long gone in which each college or university should try to remain self-sufficient in providing computing capacity. Quality of service and costs can both be improved through intelligent, well-managed sharing.

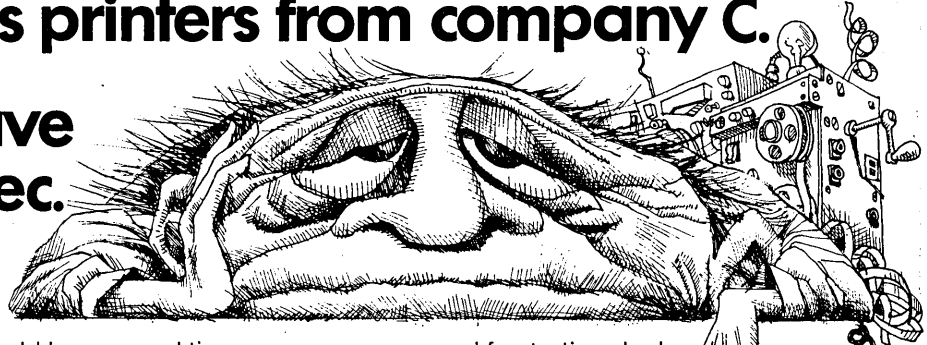
We face a very great challenge in implementing a hierarchical network that best meets our needs. Many technical and managerial problems must be solved before we achieve a completely satisfactory system. Success requires great skill, good will, and a keen sensitivity to the needs of the community as a whole. For a system as complex as a hierarchical network, success can only be achieved through an evolutionary process that adapts as changes take place in technology and our perceived needs. □



Dr. Emery is a professor of management at the Wharton School and currently serving as director of computing activities for the Univ. of Pennsylvania. He is also taking part in a computer network research project supported by the Office of Naval Research. Last year he was president of the Society for Management Information Systems. He has a BS in chemistry from the Univ. of Arkansas and a PhD in industrial management from the Sloan School at MIT.

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A method for determining and distributing edp costs among users in a multijob, teleprocessing environment

A Cost Allocation Model

by Gabrielle K. and John J. Wiorowski

Cost allocation for edp has been a complex and controversial problem since the advent of multijob-stream processing. The need to solve the problem has grown with the increased use of multijob processing and has become critical in a teleprocessing environment. There have been numerous articles discussing the problems involved and the requirements of a good cost allocation model. However, few approaches have been offered on how to meet these requirements. The major requirements seem to be that the cost allocation must be equitable, reproducible, and realistic. The cost allocation model described in this article attempts to fulfill these criteria in a multijob processing and teleprocessing environment.

The criterion of equitability applies to the edp center and user accounting centers. All edp costs including equipment, personnel, and overhead costs are allocated to the user accounting centers. The users are charged in accordance with the quantity and cost of the resources that they use.

The second criterion, reproducibility of charges, is fulfilled by breaking down resources into the smallest possible usable units without incurring excessive data collection overhead. Charges are exactly reproducible if the same multijob stream is reprocessed. If

the same job is processed with a different multijob mix, a variance of no greater than 1% is thought to be acceptable.

The third criterion of realistic charges is satisfied by deriving charges from actual costs. There are a number of advantages for both the edp center and user in realistic charging. The edp center obtains quantitative data to justify additional hardware and, further, to aid in the selection of the most cost-effective hardware. The user is provided with a basis for decisions involving processing alternatives. Realistic charges encourage the user in practices conducive to lower operating costs and thus lower charges. All of the benefits, advantages, and implications of the cost allocation model are best explored after some details of the model are understood.

Methodology and rationale

The basic cost and charge components are the cpu and peripherals. The cpu is frequently charged by a job's total elapsed time or by a job's cpu time. Charging by elapsed time is a reasonable approach in a single-job processing environment. However, the criteria of equitable, reproducible, and realistic charging are violated in a multijob processing environment. Charging by elapsed time is not equi-

table to an installation or to the users (some jobs are undercharged while other jobs are overcharged), since the charging does not depend upon the amount of resources used by the job during its elapsed time. Charges are not reproducible because the amount of elapsed time used by a job varies greatly depending upon the multijob processing mix. Charges cannot be based upon the actual cost of resources used since elapsed time is not indicative of which resources are used by a job and in what quantity. Thus, the third criteria of realistic charges is violated.

The second frequently used approach of charging for a job's cpu time closely approximates the criteria but does not consider the job's impact on core. A job which uses five minutes of cpu time and 60K of core would be charged exactly the same as a job which uses five minutes of cpu time and 120K. The criteria of equitable and realistic charges are not fully satisfied in a multijob processing environment. Cpu charges are not equitable since a job which requires more core, thus making the core unavailable to other jobs, is charged the same amount as a job which requires less core and uses the same amount of cpu time. Charging for cpu time is not realistic since charges are not based upon ac-

tual costs. The total cost of the cpu varies depending upon the amount of core on the cpu. The user is not encouraged in practices conducive to lower operating costs. Instead, he is encouraged to reduce cpu time irrespective of the amount of core occupied.

Cpu time must be known for reproducibility of charges and a job's impact on core measured to have equitable and realistic charges. A good approach is to combine cpu time and the amount of core used into cpu kilobyte hours. Kilobyte hours are defined as cpu time in hours multiplied by bytes of core divided by 1,000 ($K = T*B/1000$). Kilobyte hours includes cpu time and the amount of core occupied. Kilobyte hours are satisfactory in the example of two jobs, each of which requires five minutes of cpu time, with one requiring 60K and the other 120K. However, consider a job which has heavy I/O and occupies core for a long period of time while using relatively little cpu time. A heavy I/O job would be significantly undercharged unless the job is charged for I/O. Thus, it is necessary to introduce peripheral costs and charges.

In a single-job processing environment it is not necessary to have separate charges for the cpu and peripherals, since these resources are not usable by any other job. However, in a multi-job processing environment a peripheral can be used by any one of several jobs. It is not possible to exclusively associate a peripheral to a job for the duration of the job or even from the time that a job starts using the device until the job stops using the device, since more than one job can be using a device over a fixed interval of time (e.g., direct access devices).

A good method of costing and charging peripherals is by I/O operation. It is necessary to divide peripherals into device type and determine the most reasonable unit of measurement.

The most common types are printers, card I/O, tape, and disc. Devices such as OCR (Optical Character Recognition), MICR (Magnetic Ink Character Recognition), and COM (Computer Output Microfilm) equipment would be managed utilizing the principles applicable to the more common peripherals to be discussed in detail later. A natural unit of measure for printers is lines printed and for card I/O, cards read or punched. A reasonable unit of measure for tape and disc I/O is the number of reads or writes to a device. IBM refers to these I/O operations as EXCPS (Execute Channel Program). SMF (System Management Facility) under OS records all EXCPS by device for each job step. Costing and charging by I/O operation is an equitable, reproducible, and realistic method for most peripherals. On-line disc storage is a notable exception.

There are two basic types of disc usage. First, a job may use a disc in a manner similar to a tape, printer, or card I/O. That is, when the job is not issuing I/O operations to a device, the device is available for use by another job. Or more than one job may be issuing I/O operations to the same device. This type of usage is covered adequately by counting I/O operations. The second basic type of disc usage may require that a file be on line for a period of time with relatively few I/O operations issued to the disc (e.g., an inquiry or time-sharing file). A file which occupies a large amount of space with relatively few I/O operations should be charged for the space occupied and unavailable for I/O usage by other jobs. This on-line disc storage can be costed and charged by a spindle, a disc and a portion of the associated control unit. A small file (e.g., a time-sharing file) which occupies a few tracks or cylinders and has few I/O operations can be placed in an on-line file storage category. Thus, we have

three categories for disc usage: disc I/O usage, on-line disc storage, and on-line file storage.

Table 1 is a list of the 12 categories chosen for our installation which contain all on-line resources and off-line resources of printers, tapes, and disc storage. This list may vary depending upon the particular installation but the principles will remain the same. Before presenting a detailed analysis of each category, it is advantageous to discuss the cost and percent usage figures which are common to all categories. (The figures in Table 1 are examples and are not actual.)

The cost per month is the total cost of all equipment and resources necessary to make the particular resource available for use. The cost includes all operations and supportive personnel, and overhead. All edp costs are spread over each equipment category in proportion to the percentage of cost of the category to the total cost of equipment. For example, if the total equipment cost is \$50,000 but the total cost of providing the resource is \$90,000 (i.e., \$40,000 for personnel and overhead) each equipment cost category would be increased by 80%. An equipment cost category which totals \$1,000 would thus be \$1,800. A service bureau may wish to include their profit figure at this point. If a profit on equipment cost of 10% is required, the 80% figure would be changed to 90%.

Another approach to distributing personnel and overhead cost over equipment costs is to weight equipment which requires more human intervention higher than equipment which requires little human intervention. This would result in the cpu receiving very little personnel costs and the peripherals the majority, since human intervention is required to mount and dismount tapes and discs, place cards in a card reader and change forms on the printers. The function of operations per-

Cost-Charge Category	Cost/Month	Percent Usage		Unit of Time	Unit of Resources	Rate
Kilobyte Hour	\$50,000	CPU 30	Core 40	Hours 720	1,000 bytes 600	\$.9645061
On-line Printer	5,000	40		Minutes 43,200	Lines 1,700	.0002292
Card Reader	2,000	5		Minutes 43,200	Cards 2,000	.0004629
Card Punch	500	2		Minutes 43,200	Cards 300	.0019290
Disc I/O	17,000	60		Seconds 2,592,000	Channels 2.38	.0003215
On-line Disc Storage	2,000	40		Hours 720	Disc 2	3.4722222
On-line File Storage	4,000	50		Days 30	Tracks 12,000	.0222222
Tape I/O	19,000	50		Seconds 2,592,000	Channels 2	.0003665
Connect	3,000	50		Hours 200	Ports 12	2.5000000
Off-line Disc Storage	400	90		Month 1	Disc 20	22.2222222
Off-line Tape Storage	6,000	80		Month 1	Tapes 4,000	1.8750000
Off-line Printer	7,000	50		Minutes 43,200	Lines 22,000	.0002063

Table 1. Cost-charge categories

Cost Allocation

sonnel as well as control personnel is more closely related to peripherals than to the cpu. Peripherals would obviously receive a higher percentage of personnel costs, which would result in relatively low kilobyte charges and high peripheral costs. However, this does not seem to be equitable since the peripherals cannot operate without the cpu.

The policy of an installation may suggest a weighted distribution of personnel and overhead costs over equipment costs in order to improve overall system performance. The weighting may be developed to encourage one processing alternative over another. It is possible to encourage off-line printing more than the actual cost of equipment warrants by allocating a higher percentage of personnel and overhead costs to on-line printing than off-line printing. However, a careful analysis should be made before artificially weighting one device over another. It may be thought that the use of tapes will be more cost-effective than the use of discs. However, the overall design of a system may be more efficient with the use of direct access devices, but the advantages of disc will not be used because of a deflated low cost of tape. It is advisable to allow actual usage and costs to suggest rates. Regardless of the distribution method chosen, an allocation of personnel and overhead costs over equipment costs seems to be the most practical, equitable and realistic approach.

It is necessary to introduce percent usage figures for several reasons. No resource is used 100% of the time. Preventive maintenance must be performed and it is necessary to have sufficient equipment to meet peak periods as well as rerun a job which failed. Therefore, it is necessary to estimate percent usage figures.

Percent usage figures must be determined for each cost-charge category for a given installation. The same data required for billing are required to calculate percent usage figures. IBM users who have SMF and users with similar software will find it a simple task to obtain the needed data. Percent usage is the total resource used divided by the total resource available. For example, a line printer capable of printing 1100 lpm or 47,520,000 lines per month and that actually prints 23,760,000 lines in a month has 50% usage. It is necessary to be extremely careful to collect the required data over a representative period of time. The percent usage estimates are an integral part of the cost allocation model. If the estimated figures are high, revenue will

be less than costs. If the estimated figures are low, revenue will exceed costs.

Formulas and categories

All formulas have the same basic form. The cost and percent usage components have been discussed. The unit of time and unit of resource components vary depending upon the particular category and policy of an installation.

The quantities of unit of time and unit of resource in the rate formula must be the amount available for productive use if the percent usage figure were 100%. This will be shown for each category where applicable. The policy of an installation may dictate that certain details vary but the principles are applicable to various installation policies.

The basic form of all rate formulas is:

$$R = \frac{C}{P \cdot T \cdot U}$$

The basic form of all charge formulas is:

$$CC = R \cdot T \cdot U$$

where:

R = Rate per unit of time per unit of resource.

C = Total cost of all resources in a category.

P = Percent usage.

T = Unit of time.

U = Unit of resource.

CC = Charge.

Kilobyte hours category. The equipment included in the kilobyte hours category is the cpu, core, consoles, cables, and all equipment necessary to make the cpu available for use. The sample cost per month in Table 1 includes the total cost of equipment in the category plus a percent of total personnel and overhead costs. It is necessary to estimate a percent usage figure for the cpu and a usage figure for core because the cpu has only one dimension, time, and core has two dimensions, time and space. That is, only one job can utilize the cpu at a given instant while more than one job can be resident in core at that instant. The percent usage figure for the cpu is the sum of all productive cpu time divided by the total possible cpu time. The percent usage figure for core is the average core used by a job in 1,000 byte units divided by the total available productive core. The product of the cpu and core percent usage figures is the kilobyte hour percent usage.

The total number of hours available in a month is 720. A megabyte machine has 1,048,576 bytes of core. However, in order to use the machine, it is necessary to have an operating system resident and frequently an installation utilizes spooling and teleprocessing software. Therefore, we must

subtract resident system software from the megabyte to obtain the total amount of core available for productive use. In the sample, there are 600,000 bytes of core available. By substituting the figures in Table 1 into the rate formula, we obtain:

$$\$0.9645061 = \frac{\$50,000}{.30 \cdot 720 \cdot .40 \cdot 600}$$

the rate per kilobyte hour.

A sample charge for a job using five minutes of cpu time and 100K would be:

$$\$8.2304409 = \$0.9645061 \cdot (5/60) \cdot (100 \cdot 1024/1000)$$

On-line printer category. The equipment included in the on-line printer category is the printers, control units, multiplexor channel, and all equipment necessary to make the printers available for use. Like all other categories, the sample costs per month in Table 1 include the total cost of equipment in the category plus a percent of total personnel and overhead costs. The sample data indicates that on the average 29,376,000 lines are printed a month on a 1100 lpm printer and a 600 lpm printer; or 40% of the total possible lines that can be printed ($.40 \cdot 43200 \cdot (1100 + 600)$). The rate per line becomes:

$$\$0.001702 = \frac{\$5000}{.40 \cdot 43200 \cdot 1700}$$

The cost of paper per line may be included for a total rate per line of .0002292. A job which prints 1,000 lines would be charged \$.2292 for printer usage and paper costs.

Card reader and punch category. It would be redundant to itemize the costs and charges for the card reader and punch categories since they are very similar to the on-line printer category. Cards read (punched) are treated in the same way as lines printed.

Disc I/O category. The equipment included in the disc I/O category is disc spindles with one disc pack each and control units. The discs and control units to be placed in the on-line disc storage and on-line file storage categories should not be included in the disc I/O usage category. The unit of time in Table 1 is 2,592,000 seconds (the number of seconds in a month) and the unit of resource is 2.38 channels. In order to estimate the total possible I/O operations, it is necessary to estimate the average time to read or write a block of data. This time depends upon the particular equipment and average block size of an installation. We used 70 ms for 2314 disc drives. An estimate of the total possible I/O operations is the product of the number of seconds in a month divided by the average time to read or write a block

multiplied by the number of channels. Using the sample figures the estimated total possible i/o operations for a month is $(2,592,000/.07) * 2.38 = 88,127,998$. The percent usage figure would be the total i/o operations for a sampled period of time divided by the estimated total possible i/o operations for the sampled period of time. By substituting the figures in Table 1 into the rate formula, we obtain:

$$$.0003215 = \frac{\$17,000}{.60 * (2,592,000/.07) * 2.38}$$

A job which reads or writes 10,000 blocks of data would be charged \$3.22.

On-line disc storage category. The equipment included in the on-line disc storage category is disc spindles with one disc pack each and control units. The resources included in this category should not be included in the disc i/o or on-line file storage category. The cost of a fraction of a control unit corresponding to the number of discs placed in this category should be included. A reasonable unit of time is one hour and a reasonable unit of resource is one disc. The sample 40% usage figure indicates that 40% of the time the discs in this category will be in productive use. By substitution the rate formula becomes:

$$\$3.47222 = \frac{\$2,000}{.40 * 720 * 2}$$

A job (e.g., an inquiry job) which requires a disc on line for four hours would be charged \$13.89.

On-line file storage. The sample data in Table 1 under on-line file storage is representative of the resources used by time-sharing users. The sample indicates that the cost of four disc spindles, disc packs, and a fraction of a control unit are included under cost per month. However, the 12,000 tracks under unit of resource represents the capacity of three 2314 disc packs. The fourth disc contains time-sharing system software, and swap space used exclusively by time-sharing users. This method distributes the cost of the fourth disc over the three discs available for time-sharing user file storage. On-line file storage is charged per day per track. By substitution the rate formula becomes:

$$$.022222 = \frac{\$4,000}{.50 * 30 * 12,000}$$

A user who has a file on line for three days and occupies two tracks would be charged \$.13.

Tape I/O. The equipment included in the tape i/o category is tape drives with one tape per drive and control units. This category is very similar to the disc i/o category. The tape percent usage and rates are calculated exactly as disc percent usage and rates with the

exception that the average time to read or write a block of data on tape would probably be less than the corresponding disc time.

Connect. The connect category is designed for a teleprocessing environment. The equipment included in this category is TCU (Terminal Control Unit), line adapters, modems, and incoming lines. Terminals are usually dedicated to an accounting center and may be costed directly to the accounting center. However, the supportive teleprocessing equipment included in the connect category is frequently shared by a number of users. It is advisable to separate supportive RJE (Remote Job Entry) terminal equipment from teleprocessing equipment used primarily with slow speed typewriter terminals, such as those frequently used in time-sharing and inquiry applications. There is a significant cost difference in the required supportive equipment for these two types of terminals. The RJE user would not be charged his equitable share and the time-sharing or inquiry user would be overcharged. An advantage of having more than one connect category is that leased or purchased software costs can be placed in the appropriate connect category. The sample connect category in Table 1 is designed for time-sharing users and includes the cost of leased software used exclusively by time-sharing users.

The sample percent usage figure in Table 1 indicates that 50% of the available 12 ports will be used 50% of the available 200 connect hours. By substitution the rate formula becomes:

$$\$2.500000 = \frac{\$3,000}{.50 * 200 * 12}$$

A user connected two hours would be charged \$5.00.

Off-line disc storage and off-line tape storage. The equipment in the off-line disc storage category is disc packs and the equipment in the off-line tape storage category is tapes. Frequently discs and tapes are purchased. The amortized cost or the cost of leasing discs and tapes can be used as the cost figures. The rate is simply the cost divided by the percent usage multiplied by the number of discs or tapes available. A reasonable charge period is one month.

Off-line printers. The equipment included in the off-line printer category is off-line printers and control units. The off-line printer percent usage, rate, and charges are calculated with the same method used for on-line printers with one exception. Tape resources are utilized and the cost of the tape i/o should be included. This can be easily accomplished by adding the tape i/o rate divided by the number of lines in an average print tape block to the off-line printer rate which is per line.

Data collection, analysis and distribution. The procedure for collecting data for percent usage must be the same as the procedure for collecting data for billing. If SMF or a similar software package is used to monitor the operation of jobs, it is necessary to exercise prudence in the interpretation of percent usage figures. As mentioned, percent usage figures are required to correct for the fact that no resource is used 100% of the time. Preventive maintenance, equipment failure, excess equipment to meet peak load periods, and rerun time will lower percent usage figures. Another factor which will cause lower percent usage figures is the fact that resources used in system management, job management, and data management are not recorded for a particular job. This is as it should be, in order to obtain reproducible charges. However, these factors should be kept in mind when interpreting percent usage figures.

Percent usage figures should be recalculated and reviewed annually or every few years. An increase or decrease in jobs will, of course, influence percent usage. An upgrade in equipment will frequently lower percent usage, at least until additional jobs are put on the system. The lower percent usage resulting from an upgrade in equipment may not increase rates significantly if the upgrade results in lower costs per unit of resource. The change in percent usage and rates with equipment change provides data with which to analyze the advantages or disadvantages of equipment changes. The claim that a particular piece of equipment has a lower cost per unit of resource, or that the equipment will increase throughput, can be substantiated or discredited with the use of spin-off data from the cost allocation model. Equipment which allows an installation to have lower rates has obvious advantages. The policy of an installation may dictate that rates should not change as frequently as equipment changes. Thus, while spin-off data from the cost allocation model may be used in cost-performance analysis, revised rates need not be used in billing until the installation's equipment has stabilized.

All data required for billing of the categories in Table 1 are available through SMF or similar software packages with the exception of on-line file storage, off-line disc storage, and off-line tape storage. An installation which does not have on-line communications may not require the on-line file storage category. However, it will be necessary for the installation which does need this category to write the required software to read the disc VTOC (Volume Table of Contents) and collect data on on-line file storage. The re-

Cost Allocation

quired data on off-line disc storage and off-line tape storage may be available from the installation's library system.

Consequences of detailed billing

A disadvantage of the cost allocation model is that it is initially difficult for a user to relate to the cost-charge categories. The difficulty is primarily a result of a habit of thinking in terms of a single job environment and the complexity of a multijobbing and teleprocessing environment.

The disadvantage becomes an advantage, if the user is given an understanding of the cost allocation model. This can be accomplished by initially providing an internal seminar on how the rate and charge formulas are developed and applied. A brief explanation and discussion will facilitate the user's understanding of the cost allocation model. The user will immediately realize that the greater the overall system utilization the less his charges will be. Suggestions on how the user can reduce his charges for planned and existing applications will enhance the user's confidence and improve cooperation with his installation. Undoubtedly, some systems will be more costly and others less costly than a previous method of charging. An analysis and explanation of such variance will aid the user in understanding the rates and assist him in reducing his charges. Care should be taken in designing a bill which is easily understood by the user and contains sufficient detail. A detailed bill containing information similar to Table 2 provides the user with the information he requires in order to optimize an existing system or planned system with respect to his charges. When a user minimizes his charges, he minimizes the installation's costs, since charges are based on costs.

It is universally recognized that commercial jobs involve heavy I/O. What may not be recognized by the user is the fact that I/O costs are frequently greater than CPU costs. The average batch job in Table 2 may bear little resemblance to an average batch job at another installation. However, an average job in a commercial environment will probably be similar to Ta-

ble 2 in that the charges for peripherals will probably exceed the kilobyte charges. Detailed unit rates furnish the user with the tools which are necessary in choosing between processing alternatives with respect to costs. Estimating costs for a proposed project can be a tedious task. This burden can be relieved by a simple project costing program. We have found this approach quite beneficial. The user has access to an interactive project costing program through time-sharing. The program interrogates the user for the resources which he expects to use, and provides estimated charges. The user has an opportunity to optimize a system while the system is in the planning stages.

Systems are frequently designed and cost estimates derived based upon a "feel" for the system. This "feel" for a system is frequently based upon experience in a single-job processing environment. It is difficult, if not impossible, to develop a "feel" for a system in a multijobbing and teleprocessing environment, particularly where the job mix is constantly changing. The cost allocation model forces a detailed analysis of a planned system and provides the tools with which to make the analysis.

Virtual storage computers offer further challenges in systems design and cost allocation. The proposed cost allocation model is designed for virtual storage systems with a possible modification to the kilobyte hour category. It is not known if a significant increase in virtual system overhead would be incurred by recording the amount of real storage space used in conjunction with a given amount of CPU time. If this overhead is excessive, it would probably be advantageous to reduce the kilobyte hour category to a strictly CPU category. No other category in the cost allocation model would be affected.

Benefits

There are a number of important benefits derived directly from the cost allocation model and indirectly as a result of analysis of the data required to establish the rates and perform billing. Consider the benefits and advantages to an installation and its users as a result of the proposed model:

1. The model provides a quantitative basis for equipment evaluation

with respect to cost and performance. Information is available upon which to base decisions concerning the following controversial questions.

- a. What is the cost differential between a turnkey system on a minicomputer and a similar system on a maxicomputer?
 - b. What is the impact on the host computer and its associated cost of teleprocessing with a terminal control unit or an intelligent front end?
 - c. What is the cost differential and benefits between keypunching, off-line data entry and on-line data entry equipment?
2. Each system resource is priced to pay for itself, thus making justification of additional hardware simpler and more direct. Evidence of a need for additional resources is provided when actual percent usage approaches a maximum for an installation's demands.
 3. The data required to charge realistically is extremely valuable in operational analysis. This data may be used to determine overall system utilization.
 4. Percent usage figures provide a quantitative measure that may be used in adjusting an installation's operation schedule.
 5. The standard turnaround service, to which an installation agrees, results in higher costs as requirements for shorter turnaround time increase. The higher costs ensue due to the necessity of maintaining what is essentially an overcapacity of resources in order to allow some users pre-emptive service. Depending upon the installation's policy, load leveling may be encouraged by adding a factor or giving a discount to a job which requires a high priority or can tolerate a lower-than-standard priority.
 6. The proposed cost allocation model provides a quantitative basis for project costing. The decision to approve or reject an application development project should hinge on an analysis of costs and benefits. The cost of a system must be based upon actual costs of the resources required in order for an analysis of a system's cost to be meaningful and consistent with a corporation's overall goals and policy.
 7. Realistic charges provide a basis for user decisions involving processing alternatives, thus encouraging efficient system design. If charges are not based on costs, the user will minimize his charges in a way which will not minimize overall system costs.
 8. The trend toward centralization of hardware and decentralization of applications places considerable control of the use of resources in the hands of the user. The user must be aware of the costs of resources and feel the impact of these costs in order to keep

Category	Rate	Unit of Time	Unit of Resource	Charge
Kilobyte Hour	\$.9645061	.01485	96K	\$1.40800
On-line Printer	.0002292		2006.14	.45981
Card Reader	.0004629		299.51	.13864
Disc I/O	.0003215		5008.71	1.61030
Tape I/O	.0003665		4830.86	1.77051
Off-line Tape Storage	1.8750000	1 Mo.	1.00	1.87500
Total				\$7.26226

Table 2. Sample charges for an average batch job

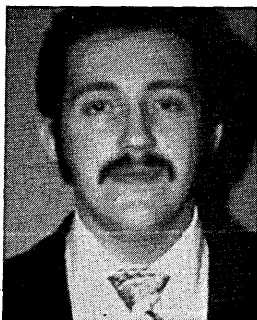
overall costs to a minimum. This is particularly relevant to RJE, inquiry, and time-sharing applications.

9. The cost allocation model charges for a job according to the job's total impact on the system. Consequently, charges are equitable to all concerned.

In summary, the cost allocation model fulfills the criteria of equitable, reproducible and realistic charges. The model establishes the relative value of resources for comparison on a common basis and encourages users in practices conducive to establishing lower operating costs. Data necessary for the implementation and maintenance of the cost allocation model provide a measurement of overall system performance. Although cost allocation in a multijob processing, teleprocessing and virtual storage system is a complex task, it is a necessary task, and can result in numerous benefits to the installation and its users. □



Ms. Wiorkowski is a staff member of the computer utility development group at the Jewel Companies, Inc. Her primary responsibility is to develop corporate goals through liaison with all Jewel Companies systems planning groups. She has a BA in computer sciences from St. Mary's Univ. and has been a lecturer on teleprocessing for the American Management Association.



Dr. Wiorkowski is a research associate, department of statistics, at the Univ. of Chicago. He was previously an assistant professor affiliated with the U.S. Army, Baylor Univ. graduate program in health care administration. He has a PhD from the Univ. of Chicago.

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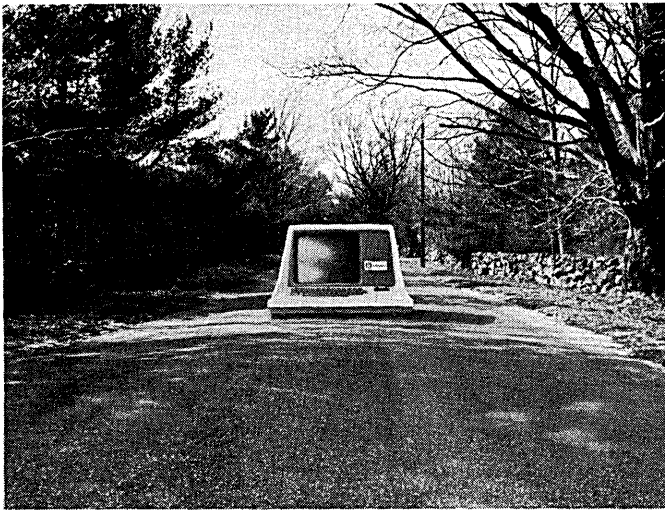
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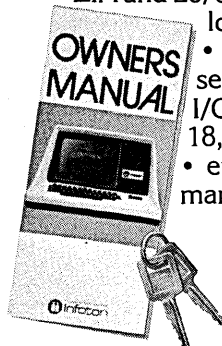
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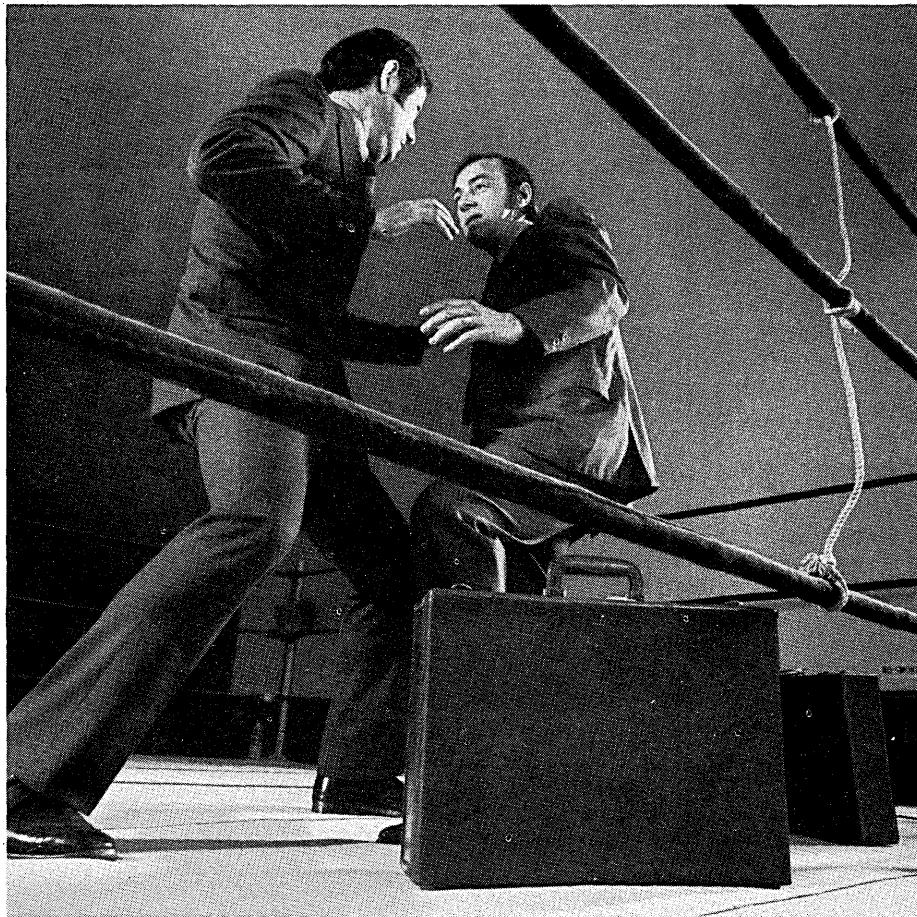
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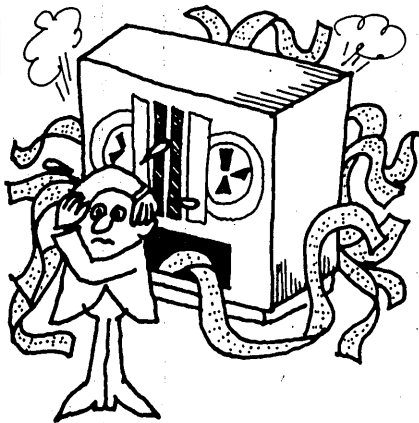
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Communications technology continues to develop faster than the industry's conscience

'73 International Communications Association Conference

by Phil Hirsch, Communications Editor

Technical improvements in computers and communications technology are eroding individual rights, and the process will continue unless computerniks, communications engineers, their employers and customers develop basically different attitudes.

This was the gist of Dr. Jerome Wiesner's keynote speech at the recent annual conference of the International Communications Association in Boston. The thoughts aren't particularly new, but Wiesner's speech represents possibly the first time a doyen of the scientific community has stood up before a large group of engineers and businessmen and told them their complacency is pushing the nation toward a totalitarian society. Wiesner, president of MIT, was science advisor to Presidents Kennedy and Johnson.

"I used to suspect that it would be much easier to guard against a malicious oppressor than to avoid being slowly but most surely dominated by an information Frankenstein of our own creation," he said. "Watergate has demonstrated I was clearly not worried enough about improper uses of technology . . . The great danger is that . . . 1984 could come to pass . . . because each step in the development of an 'information tyranny' has appeared to be constructive and useful . . . and has occurred without specific overt decisions, without high-level encouragement or support and totally independent of malicious intent."

The threat posed by current trends in communications technology has two aspects, Wiesner contended: "The first . . . arises from reasonable and straightforward applications of new technology which make the whole fabric of society more complex and require that we all live and work within narrowly defined norms for the 'system' to work effectively, trading individuality for efficiency. . . . The second . . . threat comes from the surveillance

which modern technology subjects us to. . . . Surveillance systems . . . are so common that many people just assume that their telephones are monitored . . . The effect [of government spying activity] has been to intimidate many individuals and make them draw back from perfectly legal political and social activities."

To eradicate this threat, Weisner contended, it isn't enough to write new and better programs for assuring the security of data banks. "The basic safeguards cannot be provided by new inventions. They must be provided by the legislative and legal system of this country. As a society, we should be

"Surveillance systems are so common that many people just assume that their telephones are monitored . . ."

prepared to accept the cost of considerable inefficiency . . . to safeguard our privacy . . . By costs, I mean both the financial costs and the loss of a degree of control that the state might otherwise have over genuinely threatening individuals—criminals and violent revolutionaries."

It may be significant that when Wiesner finished, although he received a respectable amount of applause, there was little or no discussion of what he had said. Similarly, in the exhibit area, attention was focused on gadgets instead of social implications.

At the AT&T booth, they were talking about a synchronous version of the Dataspeed 40. The asynchronous system—consisting essentially of a keyboard crt unit and read-only printer—had just been unveiled and was on display. The synchronous Dataspeed 40 is supposed to be available in about a year. Its transmission speed reportedly hasn't been decided yet. But AT&T

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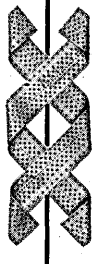
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officials promised that the upcoming, synchronous version of the system will permit "clustering"—i.e., will permit a number of terminals to share a common communications channel. A wider platen, larger display buffer, and a mag tape storage unit are other enhancements under consideration.

Carl Stuehrk, operations director of Bell's computer communications and data services group, said a 2400 bps data set—"a remake of the 201B" but using LSI and having additional service features—will be the next addition to AT&T's 208 modem line. A new version of the 202 will be out "very shortly" and "we're looking at" a 9600 bps data set.

Zak Zakarian, president of Western Union Data Services, said his company is working on two additions to the Class 33 TTY-cassette system introduced at this year's ICA conference. One addition is a crt, the other is an electronic controller with micro-processing capability. Another product in the works is a terminal capable of accessing Telex/TWX and dial-up lines alternately. It would operate at 300 and possibly 1200 baud in the latter mode, and at 10-15 wpm in the former. The heart of the system would be GE's Terminet 300, which WUDS calls the EDP 300. Disc storage is also under consideration.

Two facsimile manufacturers who displayed their wares at ICA/73—Xerox and Graphic Sciences—said they were working on digital fax equipment.

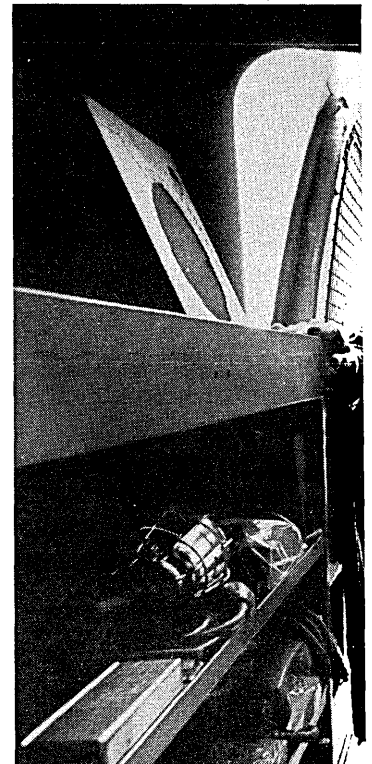
Xerox already has demonstrated and market-tested a machine using a laser scanner and xerographic printing. According to a company source, it processes an 8½ x 11-inch page in two minutes, and can be modified to skip white space, in which case the transmission speed increases to below one minute. "None of our new technology will be on the market in less than six months," he added.

Graphic Sciences has built a prototype digital fax machine, and plans to unveil the commercial version "in the first quarter of 1974," a company spokesman said. It will rent for \$200/month, possibly less, and transmit an 8½ x 11-inch page in 15-60 seconds, depending on copy density.

Possibly reflecting the growing use of data communications, attendance at this year's ICA meeting was up considerably over last year, and so was the number of exhibitors. A total of 425 members and guests registered this time, and 117 companies bought 217 booth spaces. In 1972, there were 396 registrants, 48 exhibitors, and 103 exhibit spaces. □



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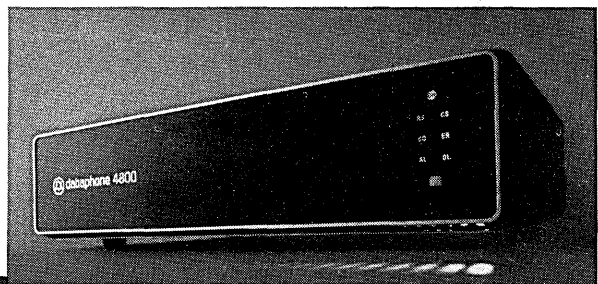
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Manufacturing Management Systems Conference

by William J. Rolph

One speaker at the Informatics/UCLA symposium on Manufacturing Management Systems said he was walking through an assembly area full of busy people with a factory production manager when the manager suddenly stopped for no apparent reason and said "there's something wrong somewhere and I've got to go find out what it is."

Whether or not computer systems can be devised that are able to sniff out manufacturing problems at this early stage was a theme that ran through the three-day conference at UCLA. As Dr. Walter Bauer, president of co-sponsor Informatics, said, such systems are "in their infancy." But there's no doubt a lot of manufacturing people hope they will mature; 103 well-wishers came to the conference. And the reason for the strong interest, of course, is that there's big money to be saved—in the obvious ways such as reducing the amount of materials wasted and the number of defective parts but also in more subtle ways.

For example, J. Paul Bergmoser of Ford explained in his keynote speech that his company's success in cutting the time for an automobile model changeover from a month to a weekend is equivalent to adding one-twelfth more production capacity . . . without having to buy the land, put up the buildings, install the equipment, and so forth. Ford now has 416 computers (and you thought you had troubles) and uses them to deal with the problems generated by 20 assembly plants that produced 2.8 million cars and 1 million trucks last year, with 3,000-3,500 parts each. This all results in some 71,000 transactions per day for each plant . . . and the arrival of a truckload of tires is counted as a single transaction.

Besides the sharp reduction in model changeover time, Ford's biggest computer triumph appears to be the increase in turnover of inventory by keeping overnight tabs on the flow of materials, parts and subassemblies from suppliers. The rate of turnover has increased from 18.4 times per year in

1970 to 23 times in 1972.

Robert F. Williams, who is now at California Polytechnic State Univ., San Luis Obispo, went into the details of a manufacturing management system that has met considerable success in Europe with such companies as Ohdner and SKF. (The speaker was one of the founders of Parsons & Williams in Denmark.) A version of this system is now marketed by Informatics under the name PRODUCTION IV. The details he went into, however, are probably of intense interest only to those already steeped in manufacturing terminology; one phrase that appears in my notes is "offload the overloaded load center to an underloaded load center," which sounds like a reasonable thing to do.

The redoubtable Frank Wagner, executive vp of Informatics, was chairman of a session called Tools for Manufacturing Management and his first speaker was George Strehlke of IBM, San Jose. He urged the audience to visit a local IBM office and get the company's movies and manuals on COPICS (Communications Oriented Production Information and Control System). This eight-volume document, Strehlke said, is a good starting place to gain a theoretical understanding of this field . . . and other people at the conference mentioned later that they agreed with him. Strehlke warned that the most common error was "neglecting the people in accounting." Without them on your side, he said, you may not get your manufacturing system.

He mentioned BOMP (Bill of Materials Processor) for the System/3 and ended with a description of some of the marvels available with IMS. This sequence prompted a question from the audience:

"Does BOMP for the System/3 have these options?"

"Well . . . if you have a programmer."

When Frank Wagner returned to the podium, he offered still another requirement, besides the programmer: "It could do as much as IMS but it might take 17 years to do it."

Informatics' Michael Lodato fol-

lowed with information about PRODUCTION IV, which now has several successful installations, introducing his remarks with the comment that he was "pleased to hear Mr. Strehlke say that COPICS is only a set of manuals."

In-house development of a manufacturing system was discussed by Gene J. Laguban, Jr., dp manager for the Allen-Bradley Co. They have gone about as far as possible with end-user involvement: the people in the shop run the system through terminals. Laguban said that what's needed for good systems is "management with faith and money." Allen-Bradley management has both and they were needed to change from a manual system four years ago to the present IBM 370/155 handling a central operations data base, on-line inquiries, sales order entry, shipping, materials control, shop floor control, and personnel.

The company has a union shop and this prompted a question on how the unions react to data collection terminals. Laguban said that they had no trouble and had worked with the union people from the start. As one result, the terminals can be used by employees to get quick answers to personal questions, such as how many days sick leave are still available.

Nearly every speaker at the conference commented on the scarcity of effective manufacturing system installations so it was good to hear from Romeyn Everdell, exec vp of Rath and Strong, Inc., that there are some. He cited as success stories the applications at Black & Decker, Bendix Brake & Steering, Davis Manufacturing Co., Ivan Sorvel, and Dodge Manufacturing Co. And he emphasized that, though many fail, the payoffs can be magnificent . . . inventory reductions of 30%, 90% of orders filled from stock or on the date promised, and productivity gains of 20% have all been realized. Some key advice from his talk: plan to get results from each step, rather than waiting to get a whole monster system operating; start with the master scheduling, because it requires the shortest installation time, has the largest payoff, and is most likely to win marketing and top management involvement and approval.

Dr. Robert Rector, incoming AFIPS executive director, handled coordination of the three-day symposium, which attracted manufacturing and edp people from an impressive list of major corporations.

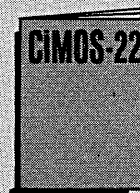
When you go to any conference at UCLA, though, don't put quarters in the machine that wants tokens: the barrier won't go up and the drivers behind you on the uphill ramp seem disagreeable about backing downhill to let you out. □



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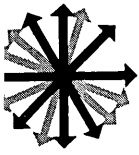
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News in Perspective

Those who purchased IBM 370/155 and 165 systems have reason to be confused and angry that IBM effectively obsoleted the two systems by announcing the 158 and 168 virtual memory machines. Now their emotions are aggravated by reports, which IBM won't confirm, that the company soon will withdraw support for OS next year. Several say they're mad enough to sue, page 76 . . .

An "information tyranny," a phrase coined by former presidential science advisor Dr. Jerome Weisner, could come about if massive banks of information are gathered without privacy safeguards. A recent House subcommittee hearing showed how administrators of federal information systems feel about privacy, page 86. Their comments weren't exactly reassuring . . .

How about the social security number as a Universal Individual Identifier (UID)? Its growing use as the de facto identifier doesn't sit well with a government committee which recently studied the issue, page 89. In fact, the report shows the SSN simply isn't a unique label . . .

Police in California and Arizona began to move against persons and companies suspected of illegally acquiring secret data on IBM's 3330 and 3340 disc files, pages 91 . . .

Europe's computer industry of the future began to take shape this summer, page 91. Philips, Siemens and CII came to terms on a long-awaited joint venture. And Britain's ICL got \$100 million from the government to help it launch a new line.

State & Local Government

Glowing Promises, Vendor Pressure and Widely Publicized Failures

It has been estimated that state and local governments in the U.S. spend \$30 billion annually for high technology equipment, much of this related to dp.

Both buying and selling in this huge market is different than in the private sector. For one thing it's more visible. After all, taxpayers' money is being spent. When a new system is launched the promises tend to be excessively glowing. When it fails, words like disaster or nightmare show up in the popular press.

Bidding procedures can be unreasonably time-consuming. If you're the dp manager your bosses can be changed overnight and with regularity. If you're a vendor your customers can change just as fast and just as often.

And then there's politics, and charges of political pressure by vendors. IBM has been the vendor most often the target of such charges but it's not the only one. Susceptibility to vendor pressure varies. Bill Williams, currently dp manager for the Oakland city schools in Oakland, Calif., believes if a dp manager can be intimidated he will be susceptible.

Williams himself refused to be intimidated when, six years ago, he did an evaluation of the Portland, Ore., city schools in which IBM came out second best. "They (IBM) sent their number one boy to see me and he threatened me with my job." In a letter to IBM, Williams threatened "to bring suit for defamation of character if you don't leave me alone." He said they pretty much have, since the letter. When he first took his Oakland job he did an evaluation for an upgrade from IBM equipment and "the same guy" (from Oregon) visited him when he was out of the office, and later left numerous phone messages. But there was no threat, only the message that "I know he'll choose the right equipment—which will be IBM." Williams went with a Honeywell 435 and a 429.

Another dp manager who considers himself non-intimidatable is Arthur Hill, currently dp director for the state of New Hampshire. His widely publicized arguments with IBM, when he held a similar position with the state of Delaware, resulted in a letter of apology from Ralph Pfeiffer, president, IBM Data Processing Div., and the dismissal of two IBM employees in Dover, Del.

The state of Delaware, under Hill,

went from three 360/40s leased from IBM to three 40s on third-party lease from Greyhound — at a savings, said Hill, of \$140,000 a year. The state also signed a contract with Greyhound to take a 360/75 in June of this year. Hill felt the 75 would have "served the needs of the state for many years to come." He said it would have replaced at least two of the 40s and maybe even the third which was located 45 miles from the state capitol and could have been replaced by remote job entry. Hill said the state would have saved an additional \$9,000 a month if it could have replaced all three 40s with the 75. "Even at two for one it would have been a break-even proposition."

Old technology

At the time Delaware signed the leases with Greyhound the state was between the election and inauguration of a new governor and his staff. Hill claims IBM representatives approached members of the incoming administration claiming he had committed them to "equipment that perhaps would not meet their requirements." A letter signed by three IBM representatives claimed it was "a commitment to seven-year-old technology."

Hill further claims that "on the morning of November 14, 1972, an IBM representative came to the office of the director of central data processing for the state of Delaware and, in the presence of witnesses, in very clear and concise terms, informed the director that he was 'finished' in the state of Delaware." Hill said he was advised that all key legislators, newly-elected officials, and key personnel in the current administration would be contacted to insure that IBM's position was known.

"In a few short hours," he said, "it became evident that this was taking place. There were nasty, threatening, and many times ignorant phone calls received by legislators and other influential personnel."

"I'm independent," said Hill. "I'm a retired military man with an independent income so I don't have to worry about anybody forcing me out of a job, and I won't be walked on."

"At the outset of this conflict I made it known that I felt that my effectiveness in the Delaware job was definitely impaired, and that I would seriously

consider any position that afforded me a better opportunity. The state of New Hampshire offered me that opportunity, and since the new administration in Delaware had made no commitment to me, I gladly accepted the New Hampshire offer. I am more convinced than ever, now, that it was a good move!"

Following Hill's departure, the state of Delaware cancelled the lease with Greyhound for the 360/75 but it still has the three Greyhound 40s. Hill contends that these will have to be replaced in one or two years if the state's growing requirements are to be met and "that'll give IBM another shot at bidding 370s."

In two other widely publicized cases of alleged political pressure by IBM, equipment decisions were still pending as of this writing. The city of Oakland, Calif., which was to have gone from an IBM 360/25 to a Honeywell 2060, before a furor which included a letter of protest from IBM, mysterious circulation of media clippings disparaging to IBM competitors among city officials, and finally the bringing of the city council into the act, still had the 25. The city council, as a result of the furor, called in a group of five large computer users in the city. This group recommended that the city go to third-party rental for one year while the city's dp staff worked out a long range plan.

The dp department came up with two alternative recommendations for an "interim" computer, one for a 360/40 from ITEL and the other for a Honeywell 2050A from Honeywell, and in mid-July these recommendations were on the city manager's desk.

Governor's choice

In the state of Nebraska, where alleged IBM pressures to prevent the state from going out for public bid are said to have reached the office of Gov. J. James Exon, requests for bids did go out and three came in, from IBM, Honeywell and Univac. The state will upgrade from its 370/145, but Ernest E. Kavalay, data program administrator for the state, said last month, "We don't know what the bids are yet so we don't know which way it will go." The dp staff will make a recommendation but the decision will be the governor's.

Gov. Exon was one of a group of "people from all over the country" who New Hampshire's Hill said wrote him letters, following his experience in Delaware, congratulating him on his stand and/or reporting similar experiences.

Another was William Smith, information systems manager of the city of Pittsburgh, Pa. Pittsburgh went from IBM equipment to NCR. "They (IBM) fought me and even went to the

mayor," said Smith. "The mayor told them if they had any suggestions regarding data processing they should come to me, as that's what he'd hired me for." Pittsburgh has no IBM equipment today, not even keypunches.

Britt Williams, Georgia Department of Administrative Services, reported pressure tactics on the part of IBM when the state went to third-party lease with ITEL, but he was philosophical about it. "They went to my boss . . . implied all sorts of things . . . but I've been dealing with IBM for many years and I'm quite familiar with their marketing techniques. I expect them to market around me instead of through me and I have full support of the state government."

Some local dp officials are reluctant to talk about political pressure. One who admitted to having been pressured "some" and who said a friend of his had "gotten even more" said he didn't want to talk about it, and he doubted his friend would, because "too many guys like us in jobs like ours . . . well . . ."

"IBM has a stranglehold on hiring," said another. "Most dp managers are hired by a controller or an administrative vp who doesn't have an intimate knowledge of dp, and tends to rely on the vendor for recommendations; and in most cases this is IBM. You've got to think ahead, like IBM could be hiring you for your next job."

This same dp manager said he believes most vendors keep dossiers on dp personnel in higher level jobs. He said he had seen one Univac had on him. Williams, of the Oakland city schools, said he was told by an IBM salesman that IBM's dossier on him was two inches thick.

Williams said the same salesman told him it was a standard procedure "straight from the manual" for an IBM salesman who wanted to discredit a dp manager—either for a potential job or to a superior—to state "he's a good man but he's limited."

IBM categorically denies this, as it denies another charge levied by several local government dp managers—that it is standard procedure for IBM to come in with a claim "that there's no long range plan" when a government installation is about to move to another vendor or a third party lease. IBM also denied that it keeps dossiers on dp personnel outside IBM and issued this statement of marketing policy: "IBM's marketing policy is to compete to the best of our ability and to conduct marketing activities fairly, ethically and forthrightly."

IBM doesn't have a corner on charges of pressure tactics in state and local government dp, although maybe 70%.

Univac has been charged with bringing pressure to bear in Butte County, Calif., and in the state of Utah (see June, p. 17). In the state of California it was charged with delaying tactics in the state's procurement of hardware for a \$40 million consolidation center which, when implemented, would displace among other things \$200K/month worth of Spectra equipment in the Department of Motor Vehicles.

Last month the number of bidders was down to two, IBM and Honeywell. Univac didn't bid but protested the Invitation for Bid (IFB). Control Data Corp. said it would, then pulled out saying the benchmark requirements were too severe. But Control Data is going ahead anyway, preparing what John Hall, Sacramento district manager, called "a proposal for a cost-effective solution to the state's problem," and he feels there's a good chance the state will consider it.

Language in the budget bill passed in early July put new restrictions on bidding. There must be two qualified bidders and they must be bidding competitive mainframes. Either Honeywell or IBM could see to it that the other didn't get the contract, said Hall, simply by dropping out. In theory that would mean a new IFB, starting all over again but Hall doesn't believe the state has time for that because of Department of Motor Vehicles requirements.

Many say the new requirement imposed by the budget bill language was a direct result of Univac lobbying, in an attempt to keep its equipment in at the DMV as long as possible.

In Orange County, Calif., where a switch to facilities management may be imminent (the Board of Supervisors was to decide by July 31), there were several series of meetings and conflicting recommendations which first saw the supervisors calling for facilities management with IBM equipment, and later dropping the hardware restriction. The county had been using Univac equipment. As of this writing it looked as if Computer Sciences Corp. would get the FM contract but hardware selection was still very much in doubt. Bob Farmer, county dp director, said "there was vendor pressure all along." If the FM concept is adopted, the Orange county dp organization will become a profit center offering services to cities in the county.

San Diego nightmare

Political pressure by vendors isn't the only way in which politics intrudes into state and local government dp. When a plan for an ambitious command and control system was scrapped by the city of San Diego, Calif., the *Los Angeles Times* came out with a lengthy story

headed "Dream of Utopian Computer Regime Turns Into Nightmare." Laird Sloan, president of Automated Systems Corp. which worked on the system as a subcontractor to NCR, which provided hardware, said "it was more like a political football. The city kept changing its mind about what it wanted, kept putting us off when we wanted to consult, and kept changing the people to whom we had to talk."

There are few people left in city government who had any direct connection with the project. Don Pardee, director of the dp department, didn't. He believes from what he's learned since joining the city earlier this year that the program was too ambitious, and the failure "wasn't really anybody's fault."

The city is after another command and control system now. "This time," said Pardee, "we're eating the elephant a bite at a time." The original system would have served all city departments and reportedly lost the city more than \$1 million, exclusive of man-hours. The new system will be used by the police department only, and the city will require that bidders be able to demonstrate installation of a similar operating system.

Another kind of publicity plagued the city of Houston, Texas, this year. A *Houston Chronicle* banner headline proclaimed: "City Paying for Unused Computers." And it was. Dp director Doug Williams said the city leased a Honeywell 632 and a Computer Automation Alpha which remained on the premises of the leasing company, Urban Systems & Services, for 14 months because a building that was supposed to be finished wasn't. There were also programming problems. Total lease payments for the period were \$96,000.

The Alpha has since been moved to city property and incorporated into a police system. The 632 was released. This, said Williams, had been used for programming but was scrapped when the system was released, on the recommendation of Arthur Young & Co., called in to study the city's dp operations. The consulting firm recommended that the function for which the 632 had been intended, police dispatching, could be consolidated onto a Honeywell 635 already in use for accounting, a tax system, and water billing.

Almost as if he were defending all maligned state and local government dp, Williams, following questioning on the unused computers, said, "Hey, we did something good!" Seems his department brought up an on-line real estate tax system within two weeks of target

date, bringing it up during the busiest season and using it to collect \$86 million in taxes. He said the system cut manual overhead 50% and gave the city an additional 4,000 sq. ft. of storage space formerly occupied by manual files. It's a good bet Williams would be one of the first to hope none of that \$86 million goes to pay for unused computers.

—Edith Myers

Users

155, 165 Owners Angry with IBM

Owners of IBM 370/155's and 370/165's are confused and, in some cases, angry over indications IBM will withdraw support for OS next year.

The issue at stake here has little to do with whether the new virtual memory 370's are better than the 155's and 165's without virtual memory. It has to do instead with what users expected to get when they bought them.

An owner of four 155's and one 165 had this to say: "I feel very strongly that IBM has made a unilateral decision at variance with historical precedent set in the computer industry and at variance with their previous practices. They have shown a lack of sensitivity for the purchase customer."

This user, who insisted on remaining anonymous, said, "When you're paying for equipment which has a life of seven or eight years, IBM is hardly justified in stopping support and enhancements for program products and operating systems before the purchase: rental multiplier has run out." References to support for the original 155 and 165 have to do with the current "functional stabilization" of OS 360/370 (no new functions added) and reports that IBM will not guarantee support for OS after the third quarter of 1974. Indeed one user, John Close of *Playboy* magazine, said "indications from Poughkeepsie" (IBM) are that OS support will effectively end in July 1974. IBM firmly says that it has not announced any dates for ending free support, although it has a target date.

Many among the prestigious cadre of 155 and 165 owners (about 150-200) continue to be angry with IBM. The firm obsoleted their systems by announcing their virtual memory 158 and 168 within a year after they took delivery. But what aggravates them is the stabilization and reports of imminent death of OS support.

Several are mad enough to sue, or at least to look into legal grounds for

suing. As near as we can tell, such a suit is not likely for practical reasons: the enormous cost in dollars, in time, and in the relationship with the vendor. One user did maintain that "I'm never going to buy another piece of IBM gear unless I have to and can't get it from another firm," and he'd like to find two or three other users who would be willing to take some legal action with him.

SHARE to twist arms

There are mild rumors that the IBM user group SHARE (which couldn't take any legal action as an organization if it wanted to) will look into the legal implications of the IBM move for the user and will look for means to assure that IBM won't make a habit out of "early obsolescence." We also hear that the user group, at their meeting in Miami in August, will "twist IBM's arm" not to make any irrevocable statements about withdrawing OS support.

If there are any legal grounds for suing IBM, they have to do with "historical precedents" which lawyers call "course of conduct." The customer has the right to rely on a company to continue to do what it has done in the past.

The case of the 155 and 165 is indeed unique, and it indicates the turbulence in IBM marketing and technological decisions in this antitrust era. These systems were announced in 1970, with deliveries beginning in 1971. They were offered with OS 360/370. They had a high purchase:lease ratio (near 50:1 vs. about 44:1 for the 360's), indicating IBM blessings for a longer life than the 360. The user community had finally become somewhat adept at advanced planning and was receptive to the concept of purchase.

Said John Goodroe, vp for technical services, Equitable Life Assurance Society, New York, "We'd planned major applications on a nationwide network under IMS (the IBM data base system then offered under OS). When we contemplated purchase of the two 165's, we asked IBM if there were any special considerations we should make. They said no."

Thus a few hundred big users went ahead and committed themselves to buying these 370's, expecting that OS and attendant systems software would be both enhanced and supported for much of the life of that system—as systems software had been on the 360 and on major second-generation systems. "We had no notion that IMS features we'd planned on, and IBM had committed themselves to in future releases, would be dependent on new hardware and software," said Goodroe.

Computing managers and vp's put their judgment and faith in IBM practices on the line to their boards of di-

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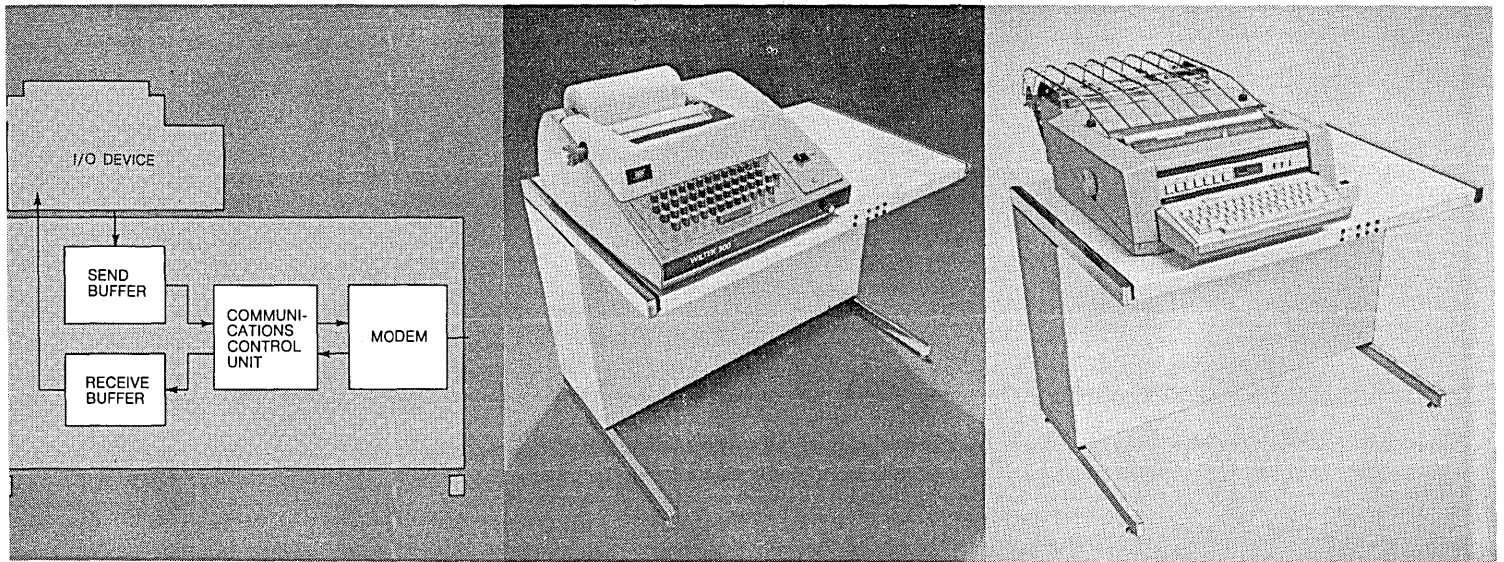
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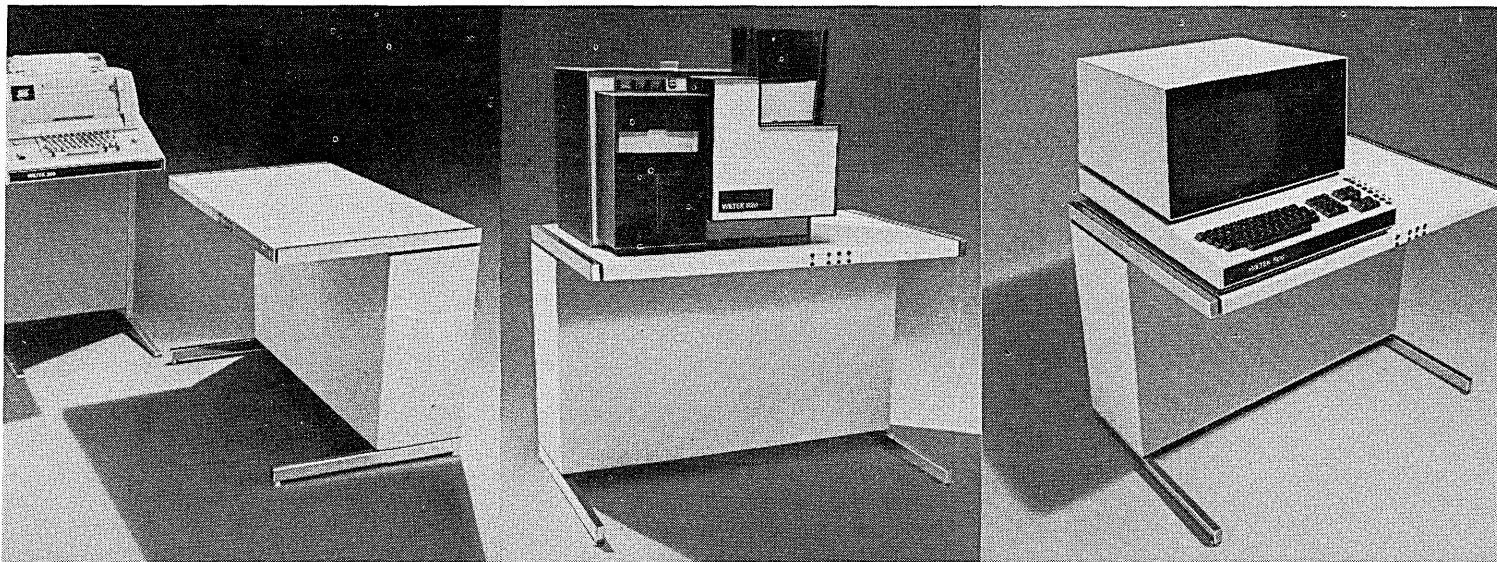
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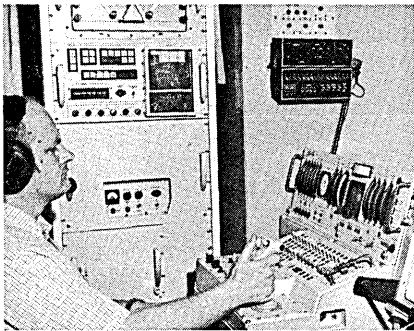
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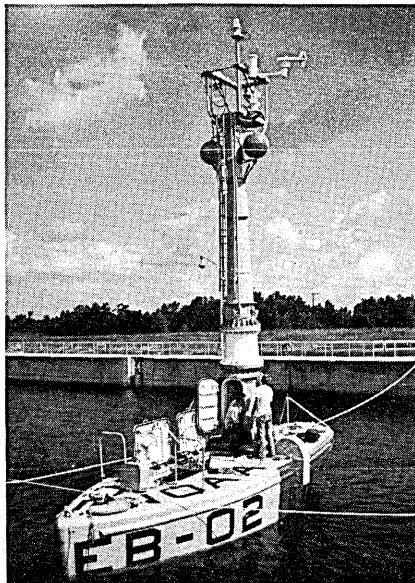
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rectors. Some were so convinced of the validity of purchase that they even swallowed a price increase on the 370 cpu's late in 1971. That's the way they tell it.

Just eight months after that increase, in August 1972, IBM heralded LSI breakthroughs and the coming of virtual storage 370 systems, starting with the 158 and 168. These systems would be cheaper than their predecessors when memory needs climbed into megabytes. And the new virtual memory operating system, dos/vs and os/vs

and vs 2, would not work on the 155 and 165 unless they were retrofitted with the \$200K and \$400K (respectively) Dynamic Address Translation (DAT) boxes. And if the owners of these systems wanted certain new functions, they'd have to go to vs, because os 360/70 was being functionally stabilized at its current version, 21. IBM had obviously made a firm decision that it would not incur the expense of supporting two major operating systems very long, and vs was the winner.

From IBM's point of view, it has not

abandoned the 155 and 165 user, as it will continue to support him with an operating system. According to Robert Burchi, product administrator for the dp division, "IBM is trying to be sensitive to the needs of those with DAT boxes. But those who opt to stay under os were given notice of eventual withdrawal of maintenance. We're saying our development dollars are going into vs systems."

Burchi explained that "functional stabilization" announced last August has been somewhat confused with support withdrawal. It means that no new functions are being added to os and that generally, new program products

Lunch Is Fine, But No Breaks on the DAT Box

When IBM effectively obsoleted the brand new 370/155 and 165 systems by announcing the 158 and 168, it wasn't surprising that the loudest protests in Europe were registered in British accents. Purchasing computers, rather than renting, has always been more popular in the U.K., and the IBM announcement impacted 13 buyers there.

The 12 who owned 155s first made themselves heard through the channels of their Computer Users' Assn. (CUA) by asking for DAT boxes free of charge, and when this failed, tried for free maintenance agreements. To all such requests the official response was negative with IBM (U.K.) pleading that its hands were tied by the antitrust laws, and warning that any publicity would weaken the CUA case.

CUA then asked IBM for a 10% discount to make up for Britain's new value-added tax which would have added 10% to the \$200K cost of the DAT box. That didn't work either, and the users abandoned the CUA approach for private negotiations between IBM and individual customers with the CUA's backing.

CUA's president Doug Eyions said, "Most members thought that we did all that was possible," and he doesn't think the CUA failed. It's believed that confidential sessions with the users have resulted in deals in such negotiable areas as the length of free maintenance periods and extra usage charges. In fact, only two of the 12 have told the CUA they're unhappy with the confidential negotiations.

The Prudential Assurance Co. is one user that found a way out of the dilemma, but the solution does not include DAT boxes. It originally planned for a twin 155 configuration but the IBM announcement caught it with only one machine in-

stalled. Consequently it decided to swap the second 155 for a 158 and to replace the 155 in March or April 1974 by a second 158. Arrangements have already been made to sell the 155 at that time at a "reasonable price" to a private buyer. Thus Derek Bourdon, the Prudential's data processing manager, is able to say, "I'm not too unhappy in retrospect because of the increase in flexibility and power that we will get."

A dirty trick

But not everyone feels as fortunate. Des Lee of Rowntree Mackintosh says: "We thought it a very dirty trick on IBM's part. I am not so worried about the obsolescence, for os will still be there, but if we want to take advantage of any new, cheaper disc drives or tape decks we will have to spend £110,000 on a DAT box." His company will see out the five-year expected life of its machine not with IBM's vs, but by plugging in extra core—going up to 4 megabytes with independent suppliers as opposed to the 2 megabytes possible with IBM.

Other users' plans are less clear-cut. David Gilchrist of the Halifax Building Society has decided to play a wait-and-see game over vs on the 155. His company has also felt the effect of the non-support of new peripheral announcements. They are interested in the new 3600 series financial terminal announcement in Europe in June but these will run only under vs, and Gilchrist's feelings about following that path are necessarily complex. The Halifax 145 has already been upgraded to run vs under extended control mode, but as he observes, "The vs operating system cannot handle our main teleprocessing program so our

general feeling about vs for our application is not too enthusiastic."

Good for independents

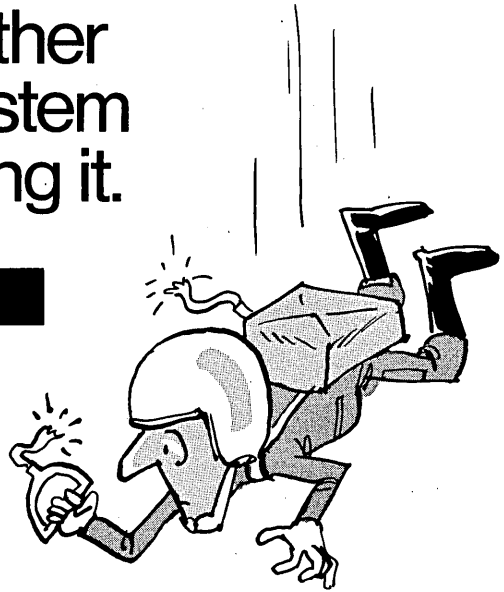
Reactions and decisions vary widely among the 12, but one thing is certain—IBM isn't exactly everybody's best friend. No one quite believes that IBM didn't know that vs was just over the horizon when the 155 and 165 were announced, and some users, happy or not with the latest round of negotiations, are out to get their revenge. "It has played into the hands of the plug-compatible people," says one user. He goes on, "I can see people getting peripherals from companies like Telex even if they don't offer any better performance but just to get one back at IBM." Of course the same argument applies to add-on core.

"We get the feeling," says another, "that though they can't do anything, IBM (U.K.) is sympathetic to us." So it should be—the 155/165 purchasers are among the U.K.'s bluest chip companies: such banks as the Royal Bank of Scotland and the National Westminster; the National Westminster subsidiary Centrefile; insurance companies like the Prudential, Sun Alliance and the Co-operative; building societies like the Halifax; local government organizations such as the West Sussex County Council; and household names like Rowntree Mackintosh. (National Westminster, the only 165 owner, had no comment and refused to participate in the CUA negotiations.)

What can the company do to win back favor? "Well," observes Des Lee, "instead of sending us a list of restaurants to use when we go to visit them, they have started taking us out to lunch." □

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being announced will not operate under it but under vs. os still has Class A support, which includes central programming support, free on-site field maintenance, and handling of all fixes or apars from the field. IBM has just issued what is said to be the final release of os, version 21.7, although IBM does not confirm it is the last. Burchi did say that IBM has a target date for reducing os to Class C support, which offers only charged-for-field maintenance. IBM will give six months' notice, although Burchi said user reaction to that has been "negative."

Burchi also explained that IBM "left the door open" last August to provide new I/O device support under os, such as the 6250-bpi tape drives and the 3740 diskette terminal. Most being announced are only for vs, such as the new 3330 double density drive, the 3600 financial equipment announced overseas recently, the 3886 OCR reader, and the 3890 document processor.

Owners of the IBM "follies" have been coping with a myriad of problems, alternatives, and pressures: whether to stay with os, how long to stay with it, what happens if os support dies "too soon," whether they can afford the 5-8 days of downtime required to retrofit the DAT boxes, whether they can afford the DAT boxes, and what to say to the board of directors.

Carl Reynolds, at Hughes, isn't upset about the functional stabilization of os, feeling it allows his installation to get on to applications development without the hindrance of constant system changes. But he intends to stay with os, as he doesn't feel his applications would gain anything by going to virtual storage. Reynolds notes a problem that others in the same situation have been experiencing; his staff thinks the installation will be left behind, as IBM enhances vs, and that they will be left behind too—in experience on the latest in IBM systems.

John Close, technical manager at *Playboy*, is reluctantly taking his firm's 155 to vs by adding a DAT box. He is personally somewhat bitter about IBM's moves and pressures, noting that "they don't care about the user group," and will end os support as soon as possible to force undecided users into vs because that is where its future revenues will come from.

Close lost his love for IBM when his installation considered replacing the IBM memory with Cambridge Memories' counterpart. IBM salesmen, he says, went around him to "my boss and my boss's boss to display me as an incompetent." *Playboy* did install the Cambridge memory and "the IBM

salesmen disappeared, the field engineers disappeared."

Close also isn't too encouraged about what DAT and vs will do to his overhead. His firm had planned to keep the 155 for up to 10 years, as it has only been running up to 70-75% utilization. But he expects that DAT and vs will chew up more than 20% more of the cpu, shortening the expected life of the 155 to five years or less.

Contrarily, a source at Union Carbide Corp. says they expect that a 165 with a DAT box will run 3% faster than a regular 165. Further, the firm has made a special request for a 64-nsec cache memory (as in the 370/195) for the pair of 165's it owns. The source says that unless operating systems coming up from IBM are radically different from vs 2, release 2, which he doubts, despite all reports of future IBM systems, the 165 with DAT (or model 11) should be usable out to the end of the decade (vs 2.2 is due out next February).

Several users, such as GTE Data Services, are looking for assurances from IBM that it will continue to support 155's and 165's with DAT boxes and without additional hardware expenditures. IBM's Burchi stated that IBM "intends that future releases of vs 1 and vs 2 will support the 155's and 165's with DAT boxes." On whether there would be additional hardware expenditure, Burchi said, "I foresee no such action, although it is impossible to predict far ahead on what architectural extensions may be made."

Try it in writing

Although IBM has pitched the 158 and 168 to his firm, one user says that it will not commit itself in writing to support for these systems for any period of time (it is standard IBM practice not to). While IBM won't put it on paper, it does imply support as in the past. For example, vs 2.3 is due out in 1975. According to Burchi, vs 2.1 can be expected to be supported in 1976. If the user is concerned about what he can rely on in the future, Professor Michael Duggan of the Univ. of Texas advises him to write his own letters to IBM, clearly stating what kind of support he expects with his systems and understands he will receive. While not a legal contract, unless IBM refuses to install the equipment, the letter will be helpful in any future legal arguments.

He is not against the potential benefits of virtual storage systems, but is against being forced into them, said a user who has a long-range program for his 155's, "putting almost all we do into an on-line environment." The plan,

devised two years ago, runs through the next 3-4 years and entails standardizing on CICS under os (teleprocessing method), the 155, and initially 3705's. But the CICS enhancements he expected are only being offered under vs, just as the IMS features Goodroe wanted are. He and others are exploring every avenue to stave off vs for the time being.

Those who opt to stay with their original configurations are looking at hardware alternatives such as more memory. Hughes has swapped its two megabytes of IBM core for three megabytes of Advanced Memory Systems' semiconductor memory. Another user saved a lot by selling IBM memory on the open market at 70% and buying Cambridge Memories' systems at 50% of IBM price. For those opting to go to vs systems, competitive DAT boxes are promised by firms like Intel and Control Data Corp. Trading systems into IBM for 158's and 168's is pointless, as IBM is restricted from resale and is offering only about 8% trade-in on the old 370's. If a user can justify the loss, current price on the open market is about 55-60% of IBM's purchase price, although that is expected to go down to 40-45% in 1974.

Owners who are opting to stay with os are exploring several alternatives, although they say their first task is to gather all available IBM documentation on it and to make sure they have good in-house os capabilities. Most preferable, but least likely, for obtaining os enhancements is to convince IBM to establish or subcontract a group to continue enhancements. Burchi made it clear that IBM is sticking with its vs-only policy for development dollars, and "I don't see a change in directions." The users could establish their own cooperative development group or independently develop and market os products. And finally, there may be a choice market for a savvy software house to specialize in.

But while the owners make their decisions about their installations, Professor Mike Duggan suggests that those who feel strongly about the situation make some form of public complaint if they are to protect themselves against a recurrence.

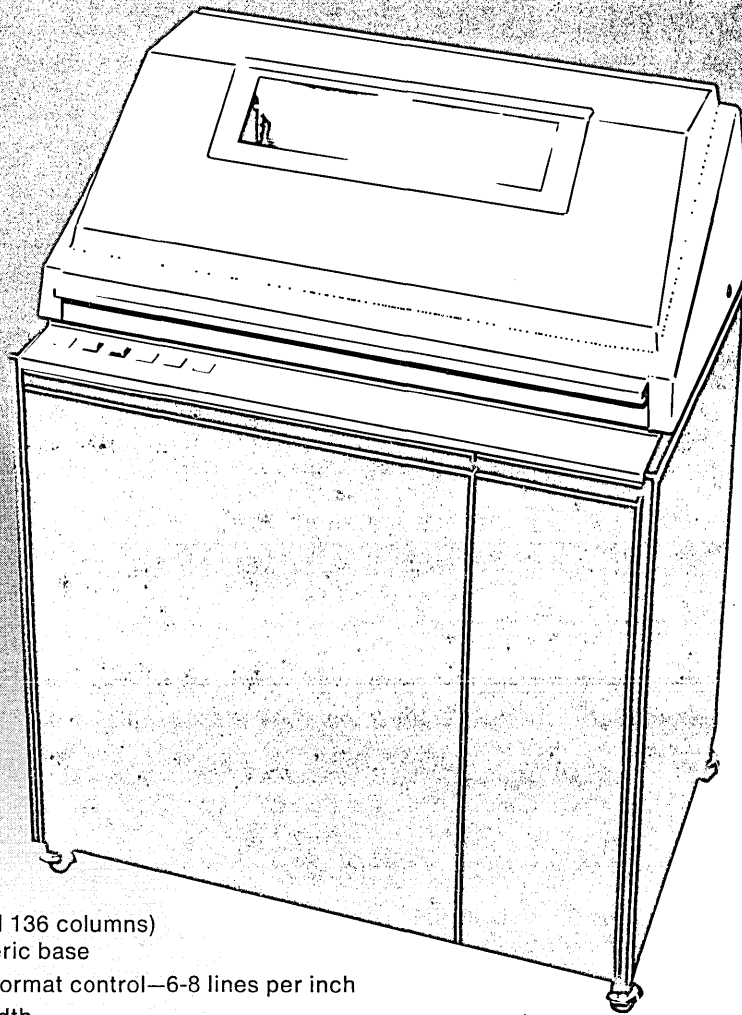
Even if firm grounds for a lawsuit can be established, Duggan doubts that owners will find it worth the effort. Class action suits have been suggested but, he explains, because of difficult stipulations, they would probably take twice as long as an independent action. They also would require about \$150K to \$200K right at the outset.

Duggan is of the opinion that concerned owners ought to file a complaint with the Justice Dept. about the matter, if only for the record, in case of

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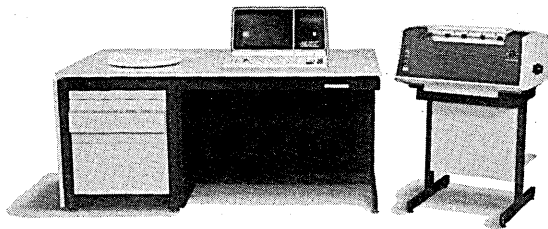
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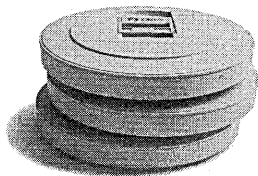
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news in perspective

future instances of early obsolescence. "If you don't exercise your rights, they evaporate."

For those relying on IBM's sticking to tradition, one user warns that when it comes to dealing with customers, "Frank Cary is tougher than Learson."

—Angeline Pantages

Privacy

The Problem Doesn't Alarm Bureaucrats

Anyone wondering whether data banks are endangering his privacy will learn a lot from recent hearings conducted by a House Government Operations subcommittee. Not that the subcommittee uncovered any nefarious schemes to convert us all into Orwellian ciphers. Rather, the hearing shows how administrators of federal information systems feel about the privacy problem. Considering the strategic jobs these bureaucrats hold, their comments were not exactly reassuring.

For example, Robert Knisely, of the Dept. of Housing & Urban Development, was asked whether a local government, before receiving federal funds to develop a computerized management information system, should be required to pass a law making it illegal for any unauthorized person to get into the system.

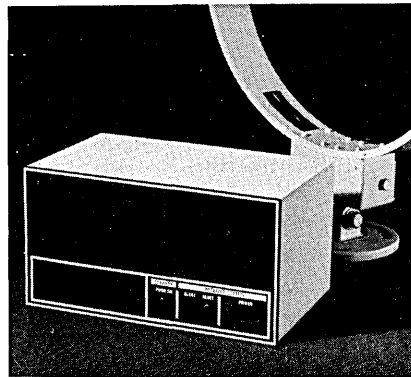
"I am somewhat hesitant about coming in as a federal official and attempting to hold out money in exchange for the passage of legislation," he answered. Knisely manages the "USAC Program," an effort to develop a model computerized management information system for the nation's municipalities. About \$18 million in federal, state, and local funds has been invested in the project since FY '70, when it began. Systems are under development in five cities, and Knisely reported that "a very large number of other municipalities" want to crank USAC software into their own operations "as soon as possible."

Radio network

Another witness, Ren Read, who works for the Defense Civil Preparedness Agency in the Pentagon, told the House subcommittee about Decision Information Distribution System (DIDS)—a low-frequency radio network being developed to warn people quickly of impending enemy attack. If this system materializes, which seems likely, we will all be asked to buy a specially-designed, two-chip radio receiver capable

of receiving DIDS warning broadcasts. In many cases, the chips will be attached to new radio and TV sets before they leave the factory, and the price will be hiked accordingly. The receiver will cost less than \$10, Read said. To make this investment more appealing, the DIDS receiver will also warn listeners of impending floods, hurricanes, and other natural disasters, and will provide other services which the Pentagon is still evaluating. The disaster-warning function requires receivers to be discretely addressable, Read explained, adding that logic to do this has already been developed.

After admitting to the subcommittee that the DIDS receiver "could be" converted into a transmitter, Read was asked whether it might be a good idea to enact a law making this a crime. His agency's general counsel, Charles Manning, answered, "We would first have to address the question of wheth-



RADIO RECEIVER for Decision Information Distribution System (DIDS) is being installed in government offices in 10 eastern states to receive broadcasts of impending disasters from Defense Civil Preparedness Agency. Outdoor antenna is in background. Plans are to seek funds to install receivers on new radio and TV sets, thus opening network to individuals. Agency says coast-to-coast network could be in operation before 1980.

er it should be a federal or state law. I am not sure current statutory provisions, from the federal standpoint, would not be adequate."

Later, a coterie from the Social Security Administration (SSA) admitted at the hearing that anyone can obtain an individual's SSA earnings record if he can supply the correct name, social security number, and birth date. "We are . . . in the middle between the need to effectively serve people . . . and the need to protect the privacy and confidentiality of our records," said SSA division chief Richard D. Shepherd.

Elsewhere in his testimony, Shepherd reported that in FY '72, SSA filled

302,000 requests for its records from other federal agencies, including 105,000 requests from the Internal Revenue Service. None of the individuals represented by these records was notified, he added.

A spy system?

A major reason for convening the hearings was that the chairman of the subcommittee, William Moorhead of Pennsylvania, became uneasy last winter after reading a report prepared for the President's Domestic Council (December 1972, p. 90). The report described a number of information systems being worked on by various federal agencies, including the DIDS project, which Moorhead called "a Nixon administration plan for a potential government-operated propaganda and spy system."

Read, the DIDS administrator, tried to allay these fears by stressing that the system is still being tested, no decision has yet been made to deploy an operational version, and no deployment funds have yet been obtained. But it's doubtful that he succeeded.

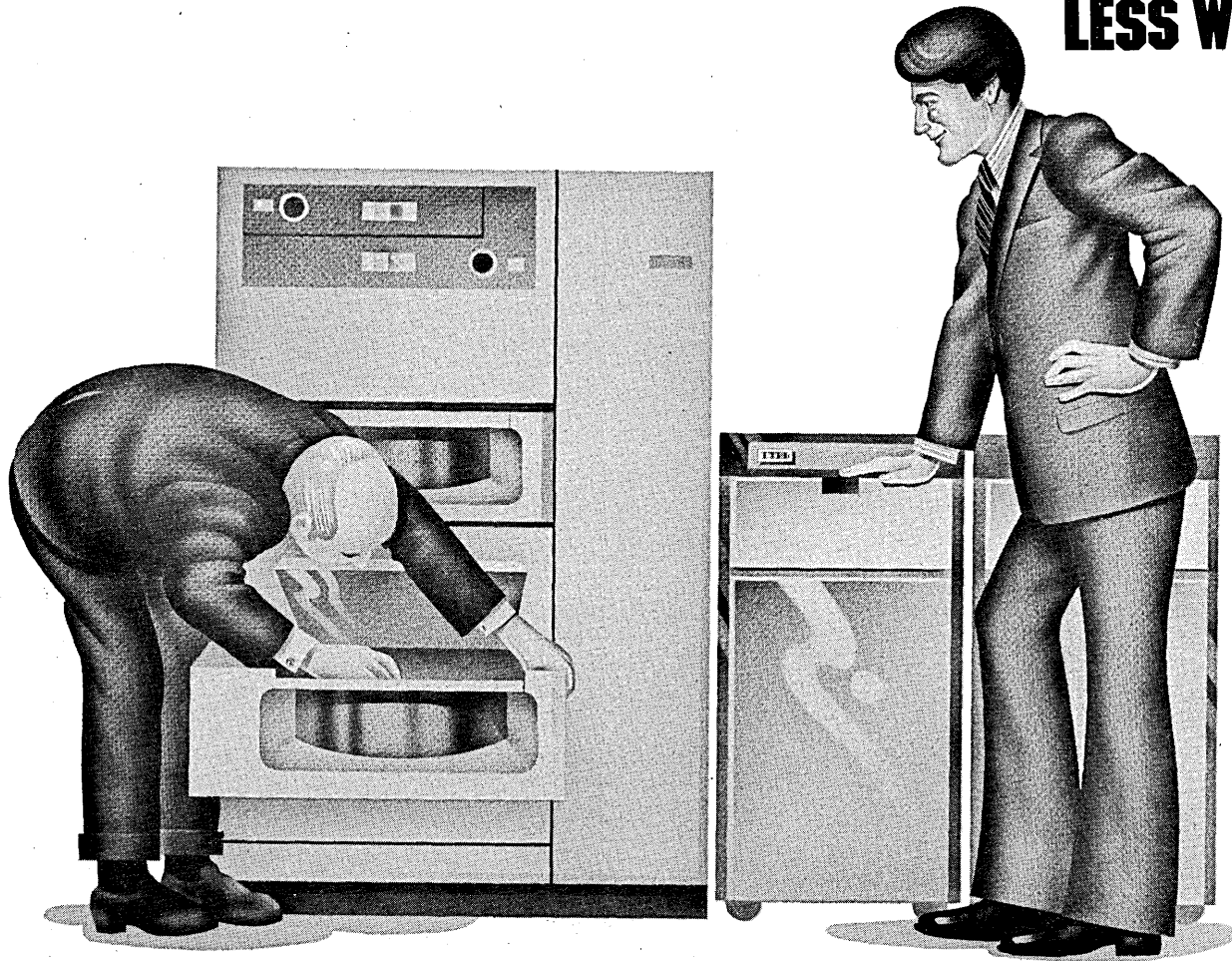
Said a subcommittee staff member who asked not to be identified, "They'll ultimately decide to go ahead with DIDS because they'll be evaluating only its *technical* performance, not its political possibilities. Technically, I'm sure DIDS can be made to work well. What bothers me is the possibility that it will be used by a President or a White House aide to spread misinformation. Granted, this is a remote possibility. Granted, the technicians who design and deploy the system don't intend it to be used that way. But recent events have shown rather clearly that remote possibilities can become immediate realities, and that federal agencies and resources can be used in ways that weren't originally intended. The Committee to Re-elect the President (CREEP) has made a lot of Americans feel creepy about their government."

Information tyranny

Much the same thought was expressed a few months ago by Dr. Jerome Wiesner, president of MIT and science adviser to presidents Kennedy and Johnson. Wiesner, keynote speaker at the annual meeting of the International Communications Association, said, "I used to suspect that it would be much easier to guard against a malicious oppressor than to avoid being slowly but most surely dominated by an information Frankenstein of our own creation. Watergate has demonstrated I was clearly not worried enough about improper uses of technology . . . the great danger is that 1984 could come to pass, because each step in the development of an 'information tyranny'

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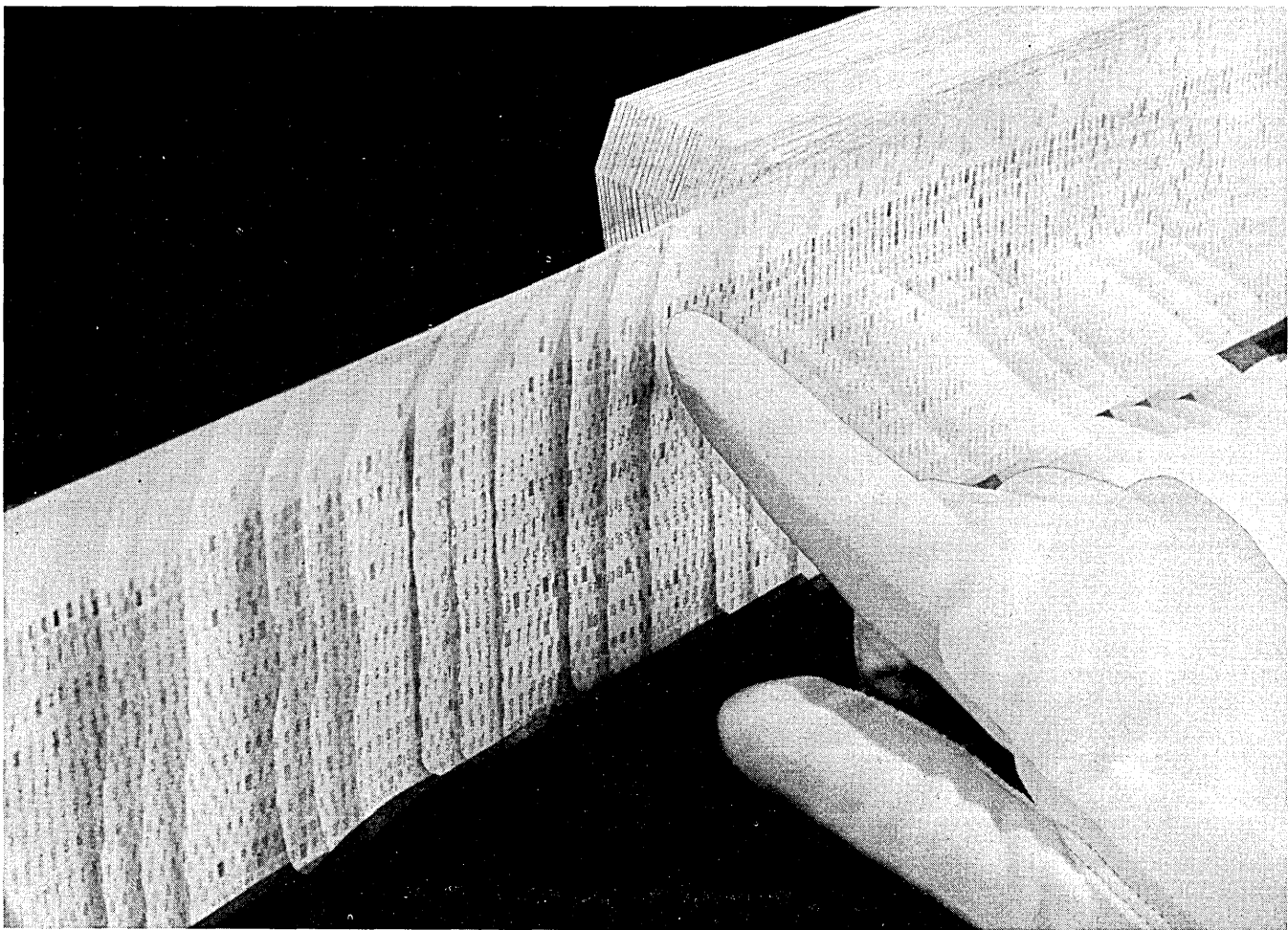
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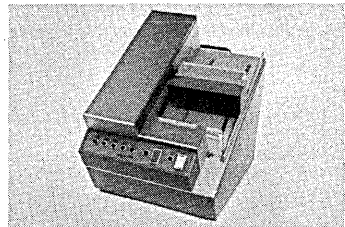
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One way of building such an "information tyranny" would be for a federal agency, say the Department of Agriculture, to gain access to the income tax returns filed each year by the nation's three million farmers. The initial justification could be completely legitimate. It might go something like this:

In order to estimate U.S. crop yields, the Agriculture Department must send questionnaires periodically to a representative sample of the farm population. Analysis of individual income tax returns is the best, most cost-effective way of determining which farmers should receive the questionnaires. Later, after the department received authority to look at individual returns, other federal agencies could request the same authority. They would present an equally reasonable justification, and would almost certainly indicate that it's unfair to give to one federal agency what is denied to the others.

Eventually, somehow, the income tax data could get used for an ulterior purpose—maybe a presidential re-election committee would use it to solicit campaign contributions; maybe a government official who had direct or indirect access to the information would use it to harass somebody he didn't like.

Now, back to the real world.

Last January, President Nixon issued Executive Order 11697, allowing the Department of Agriculture to look at the income tax returns of the nation's farmers. The department wanted to construct a representative sample of farmers who could supply crop estimate information. Officials explained that the best, most cost-effective way of selecting the respondents was to analyze their federal tax returns.

Limits, but allows

Congressmen Jerry Litton of Missouri and Bill Alexander of Arkansas contended that the executive order violated farmers' privacy, and after hearings were held by the House Agriculture Committee, the president issued a new order, No. 11709. It limits the Agriculture Department's access to income tax records, but still allows officials of the agency to inspect key parts of an individual return directly and copy from this document "one or more measures" of the size of the taxpayer's farming operation. As Congressman Litton put it during a hearing held by the House Government Operations subcommittee, "almost any

piece of information on the return could be considered a measure of the size of the taxpayer's farming operation."

Assistant Atty. Gen. Robert Dixon, who reviewed the president's first executive order before it was issued, admitted to the House subcommittee that this order "was prepared . . . in language designed to serve as a prototype for future tax return inspection orders," enabling additional federal agencies to analyze individual income tax returns.

The hearing also disclosed that the Agriculture Department has been granted considerably more authority to look at income tax records than it asked for. The department's original request, made in 1970, "was subsequently revised and its scope was broadened during the review process in the Treasury and Justice Departments," said Don Paarlberg, the official in charge of the crop estimating program.

Asked by Congressman Alexander what he would do if "the White House" requested names and other data collected under the authority granted by

Identifier Use Fares Badly with Committee

The concept of a standard ID for each person in the U.S. might sound good to some people, but it didn't go over well with a Department of Health, Education and Welfare committee.

In a report just issued, the Secretary's Committee on Automated Personal Data Systems found that the dangers inherent in a standard unique identifier, "without legal and social safeguards against abuses," far outweigh any of the practical benefits."

The dangers exist even in the use of the de facto standard identifier, the social security number (SSN), according to the committee established by former HEW secretary Elliot Richardson. The committee warned that the SSN is not a unique label. More than 4.2 million people have two or more SSN's; 39 taxpayers share the number 078-05-1120. Because of these obvious limitations, the committee recommended that use of the SSN be limited to federal programs with a legislative mandate to use it. But, legislation still is needed to protect the SSN from shifting more and more toward becoming a unique identifier.

The HEW report is based on lengthy conferences the committee held last year on automated personnel data systems, with particular attention given to

Executive Order 11709, Paarlberg said "I'd quit." Alexander commended him, then indicated that this might be necessary someday. The congressman referred to recent newspaper stories alleging that last year, the Nixon campaign committee obtained a list of subscribers to U.S. State Department publications and solicited these individuals for political contributions.

One interesting question raised by this whole affair is whether the Agriculture Department can make *any* use of income tax data without violating individual rights. If income tax information obtained from a particular farmer persuades the department to take action adverse to that individual's self-interest—like reducing his crop subsidy—he may have a basis for a lawsuit.

A related question was considered last year by the Ninth Circuit Court of Appeals in *Garner v. U.S.*, a case involving a taxpayer found guilty in a lower court of violating gambling laws. The evidence against him included his income tax return. The court overturned the conviction, saying that the feds, by requiring Garner to file a tax return and then using the information against him, was abridging his privilege against self-incrimination.

—Phil Hirsch

use of the SSN as a likely universal ID. It's already being used to identify students, welfare recipients, and owners of bank accounts, among others (December 1972, p. 90).

The committee added in its report that individuals should be required to disclose their SSN's only to those government agencies that, by law, are entitled to obtain this information. When an individual refuses to disclose the SSN, and loses benefits as a result, he should have the right to legal redress, the report recommended.

Controlling the data

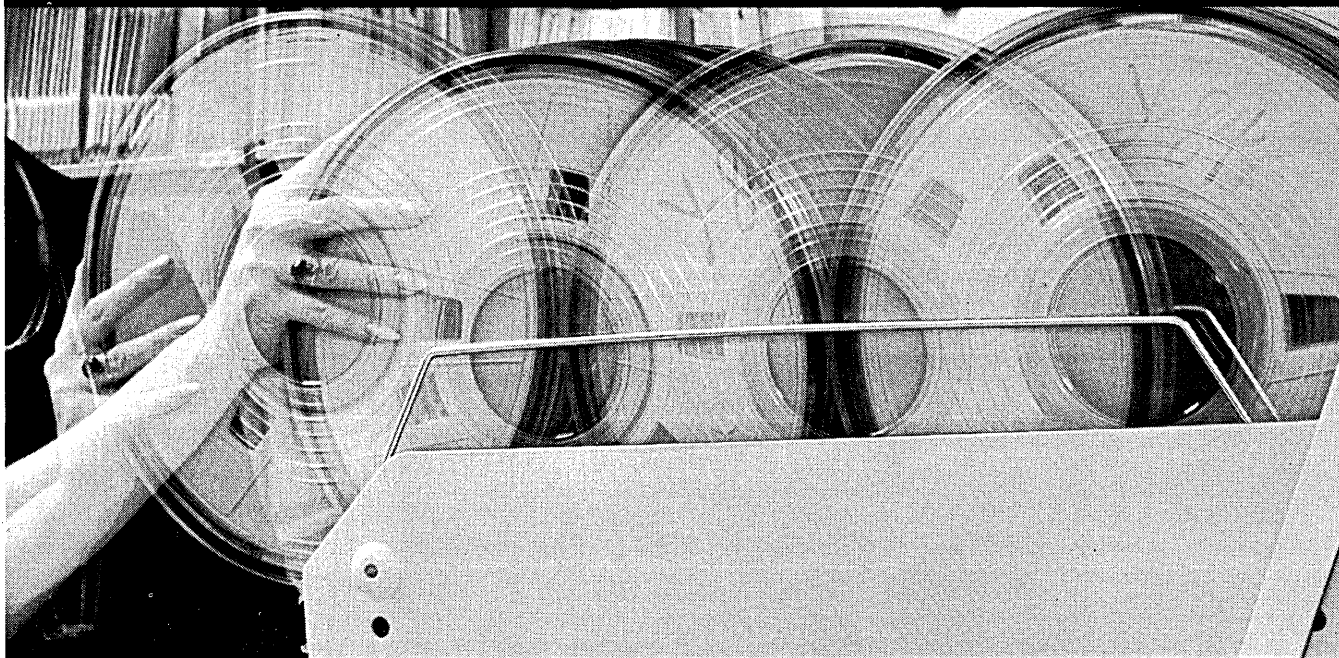
One effect of a universal individual identifier would be to make it easier to integrate personal files now maintained independently by private and government organizations. To control the abuses that might result from such easy access to vast files on individuals, the committee:

— Endorsed a Code of Fair Information Practices, which would define such practices and give the individual the right to bring suit to "recover actual, liquidated and punitive damages in individual or class action."

— Recommended amending the Freedom of Information Act to require a federal agency to obtain the consent of an individual before disclosing information about him.

— Advocated amending the Fair

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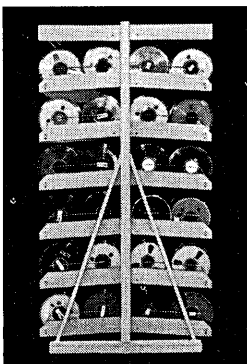
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DATAMATION

news in perspective

Credit Reporting Act so that an individual could personally inspect his records and copy their contents.

— Said that methods must be provided for an individual to find out what information is stored on him in data banks and how it is being used. These methods would also give the individual the right to correct or amend the record. The committee also endorsed another safeguard requirement

which would have the agency obtain the individual's consent before transfers of data take place.

Rep. Barry Goldwater Jr. will be introducing legislation shortly which will address precisely this issue. Although this legislation is not yet drafted, it will involve the individual's right to see records the government holds, and other issues.

Security

IBM's Merlin Heist: The Roundup Starts

It was in the spring of 1971 that the disappearance of property from IBM's San Jose plant in California was reported in these pages. The facility, responsible for IBM's disc file development and production, was said to have lost a part of a 3330 when that system was still supposed to have been an enigma to competitors.

But it was not until late last June that the first of a number of arrests was made, the suspects being charged with felony, theft of trade secrets, conspiracy, receipt of stolen property, and offering or accepting inducement to steal trade secrets. At the time of the arrests, those apprehended included one current and two former IBM employees and a current and a former Memorex employee. But no action was

taken to imply any wrongdoing on the part of Memorex.

Said to have been stolen were plans and drawings for the 3330, code-named Merlin, and the more recent Winchester file, the 3340. A valuation of \$160 million was placed on the 3330 data, possibly higher for the 3340 specs.

Search warrants were issued for the homes of the seven of the 10 arrested, as well as the premises of five companies: K & K Manufacturing, Inc., Campbell, Calif.; Sigma Technologies, Inc., Phoenix, Ariz.; Computer Disc Mastertape, Torrance, Calif.; International Management Systems, Inc., Irvine, Calif.; and Forro Precision, Inc., Woodland Hills, Calif.

Companies

IteI: Shedding Another Risk

Although still very much in the computer leasing and services business, IteI Corp. of San Francisco has decided to get out of the computer manufacturing business. In 1971, it left the office products manufacturing business and last year sold its interest in Diablo Systems, Inc., to Xerox Corp. Last month it made a clean sweep, selling off its last manufacturing operation, Information Storage Systems (ISS), to Univac for about \$30 million.

IteI acquired ISS in 1971 for stock valued at that time at about \$35 million, but has carried the subsidiary on its books at a value of \$12 million. The company's exec vp Gary Friedman said the sale does not mean that IteI has lost faith in the independent peripheral manufacturing business, but he didn't elaborate, except to say, "We keep the benefits of ownership and none of the risk. We still get products. We have arrangements to get future products."

ISS has arrangements to sell 3330-

equivalent disc drives as well as 2314 equivalents and double-density files to IteI, Telex and Storage Technology Corp. The arrangement will continue under Univac ownership. Univac made an initial payment of \$23 million in cash to the San Francisco company and additional cash payments of about \$7 million will be made on the basis of ISS sales to customers other than Univac, which will operate it as a subsidiary.

ISS also has an agreement to manufacture a \$15 million word-processing system for Xerox Corp. Company officials are vague, though, on when mass production will start, noting that the date is being continually delayed.

Once almost exclusively in the IBM 360 leasing business, IteI in recent years has diversified into other leasing fields including commercial aircraft, railroad cars, oil tankers, barges and plant facilities. It is a pioneer in the "full systems lease" concept, leasing IBM 360 and 370 cpus with peripherals supplied by ISS

and other independents, and memories from Advanced Memory Systems with which it has some exclusive marketing arrangements. It also is engaged in the computer service bureau business.

The move benefits both parties. Univac gets its long-sought capability in large storage disc drives and IteI, while retaining a source for the product, is freed of the risks that the independent plug-compatible manufacturers face from IBM. Said Friedman, "There's no question but that IBM is trying to close in on that area."

International

Europe: Unidata Born, ICL Gets its Money

The future of the European computer industry begins to look clearer.

The biggest British manufacturer, International Computers Ltd. (ICL), has obtained \$100 million from the U.K. government for some of the development and launching costs of a new line of computers. On the same day the agreement was announced, Compagnie Internationale pour l'Informatique (CII) of France, Siemens, of W. Germany, and N. V. Philips' Gloeilampenfabrieken of the Netherlands, signed a long-awaited agreement establishing a joint organization called Unidata.

Unidata is the trade name under which the nine systems being made by the three will be sold. But the agreement is aimed at consolidating a base for a new IBM-compatible series, mini-processors, and keyboard machines.

Both arrangements have emerged from slow and painful negotiation. But they should provide a stability over the next few years that is vital to creating confidence in the European-based computer industry. It has not been reached without bloodletting.

In Britain, the government wants its money back over a seven-year period between 1978-1985 from ICL's pre-tax profits. The company's managing director, Geoffrey Cross, says that is feasible and Christopher Chattaway, the conservative minister for industrial development, concurs. But the terms of the repayment left some observers doubtful. Repayment begins when ICL's pre-tax profits rise above 7½% of turnover and continue up to a maximum of 25%. ICL's profits haven't reached 7½% for more than 10 years. This means, as Chattaway told a press conference, that ICL is going to have to retain most of its earnings.

ICL thinks it will spend \$400 million to launch the new series, but much of this figure covers the writeoff when the new systems begin to impact ICL's ex-

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Terminal and teleprocessing I/O are handled as logical units. VTAM is extraordinarily easy to use; application-level programming is all that's required.

Perhaps the most important feature of VTAM is its flexibility. It functions equally well as a base in a broad range of communications applications—from systems dedicated to functions such as store and forward message switching or front end processor. Or, the communications may be a supplemental function to other processing tasks. Like remote inquiry into an instrumentation data base. Or satellite processor connection with a distributed processor network. Even data exchange with a remote host computer after local processing.

And modularity lets VTAM handle systems that range from one or two low speed lines to large multi-node

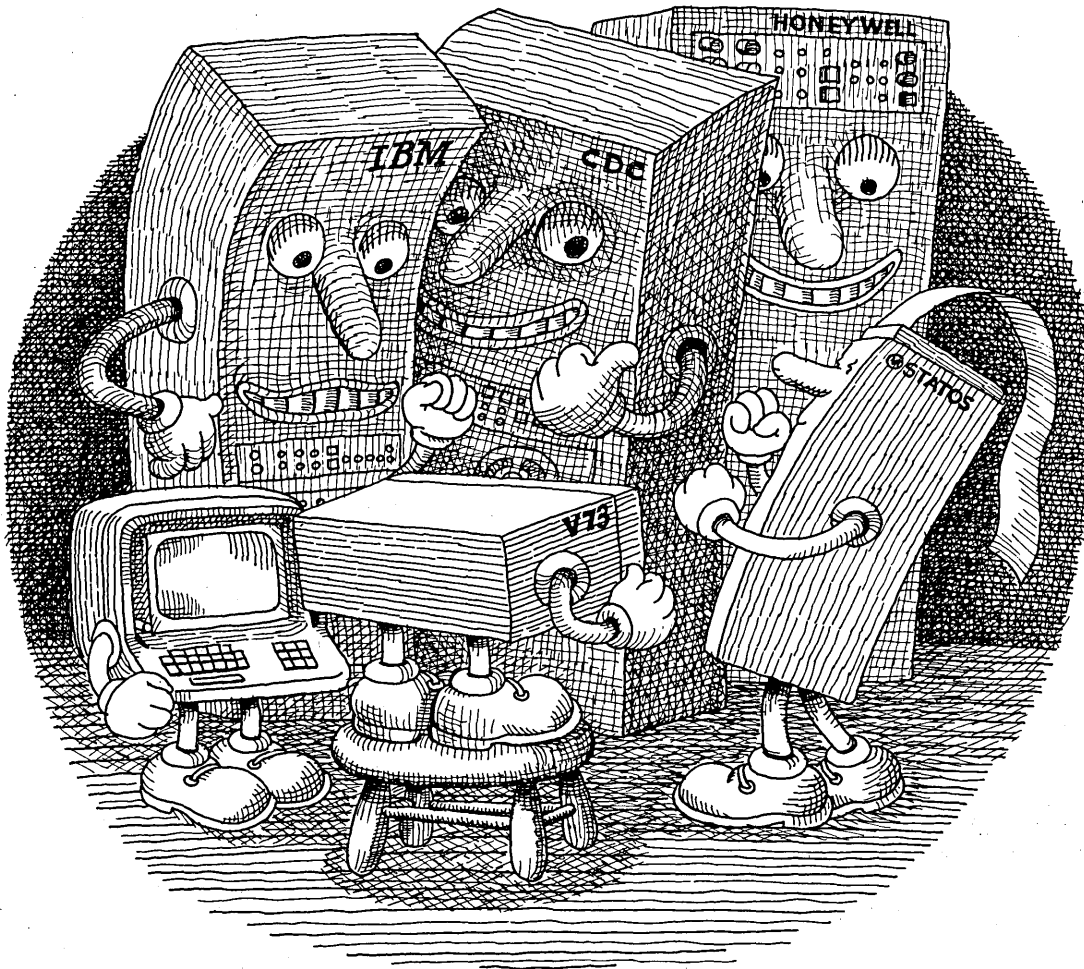
networks. From simple teletypes to the most complex line disciplines.

Our microprogrammed, message mode Data Communications Multiplexer completes the hardware/software package and takes full advantage of our multi-bus, extendable architecture 330 nsec V73. With message mode communication, software overhead is minimal. VTAM and our other data network or stand-alone packages are available now. At far less cost than you would have thought possible in a system this size.

For the full story write Varian Data Machines, 2722 Michelson Drive, Irvine, California 92664 or call (714) 833-2400.

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VTAM. Varian's reply to some very big communications talkers.



news in perspective

isting 1900 and Systems 4 lines.

Mindful that the computer manufacturer already has swallowed more than \$150 million in past government aid, the U.K. government took more than a year before consenting to this new loan. It demanded a management overhaul and a close monitoring of the company's performance. In compliance, ICL has chopped its work force to 24,000 from a peak of 38,000 at the end of 1969, and overhauled its management. Cross joined the company from Univac last year. But what really clinched the loan was Cross' detailed accounting to the government in July showing pre-tax profits in the current fiscal year of \$11 million on a turnover of \$200 million.

A major part of ICL's new model costs will go to developing software for data base management on systems to be upgraded by federal and local government customers. In the non-government sector, the effort is toward a system that would rival the Burroughs B1700 in soft machine architecture. In fact, ICL last year held cross-licensing talks with the Detroit company, but was unsuccessful. The company has an acute compatibility gap to bridge between its existing systems and any new series. Cross seems confident, though, that all of this can be done without being forced into slavishly following an IBM architecture.

This is where the difference lies between ICL and the new Unidata group.

Mostly equal

Unidata is owned on an equal partnership to act as a holding company to control all of its commercial activities. But each partner has a major stake in the operating company in its own country. Hence Unidata (Germany) will be 80% controlled by Siemens; Unidata (France) will be 80% controlled by CII, and the Philips group takes the 80% in the Netherlands operation.

In all other nations, the equal share rule applies. Agreement between the three companies was delayed by a dispute between CII and Philips over the products the new company would make. CII wanted to keep minicomputers out of the partnership, but this is one of the natural strengths of Philips. As the largest European communications manufacturer, Philips has developed processors for telephone switching and data communications that are natural front-enders for Unidata systems. Philips also has the widest experience in visual display developments of the three. Its existing dp

company, Philips-Electrological, is entrenched in the small-to-medium user market with new direct entry systems using some of this computer-communications equipment.

At the other end of the product spectrum, Siemens has chosen the main processor family for direct compatibility with IBM. There is reason to question this approach. Replacement of IBM equipment may seem an obvious tactic, but customers may find they cannot transfer unbundled software from IBM directly onto another system without infringing on binding contracts.

—Pearce Wright

Benchmarks

Positive If: Memorex Corp. last month was out of the mainframe computer business and in a very iffy financial position. The Santa Clara, Calif., firm faced a potential \$85 million in write-offs and had more than \$200 million in senior debt. Trading of its stock on the New York Stock Exchange had been suspended. *If* negotiations with Singer Co. (Singer would invest \$15 million in exchange for equity securities, which would have a majority vote, and would give them the right to obtain a majority of Memorex's common stock) could be favorably concluded, and *if* Memorex creditors would agree to convert their debt into preferred stock, the company still would wind up with a positive net worth. Otherwise, the firm said, its net worth would be negative, which probably would lead to permanent delisting by the NYSE.

Another Specialist: Giant International Telephone and Telegraph Co. became the latest to seek entry into the specialized common carrier business in an application filed with the Federal Communications Commission last month. ITT's subsidiary, U.S. Transmission Systems, Inc., wants to build a microwave system covering 4,000 miles between New York and Houston, with service to Philadelphia, Washington, D.C., and Atlanta. Part of a planned nationwide network, it would have the capacity to transmit 1,800 individual phone conversations or transmit data and facsimile messages. The New York-Houston leg would be built on the right-of-way of a pipeline owned by Transcontinental Gas Pipe Line Corp. which has a 2% interest in the ITT subsidiary. First reaction from independent carriers was that ITT may be forbidden from entering the domestic

communications market because it's the parent of ITT World Communications, Inc. The Federal Communications Act bans international common carriers from the domestic market.

Certifiers Incorporate: The newly-named Institute for the Certification of Computer Professionals expected to be in business this month when it files papers as a Delaware corporation. Formed last fall as the Computer Foundation, the institute plans an election meeting in September to be followed by negotiations with the Data Processing Management Association (DPMA) to take over that group's Certificate in Data Processing (CDP) program. John K. Swearingen, co-chairman of a committee that organized the institute, said 10 societies, representing some 75,000 computer professionals, will join late this summer and early fall, committing loans of around \$20,000 during each of the institute's first three years in operation. Among the charter societies are the DPMA, Association for Computing Machinery (ACM) and the IEEE Computer Society.

Eased Imports: Restrictions on the importation of computers are due to be liberalized by the Japanese government during 1975, more than two years earlier than had been recommended by the Japanese computer industry. Earlier this year, it had sought a delay in the liberalization until after April 1977. If the government should wait until the end of '75 to lift these restrictions, the date could coincide with the opening of the hardware end of the industry to 100% foreign ownership. Not until April 1, 1976, can a software house in Japan be owned totally by foreign interests. Under the liberalized import rules, it remains to be seen what manufacturers benefit most, and which ones were merely using the legal restrictions as a crutch to explain an unsuccessful marketing effort.

Too Much or Too Little? A conference committee is trying to resolve a \$30 million difference in the '74 fiscal year authorizations for the National Science Foundation, voted recently by the Senate and House. The Senate authorized a total of \$130 million in computer-related money. Of that amount, \$111.7 million would go to the NSF's Research Applied to National Needs (RANN) program; \$41.2 million more than the Foundation requested. Ten million dollars is earmarked for research in computer science and engineering and related computer activities, and \$8.3 million is slotted for science information activities. A scaled-down House version authorized \$87.8 million. □

Hardware

Off-line

In upcoming issues Datamation will publish surveys of crt terminals and general-purpose hardcopy terminals that operate at speeds above 30 cps. If your firm produces either or both of these types of products, please write for a questionnaire to Datamation, 1801 S. La Cienega Blvd., Los Angeles, CA. 90035. Attn: Hardcopy Terminal Survey, or Attn: Crt Terminal Survey.

Datamation reported (March, p. 161) that IBM might change to a 9-bit-plus-parity byte that, while being transparent to user programming at present, might be the cornerstone of a future announcement that 370s could efficiently represent data in character codes other than EBCDIC. An industry observer has told us that the change-over to 9+1 logic and memory chip production has been made (no later than last March) and that the 8-bit byte is no longer being produced.

A Varian 620/f minicomputer is helping researchers at the Univ. of Arkansas Medical Center investigate brain dysfunction in slow-learning children. The mini will be used principally to reduce large amounts of data taken from tests measuring each child's response to various stimuli, such as light flashes, sounds, and spoken words. Because these responses are mild and difficult to detect, the mini will be used to distinguish between true patient responses and normal brain activity.

It appears that the techniques used to assign model numbers to computers is often as logical as the products. Rumor has it that when Bill Norris and associates left Univac's Roseville, Minn. facility 16 years ago to form Control Data, shop was set up in nearby Minneapolis. The first product from the 501 Park Ave. address was intended to be a "better" 1103 than the team had been working on at Univac, the sum of the numbers, 1604, was chosen.

32-bit Computer

Decreasing circuit prices and mini-computer packaging techniques are credited by Modular Computer Systems' president for his firm's being able to offer a 32-bit computer with 8K words, 240 general-purpose registers, 64-bit floating-point hardware, and 1K 12-bit virtual memory mapping registers for only \$23,500. The MODCOMP models IV/10 and IV/25 have an additional bonus in that they are upward compatible with the firm's 16-bit com-



puter line. Maybe we should say compatible with what is left of the firm's 16-bit product line: the 32-bit MODCOMP/IV's price is very close to the firm's MODCOMP/III, and the performance of the IV clobbered the III so badly that the III is being withdrawn from the market.

The IV's cycle time is 640 nsec, which applies to a choice of core or semiconductor (MOS) memory. There are bit, byte, and 16-bit word instructions, and stack processing instructions on the IV. Another unusual feature of the machine is its ability to switch the contents of the general-purpose register files and the address mapping register files. The IV/10 has all of the features of the IV/25 except the 240 g-p registers and 1K address registers. Its price is \$18,500.

Software includes the MAX III real-time operating system, FORTRAN IV, BASIC, and a macro assembler.

A complete line of peripherals is offered for the computers, with initial deliveries scheduled for early next year. MODULAR COMPUTER SYSTEMS, Fort Lauderdale, Fla.

FOR DATA CIRCLE 338 ON READER CARD

3-D Graphics System

If you saw the dramatically realistic graphic representations in the movie "2001" showing such things as a pilot's eye view of a space station as he maneuvered to land in it, you have a

good idea of what THE PICTURE SYSTEM can portray. Almost incredibly, the "2001" computer displays had to be hand-drawn from information calculated by computers; there was no graphics system around at the time which could provide true three-dimensional views from infinity down to actually entering an object. About the only thing THE PICTURE SYSTEM can't do is calculate and display all the shading variations an object undergoes. And no color... yet.

The hardware is a DEC PDP-11 driving a matrix arithmetic unit that supplies information to a vector generator. The generator can write the longest line across a 21-inch crt in 20 usec. The resolution is 4K x 4K points. Up to several thousand line segments can be constantly refreshed with no noticeable flicker in 256 intensity levels. Image refresh is independent of the incoming information rate. Another aspect of the system that seems to set it apart from others we've seen is the "intelligent" matrix arithmetic unit. If it sees that you are performing certain kinds of picture manipulations more than others, it alters its time-sharing algorithm for those functions dynamically, and only spends its time processing data that will actually find its way to the crt, first looking at how it has been told to zoom or clip the object image.

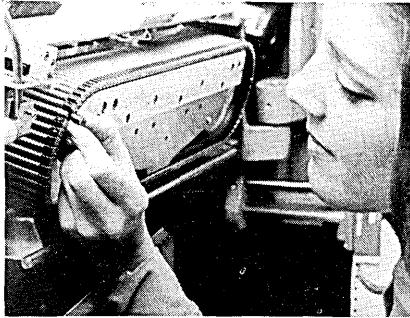
A typical system, consisting of a 4K PDP-11, scope, graphic tablet, desk and tty is priced at something under \$80K. Included in the price is basic graphics software for calculating viewpoints and managing the source information data base. EVANS & SUTHERLAND COMPUTER CORP., Salt Lake City, Utah
FOR DATA CIRCLE 323 ON READER CARD

The Charaband Printer

Data Products is one of the technological leaders in the building of printers, and for some time has been showing potential oem customers a unique design called the charaband printer. It differs from conventional chain, train, and drum printers in that it uses a steel-belted polyurethane band, with print slugs permanently attached to it, which rides on a roller bearing roadbed. The type caps are easily removed from the slugs, allowing operators to install seldom-used special characters on the band for special printing requirements, or for maintenance personnel to easily replace worn characters. Each character band holds two different character sets since every plastic cap can hold two characters. The object of the new ap-

proach was to produce a printer capable of very high quality and quantity printing and to reduce the need for numbers of expensive though seldom used special print trains.

The model 2550 is the first production printer using the new print band. It prints 1250 132-column lines a minute with ocr-quality appearance, while



for standard printouts the rate jumps to 1550 lpm, based on a 45-character subset. Sets corresponding to the IBM 1403 N1 and 3211 printers will also be available on charabands. An IBM-compatible 12-channel carriage control tape reader or a program-control unit can be selected by oem's, and a power paper stacker is also available. For orders of 80 or more 2550 printers, the price is \$18K each. Production models will be available next spring. DATA PRODUCTS CORP., Woodland Hills, Calif.

FOR DATA CIRCLE 344 ON READER CARD

Remote Batch Terminal

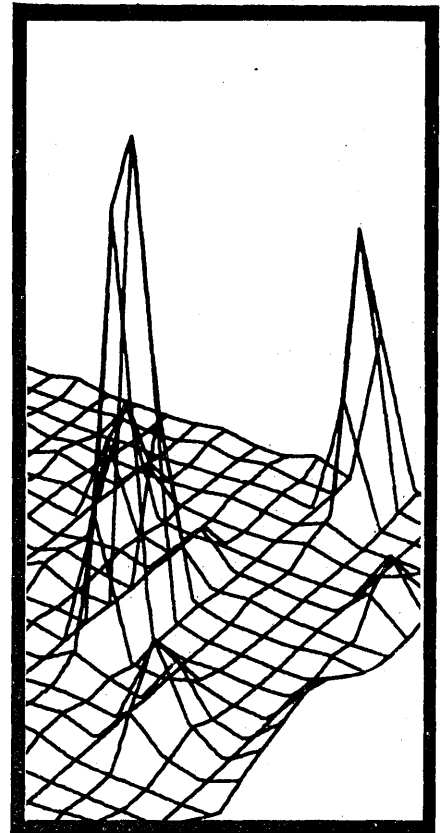
Many batch terminals use a small minicomputer for a controller, and while these products perform their intended functions adequately, most aren't ready to take on any added responsibilities. Electronic Associates' batch terminal, the SPACER, is different in this respect because it is built around the manufacturer's PACER 8-32K 16-bit minicomputer that can be expanded from 8-32K of 1-usec memory. With this much processing capability, the SPACER can hold communications programs that allow it to talk to any computer you can think of, and support high-performance peripherals at the same time. An 8K SPACER, with a 300-cpm card reader, 300-lpm printer (132-columns), and 4K communication controller for handling line speeds up to 9600 baud, is priced in the region of \$50K. A 1000-lpm printer is available. Deliveries are approximately 90 days. ELECTRONIC ASSOCIATES, INC., West Long Branch, N.J.

FOR DATA CIRCLE 324 ON READER CARD

Pc-board Minicomputers

A new, compact core memory module is the basis of Data General's latest minicomputer offerings, the Nova 2/4 and 2/10. The model numbers designate how many 15-inch square circuit boards the respective chassis can accommodate. The memory on the boards can be either 1.2 usec core (up

Computer users:

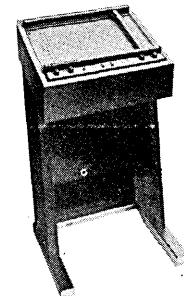


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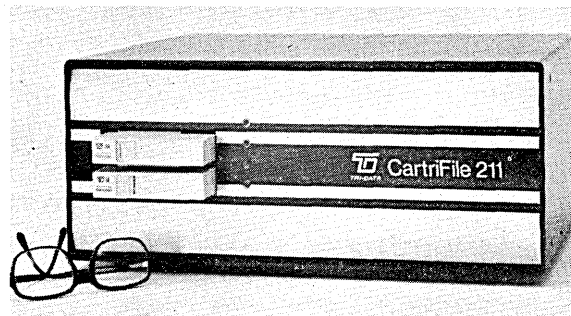


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product spotlight



Combination Peripheral

Why not design a controller that could supervise two different types of storage mediums so that it could share the data electronics, power supply, and interface? That is the basic logic behind the CartriFile 211, but Tri-Data has taken it a step further: the two ¼-inch tape cartridge drives and a 2.5 megabit disc have been combined into a single cabinet. The resulting mini peripheral system thus saves space, money (no second controller), and one minicomputer I/O slot.

In operation, the user can be reading or writing the disc while simultaneously loadpoint searching either or both tapes, or can be reading or writing one tape, loadpoint searching the other,

and positioning the two parallel disc heads. Each head looks at 64 tracks, and accesses take 10 msec track-to-track, 10 msec settling, plus 16.7 msec average latency (rotation) delay. The heavy-duty sealed tape cartridges are recorded at 1600 bpi on two parallel tracks at 15 ips, and come in lengths of 10, 25, 50, and 150 feet. All data transfers from the 206 handle data to the host mini as 8-bit bytes. The first interface available for it will be to PDP-11s, and interfaces for other popular minicomputers are scheduled. Complete with PDP-11 interface, the 206 is priced at \$5,995, with deliveries beginning in September. TRI-DATA CORP., Mountain View, Calif.

FOR DATA CIRCLE 320 ON READER CARD

hardware

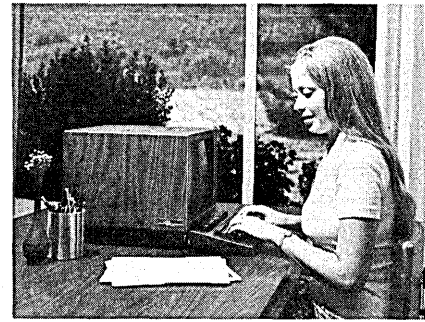
to 16K per board) or 800 nsec core modules of 4K and 8K, and the types can be intermixed in the computer. A 4K 2/4 is priced at \$3,850 and a Nova 2/10 with 32K is \$10,150. The minimum initial order is five machines, available in approximately 90 days. DATA GENERAL CORP., Southboro, Mass.

FOR DATA CIRCLE 336 ON READER CARD

Crt Terminal

The MINI-TEC gets this month's award for "most crt for the money," but

we've recently witnessed a number of inexpensive products introduced, and the parade may not be over yet. The MINI-TEC's price of \$1,300 for single units (\$995 each for an order of 500) suggests that it is a straight tty-compatible unit, but the unit is something more than that. The 12-inch diagonal screen displays 12 lines of 80 5x7 dot-matrix characters (24 lines are in the works), and features half- and full-duplex transmission at switch selectable rates ranging from 110 to 9600 baud, cursor controls, selected blinking, and field protection. Interfaces for the MINI-TEC include the tty current loop, RS232, and TTL for



oem's, with an interface for Burroughs equipment scheduled for early next year. First deliveries are scheduled for October. TEC, INC., Tucson, Ariz.

FOR DATA CIRCLE 342 ON READER CARD

A Brief Treatise on Data Transmission via Laser Beam

MORE BITS PER BUCK is the reason for a laser data link. You can batch up to 250 kb/s into its beam for less than \$10,000 complete system cost! That's 4¢ per bit! And no modems, licenses, cables, or recurring costs are involved, either.

***4¢**

NO WAITING, either, assuming you agree our 45 day delivery and installation is just a bit in the bucket compared to 6 months or a year for cable or microwave radio links. In fact, we can produce and install a complete full-duplex system in the time it normally takes to process the lease or purchase papers.

WHERE THE LDL SHINES BEST is at data rates from 40.8 kb/s to 250 kb/s. In other words, you can remote up to five 40.8 kb/s batch terminals via one laser data link and still maintain an error rate of only 10⁻⁸.

And we will guarantee electrical compatibility with your equipment.

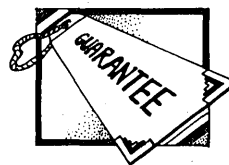
* Divide \$10,000 one-time cost by 250 kb/s and get \$.04 per bit total cost. How much does yours cost?



NEITHER RAIN NOR SNOW nor other atmospheric impair the LDL's performance at ranges of one mile or less, and operation in clear weather exceeds 7 miles (data on request).



NATURALLY, WE GUARANTEE the LDL to do



days to prove it.

IF YOU'D RATHER KNOW MORE FIRST, then just drop us a line and ask for our not-so-brief treatise on the Laser Data Link.

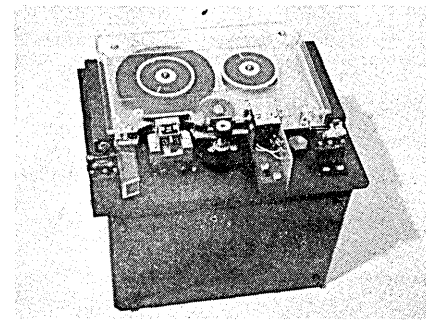
what we say it will and, what's more, we'll even let you try it out for 60



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Orlando, Florida 32805
(305) 843-4731 TWX (810) 850-0195
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Tape Cartridge Drive

This new company's first product is a tape drive that operates with the popular 3M DC-300A 1/4-inch tape cartridge. The TCD-300 conforms to the 3M proposed standard (ANSI 3B1/591), with a read/write speed of 30 ips, and a rewind/search speed of 90 ips. A number of read-after-write heads can be supplied with the unit for



recording at 800 or 1600 bpi across one, two, or four tracks. There is a growing number of similar drives already on the market, but this manufacturer thinks that what really makes the TCD-300 a better mousetrap is a unique latch mechanism that precisely aligns the recording head with the tape. In deck form, with a one-track read-after-write head, the TCD-300 is priced at \$300. Complete with motor speed control and read/write electronics, it's priced at \$695. Several units have already been sold and delivery is approximately 30 days. THREE PHOENIX CO., Phoenix, Ariz.

FOR DATA CIRCLE 348 ON READER CARD

High-speed Terminals

Centronics has added keyboards to two of its highly successful serial printers to turn them into high-speed KSR pre-printer terminals. The models 308 and 508 accept operator input through 64-character ASCII keyboards as fast as it can be typed, with computer responses printed at up to 120 cps across 80 columns on the 308, and at 100 cps

across 132 columns on the 508. An RS-232 interface is standard on end-user versions of the terminals. Options include a current loop interface and an additional 32 ASCII characters. Production quantities of the 308 will be available later this year for \$2,690 (single quantity end-user version), and the 508 will be available early next year for \$2,600. Nationwide maintenance for the terminals has been arranged. CENTRONICS DATA COMPUTER CORP., Hudson, N.H.

FOR DATA CIRCLE 346 ON READER CARD

Batch Terminal

The model 71 batch terminal is offered as a replacement for the IBM 3780 data communications terminal. It features logical compatibility with the 3780, binary synchronous communication at 2000, 2400, 3600, 4800, or 7200 baud, 512-character buffers, data compression/decompression, horizontal tabbing, and automatic answer/restart. Peripherals offered for the 71 include a 450- and 600-cpm 80-column reader; a 400- and a 600-lpm 132-column printer (64-character set) which is also available with 120-column capability, and punches ranging in speed from 59-200-cpm. Bisynch communications protocol at 9600 baud is also offered as an option. A model 71 with 300-cpm reader and 300-lpm printer rents for \$810/month on a one-year lease, including maintenance. Deliveries begin during the next quarter. DATA 100 CORP., Minneapolis, Minn.

FOR DATA CIRCLE 337 ON READER CARD

Small-scale Computer

In less than a year, PRIME Computer Corp. has become one of the "rising star" suppliers of oem minicomputers, and its third product, the PRIME 300, shouldn't tarnish that image. One of the reasons for the firm's success has been the importance it has placed on operational software, and the 300 is announced with a virtual memory disc operating system, DOS/VM, and a virtual memory real-time OS. Not only are the file structures of these two monitors interchangeable, PRIME's entire product line to date has had compatible software. FORTRAN IV, a macro assembler, and (very soon) BASIC also run inside the 300.

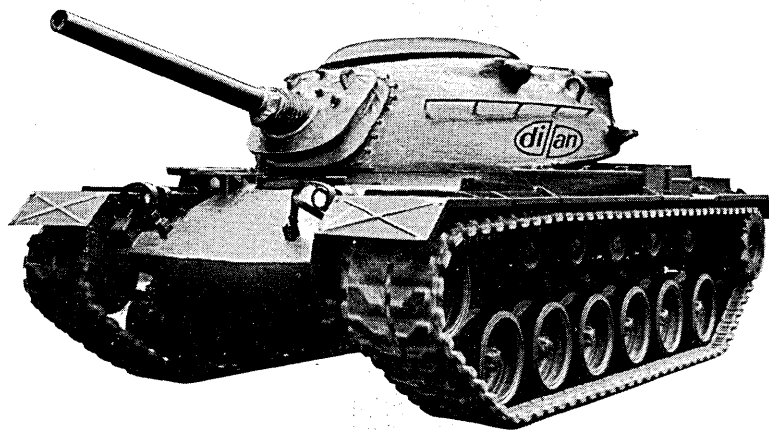
A 200-nsec CPU exercises up to 256K 16-bit words of MOS memory with its 164 basic instructions, and comes complete with hardware arithmetic (including floating-point), byte parity, eight direct-memory access channels, automatic program loaders, an asynchronous serial communications interface, 32 general-purpose reg-

isters, and a 64-level vectored priority interrupt scheme. But the feature attracting the most attention is a virtual memory ranging up to 50 million words in size, broken into 512-word pages. It is disc-based (roughly 12.5 million words per disc), with access times on the order of 35 msec and transfer rates of 6 usec/word. The basic 300 configuration, with 8K of memory and operator's console, is priced at \$12,500, and can be expanded to support virtual memory processing at any time desired. First systems go to oem customers in mid-September, with regular deliveries beginning approximately 60 days later.

PRIME COMPUTER CORP., Natick, Mass.
FOR DATA CIRCLE 326 ON READER CARD

Intelligent Terminal

The Sycor 250 is probably the most competitive intelligent terminal yet announced to do battle with the IBM 3270. Both hardware- and software-compatible with the 3270, the 250 system can be configured from a variety of equipment to tailor it to specific customer requirements. The equipment list includes a 9½ x 6½-inch CRT terminal expandable from 12 lines of 40 characters up to 24 lines of 80 characters, a byte-oriented processor



We make a very rugged Teleprinter.

When the work is hard and service is next to impossible, you need rugged equipment. That's why for 10 years the military and OEM's have specified Di-An printers for the remotest of installations (oil rigs in the Gulf of Mexico, power plants in Northern Canada and submarines in mid-Pacific). Small wonder people who know us want our 9030 Teleprinter. In fact, they've ordered thousands.

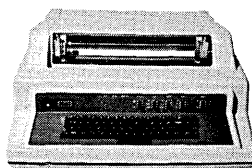
Why? It's tough... inside, where it counts. Just three rugged mechanical assemblies and advanced integrated circuitry have replaced the complicated movements common in other asynchronous impact printers. Our design offers highest reliability, low maintenance costs, plus a unique extra... unlimited life. (Any assembly that fails can be replaced in a half-hour or less.)

Di-An's 9030: 30 cps operation, 132 column printout, six-part copy, and some of the toughest features in the business. Production units have proven themselves. We KNOW it works.

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CIRCLE 84 ON READER CARD

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That's why so many people turn to us for assistance.

We've established our own service centers across the country. And we've helped a lot of organizations set up their own microfilm operations.

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Since we're familiar with how equipment is used, we can help you choose the units that are best for you and your operation.

If you have equipment preferences, we'll go along with you. Or we'll recommend the equipment that will do the best job at the lowest cost.

For example, there's the Northstar 3700 Computer Output Microfilmer—one of the easiest to use COM units available. It can produce clear, sharp images on 16 or 105 mm film, or on optional 35, 70, or 82.5 mm film.

Or there's the Northstar 3701 Microfilm Processor. This compact processor handles film widths ranging

from 16 mm to 5 inches. It uses pre-mixed chemicals and is totally self-cleaning.

To duplicate your film we might recommend the Northstar 3702 roll duplicator or Northstar 3704 automatic card-to-card microfiche duplicator.

But remember, we're not here just to sell equipment. We want to make certain you and your people know how to get the most out of microfilm.

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CIRCLE 29 ON READER CARD

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we give you more than equipment.
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hardware

that has from 1-8K of ROM responsible for duping 3270 functions (including bisynchronous communication at up to 4800 baud), from 1-6K of read/write memory for user-developed functions such as "fill-in-the-blanks" data entry, field mode and character checking, range checking, table compares, arithmetic operations, check digit generation/verification, or anything else



one can fit into the memory. Available as options are a light pen, card reader, and three forms printers ranging in speed from 40-165 cps capable of printing side-by-side tractor-fed forms simultaneously.

The 250 can either be used as a stand-alone terminal, or, with the addition of a line controller, can control up to 32 cluster terminals located up to 2000 feet away. Terminal keyboards are available in both keypunch and typewriter arrangements, with 10 program function keys available for particular application functions.

A typical 250 configuration, consisting of four crt's, 1K of RAM, and line controller rents for \$600/month on a one-year lease, including maintenance. Delivery is currently 60-90 days. SYCOR INC., Ann Arbor, Mich.

FOR DATA CIRCLE 339 ON READER CARD

Selectric Plotting

The ACCUGRAF is comprised of a special golf ball element and supporting software package that turns the IBM 2741 Selectric typewriter into a fairly capable plotter for most applications. The resolution is 30 program-addressable points/inch, said to closely approximate a trained draftsman, and plots can range in size from 1 x 1-inches to 10 x 36-inches. The software handles functions such as automatic sizing and scaling, data magnification/reduction, and switching symbols for multiple curves. The package is written in FORTRAN IV level G and requires approximately 14K bytes. Plots are generated at the 15 cps rate of the Selectric. The only time ACCUGRAF skips (tab key) is to draw the far right axis, as it has been found that using the

space instruction is more accurate. ACCUGRAF can be leased for \$2,500 the first year and \$1,250 each year thereafter. SYSDYNE, INC., Calabasas, Calif.
FOR DATA CIRCLE 347 ON READER CARD

Remote Batch Terminal

Pertec was building nearly everything needed for a batch terminal in its various peripheral divisions, and has now combined them into the DT1300, the firm's first product of this type. The Pertec key-to-tape unit is the basis of the 1300, and gives it the capability to receive remote transmission at speeds up to 9600 baud; recording it on the tape for subsequent printing. The tape buffer also retains the capability of letting the operator build a tape through the ASCII or EBCDIC keyboard. The line printer is Pertec's new 300-lpm unit. The DT1300 also features automatic send/receive for unattended operation, a reverse channel feature, and compatibility with 360 and 370 HASP protocol. The send/receive terminal, printer, and a paper tape reader are priced at \$24,500, or \$450 monthly rental. The DT1300 will be marketed through a network of independent distributors. PERTEC CORP., Santa Ana, Calif.

FOR DATA CIRCLE 325 ON READER CARD

Crt Terminal

It's certainly a buyer's market for users seeking crt replacements for mechanical teleprinters—with perhaps half a dozen such products introduced in the last two months. Infoton's latest entrant, the VISTAR/GT has a number of nice features that buyers should evaluate before making that final purchase decision. For example, many of the performance characteristics of the /GT are switch-selectable, including 11 data rates ranging from 75-9600 baud, half- or full-duplex communication mode, and parity generation. In addition, there is a capability for attaching one external communication line at any data rate up to 1800 10- or 11-bit cps.

The keyboard is a 64-character ASCII subset, with characters on the 9x7-inch screen displayed in 5x7 dot-matrix form. Both current loop and RS232 interfaces are standard on the VISTAR/GT for \$1,595, with delivery times on the order of 60 days. INFOTON INC., Burlington, Mass.

FOR DATA CIRCLE 341 ON READER CARD

Graphics System

Graphics systems offered by this manufacturer in the past have primarily been stand-alone units, but the 400 is a graphics front-end: it must be attached to a host computer. It comes with a choice of a 19-inch diameter round-tube crt and a 21-inch diagonal

Peripheral

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CIRCLE 87 ON READER CARD

Oem Peripherals

It almost seems that Control Data has set out to second-source every IBM peripheral. Included in its latest announcement are train line printers, 6250 bpi tape drives, low-speed tape transports, 80-column card readers, a floppy disc, a fixed-disc file, a product best described as a double-density 3330 drive (perhaps anticipating some IBM announcement), and a tabletop disc drive that doesn't resemble anything IBM currently manufactures.

The "Fastrain" family of high-speed printers contains models for 1200, 1600, and 2000-lpm print rates across 132 columns. Principal features include sound dampening, a counterbalanced hood, automatic print density control, a swing-out gate that houses the train and ribbon system, and an optional hinged door that facilitates servicing the

printer electronics. The automatic print density control adjusts to varying multiple-part forms thicknesses to assure print quality on all copies. The standard train holds eight 48-character sets. An automatic forms stacker is standard on the two higher-speed units, and optional on the 1200-lpm unit. Prices start at \$22,700 for the 1200-lpm printer, or \$28,200 complete with controller. Deliveries begin in the fourth quarter.

FOR DATA CIRCLE 328 ON READER CARD

Just as the IBM modifications to the existing 3420 tape drives (and controller) were sufficient to raise the recording density levels to 6250 bpi, the same is true with CDC's 92200 series. The 6250 capability is offered either by itself or combined with 1600 bpi recording at five drive speeds ranging from 75-200

ips. The increased packing density typically adds from \$1,200-1,700 to the price of the 92200 line.

FOR DATA CIRCLE 329 ON READER CARD

Two low-speed single-capstan 7- and 9-track transports have been added to the 92000 series, operating at 25 and 50 ips, respectively. They are designed to be incorporated into small computer and terminal systems, and can be mounted in a standard 19-inch frame. Available during the third and fourth quarters, pricing for the drives starts at approximately \$3,100, depending on model.

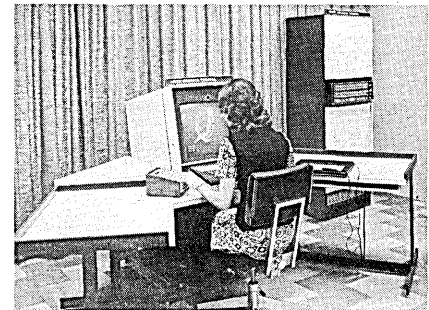
FOR DATA CIRCLE 330 ON READER CARD

A key feature of the four models in the 9200 series of card readers is modular subassemblies to ease maintenance problems for oem's who will maintain the equipment in

hardware

rectangular, both with 2K x 2K addressable points. The vector generator draws segments up to 12 inches at the rate of .75-inch/usec. Intensity levels are selectable from visual cutoff to

maximum screen brightness. A depth cueing option makes brightness of perspective objects proportional to the length of the z axis. The basic character generator holds a set of 96 ASCII characters, expandable to 256. A light pen and 32 function switches are stan-



dard on the 400, and a long list of options includes a joystick, graphic tablet, color crt, italics mode, and hardware windowing for two and three dimensions. Scheduled for delivery in the first quarter of next year, the 400 base price of \$30K can quickly escalate to \$50K for 3D capability. ADAGE, INC., Boston, Mass.

FOR DATA CIRCLE 321 ON READER CARD

Conversational Terminal

The model 2000 conversational terminal is based on a heavy-duty Selectric typewriter that can do double duty as either a 2740-1 or 2741 terminal by flipping a single switch. Housed in a desk-like work station, the 2000 has a small control panel with an additional switch for operation off-line as a standard typewriter, and also features capabilities for record checking, station control, multiplexor transmit control, automatic end-of-block recognition, and automatic answer. An RS232 interface for half-duplex operation is standard, or a built-in modem can be supplied which would add \$9/month to the 2000's \$90/month rental rate, including maintenance, on a one-year contract. Deliveries have begun.



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Like Magic, these silent windows into your files quickly and quietly present a record for viewing or verification by the operator, customer, client, or patient.

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CIRCLE 85 ON READER CARD

customer locations. The complete subassemblies include the hopper and feeder, read station, card stacker, power supply, and logic. The units are available in a number of different speeds ranging from 300-1200 cpm. The series is basically for 80-column punched cards, but options are available for reading 51-column cards and optical mark reading of 80-column cards. Prices for orders of 100-200 units range from \$1,275-\$1,700 depending on speed.

FOR DATA CIRCLE 331 ON READER CARD

The 9790 is a very-high performance disc drive that records data at 6000 bpi on a fixed-disc medium. Up to four recording heads can be ordered with the 9790 which would provide a 38.7 megabit transfer rate. The spindle speed is 3600 rpm and the average data access time is 50 msec. A price of \$29,600 per

drive in orders of 100 or more includes the cabinet-mounted spindle and drive motor, voice-coil head positioner and servo system, recording medium, power supply, and logic chassis. CDC is quoting six months ARO for delivery.

FOR DATA CIRCLE 333 ON READER CARD

The 9760 is a 40-megabyte, tabletop disc drive that records data at 6000 bpi on a model 9876 five-platter disc pack. The 9760's 2400 rpm spin rate yields a transfer rate of 1.2 megabytes and an average access time of 30 msec. It's priced at \$3,900 in orders of 100. The Fastrain printers, 6250-bpi tape drives, and 9200 series card readers are the first products produced by the NCR/CDC manufacturing combine Computer Peripherals, Inc. CONTROL DATA CORP., Minneapolis, Minn.

FOR DATA CIRCLE 335 ON READER CARD

A floppy disc drive that stores up to three megabits in a 14 x 9 x 5-inch cabinet will be available in the fourth quarter. Production on the 9400 will start in the fourth quarter, but CDC is quoting six months' delivery delay. An order for 100 units drops the price to \$625 each.

FOR DATA CIRCLE 332 ON READER CARD

The 9780 is probably the most interesting product in the announcement because it may be anticipating a pending IBM announcement of higher density recording on 3330-type, removable media disc storage devices. The 9780 stores 200 megabytes of information per drive but retains other typical 3330 characteristics such as transfer rate (roughly 806 KB/second), and average access time (30 msec). In quantities of 1-100 the 9780 is priced at \$10,500.

FOR DATA CIRCLE 334 ON READER CARD □

TRENDATA, Sunnyvale, Calif.
FOR DATA CIRCLE 343 ON READER CARD

2315-type Disc Drive

The model 206 is a front-loading cartridge disc drive that in addition to its one removable cartridge drive can be

equipped with a fixed cartridge beneath it. The 206 stores 48 megabits (unformatted) on each cartridge, and the movable heads can access data in 35 msec average, and send it across minicomputer channels at 2.5 MHz. Offered to oem's as interfaces to vari-

ous minicomputers, 100 units of the single disc drive would drop the price to approximately \$3,800 each, as would an order for 500 of the dual-disc versions. CAELUS MEMORIES, INC., Hawthorne, Calif.

FOR DATA CIRCLE 322 ON READER CARD □



Range Rider 1310

Full duplex testing of TDM and FDM multiplexers, synchronous modems to 3 megabits/sec. and asynchronous modems from 75 to 9600 bits/sec. Generates and analyzes pseudo-random start-stop characters with 5,6,7,8 levels; odd, even or no parity; and 1, 1.4 or 2 stop bits. Direct display of bit, character, and block error rate. Mark to space transitions counted also. 8 LED's monitor DTE and DCE interface. 1% bias distortion meter, and a hard copy output option.

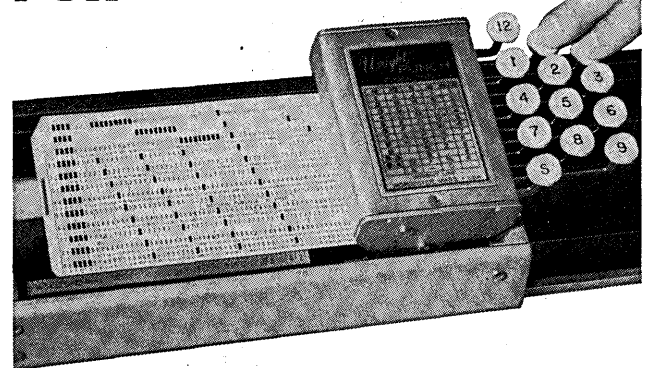
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CIRCLE 89 ON READER CARD

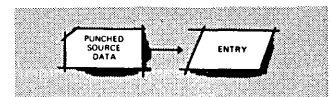
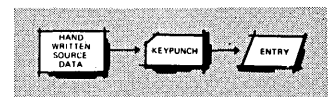
August, 1973

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CIRCLE 72 ON READER CARD

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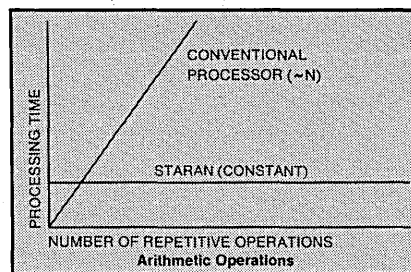
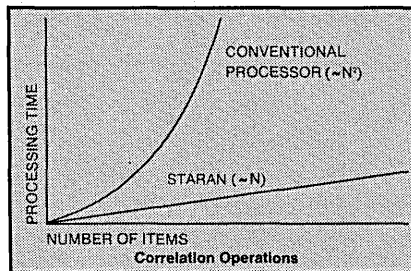
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STARAN can achieve input-output rates of up to several billion bits per



second. And execution rates of up to several hundred million operations per second.

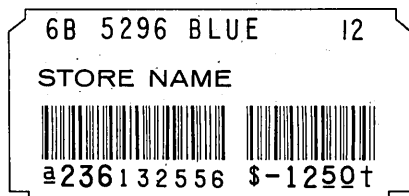
Yet STARAN is relatively inexpensive. You can buy it with varying capacities of array and sequential capability to suit your needs. A minimum basic STARAN system can cost as little as \$250,000 and software cost can be reduced to one-third of conventional system software.

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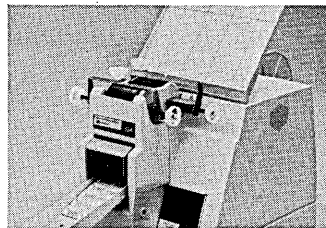
An automated input system is vital to your future. Monarch has one that fits you. For more information on the CODABAR code and related products . . . how and why they can serve you best . . . write to Vice President for Marketing, Dept. 288, Monarch Marking Systems, P.O. Box 608, Dayton, Ohio 45401.

Monarch Marking Systems

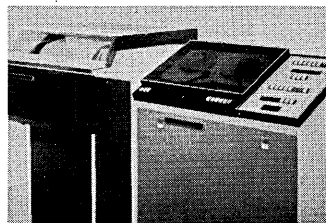


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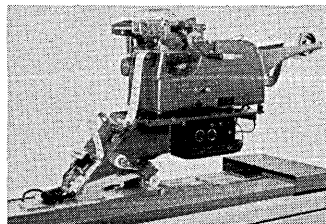
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Model 104 Dial Printer is a low-cost, easy-to-operate in-store printer. Accurate . . . you can see what you dial. It prints what you see . . . both eye readable and machine readable. Has a nominal speed of 174 impressions per minute on all sizes of tags and labels.

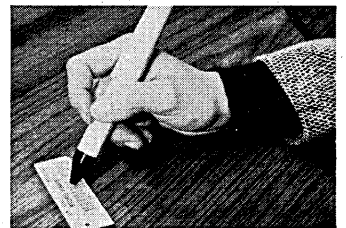


Monarch 2000 CODABAR Encoding System is a high-speed computer-controlled line printer with programmable logic and expandable memory. Ideal for high-volume distribution center printing of bar-coded tags and labels.

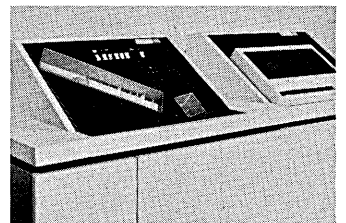


Model 2023 Rotary Imprinter is a fast, simple and reliable rotary mat printer. Enables vendors to print data on conventional merchandise tag and label supplies right on their packaging lines.

2 ways to capture it.



Model 2243 Bar Code Scanner comprises a hand-held light pen and logic for reading the CODABAR code with an interface. Data is checked seven times in the logic to assure accuracy before being released to the interface and entered at point of sale.



Model 2310 Batch Reading System is a high-speed data collection center. Reads 400 encoded tags per minute, feeds automatically, requires no tag orientation, records data on computer-compatible magnetic tape.

Get Monarch into your system . . . to get the most out of it.

Software & Services

Updates

Researchers at Stanford Research Institute have developed a seven-jointed artificial arm controlled by a minicomputer that allows a handicapped person to comb his hair, feed himself, and scratch his back. A single transducer mounted inside the attachment strap presently relays shoulder muscle movements to a nearby minicomputer. The scientists think that a microprocessor could be built into the arm capable of interpreting a myriad of Morse code-like commands that would include procedures as sophisticated as tying one's shoelaces. A system with this capability could be developed within five years and sold profitably for approximately \$3,500 (today's dollars), says the team.

A subset of PL/1 has been developed by Intel Corp. to make programming its MCS-8 and Intellec 8 microprocessor chips easier. Called PL/M, the language is said to offer users PL/1-like control and variable definition capabilities, while the data types and basic operation reflect the architecture of the 8-bit cpu's it runs in. The compiler is written in ANSI FORTRAN IV, and the PL/M statements can be used either to generate ROM or PROM masks, or binary code images for paper tapes for loading into 4-16K of dynamic memory on the Intellec series. The cross-compiler can be purchased from the Santa Clara, Calif. firm for \$1,250, or accessed on the GE, Tymshare, and Applied Logic Corp. time-sharing networks.

The Bicentennial Information Network (BINET) has gone on the air nationwide to act as a data base and clearinghouse service for information on international and domestic projects relating to the U.S.' 200th birthday. Developed by the American Revolution Bicentennial Commission with the assistance of Computer Sciences Corp., the Bureau of Standards, and the General Services Administration, subscribers to the service can conversationally enter or retrieve information from files stored on a Univac 1108 computer with crt or hard-copy terminals at rates up to 30 cps.

Programming Language

As business demands become increasingly complex, more sophisticated tools are needed to guide management through the perils of decision making. A new programming language, BBL (Basic Business Language) is offered to managers and analysts engaged in management science: the automation of calculations associated with management and problem solving. The language combines a number of English commands borrowed from COBOL and FORTRAN into a package that is good at doing risk analysis, financial modeling, queueing theory, imminent event simulations, etc. In general, BBL can assist in the problem-solving process in three broad areas: structuring the problem, performing the complex calculations, and providing management reports that assist in the implementation and control of the management action.

The package is available under a

perpetual license for \$18K and can also be rented for \$350/month on a one-year lease. BBL has already been sold to two service bureaus: Tymshare, Cupertino, Calif.; and First Data Corp., Waltham, Mass. CORE & CODE, INC., Wellesley, Mass.

FOR DATA CIRCLE 361 ON READER CARD

JCL Generator

JCL-GEN is an ANSI COBOL routine that generates job control language decks, documentation reports, and tape labels for users of IBM's OS/360, OS/VS1, and OS/VS2 monitors. Guided by instructions punched from specially formatted coding sheets, JCL-GEN generates three reports, including a listing of the updated procedures, a documentation listing for the programmer that shows pertinent file information, and a job description (roadmap) listing that shows operations personnel what is required to run the job. Up to

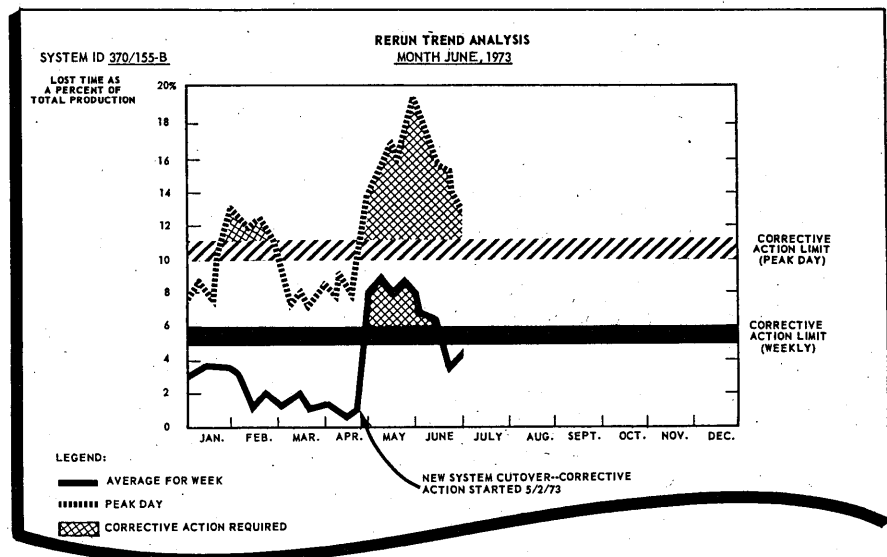
Computer Utilization

BACUS, (Booz, Allen Computer Utilization System) is a collection of 18 COBOL and one assembler language programs that expand basic accounting information (SMF data) generated on IBM 360 and 370 computers operating in OS, DOS, or virtual environments. There are three principal categories of reports that are generated by BACUS. The first category generates graphs of utilization percentages of various hardware resources, such as memory, cpu, channel, tape, etc. A second set of programs provides rerun analysis and the time taken up by programs being tested. The final program category generates cost allocation data, and it's claimed that these programs can even out the billing variation problems that

tend to occur in multiprogramming environments. Current and prospective users of virtual memory IBM equipment will be interested to know that some of the programs track such things as system paging activity, paging versus cpu activity, and in general provide useful information for virtual memory programming environments.

BACUS is priced at \$7,500 for OS and DOS; \$10K for the virtual memory programs. The prices include the first year's maintenance, and both source and objects decks are furnished the customer. The programs comprising BACUS are also available separately. BOOZ, ALLEN & HAMILTON INC., New York, N.Y.

FOR DATA CIRCLE 362 ON READER CARD



It's not that their graphics terminal is dumber. It's just that ours is brighter.

The Computek 300S: Brightest of the low-priced two.

Let's face it. When you're talking low-priced, high quality graphics terminals, you're talking us and them. You already know about them, so now we're going to tell you about us. And in the process, we hope to impress you with a few significant differences.

First, our raster scan design. It provides a TV-compatible display that's remarkably bright. About three times brighter, in fact, than our competition's. Which makes the 300S a whole lot easier to read in a well lighted room.

Selective erasing.

An especially good thing about our raster scan 300S is this: it lets you selectively edit vectors and characters quickly, easily, and one at a time. No need to erase and re-write the entire screen, which is what you have to do with theirs.

Scroll.

Maybe one of the nicest pluses we offer is our scroll feature, which lets you roll the display up just like an actual scroll. It's a truly useful convenience, and once you've used it you're spoiled forever. We're happy to say that of the low-priced two, we're the only one who has it.

Other bright features.

The Computek 300S has a lot of standard features that help make it a standout in its field. It's highly interactive. Its picture build-up is very fast, even from slow data rate channels. It has a complete Fortran-based software package. Its video output can be fed directly to standard TV

monitors. It has hard copy and graphics input options. It has serial and parallel computer interfaces available off-the-shelf. It's compatible with our Series 400 line of storage-tube terminals. And it complements our Series 200 line of programmable alphanumeric terminals and our GT50 graphics tablets.

The right byte.

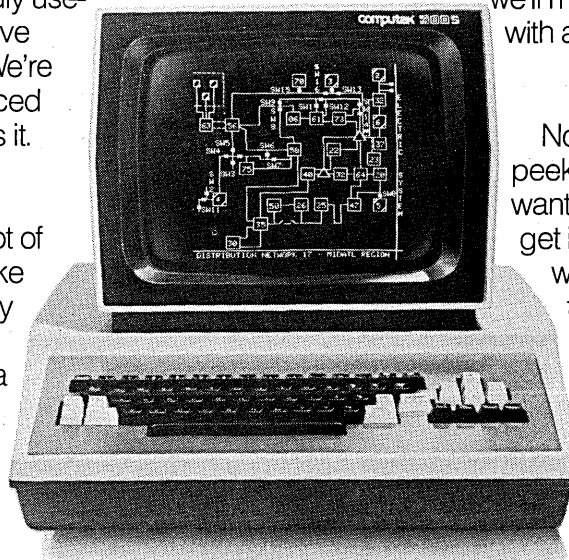
You may have heard a lot about the wonders of 10 bit display. We won't deny that it's good. But a low-priced graphics terminal with 10 bit display will cost you in one of three ways: (1) More money. (2) Less features. Or (3) less quality. So we ask you to consider this: Why pay more for 10 bit when 8 bit will do just as well? (We'll tell you an interesting story about 8 bit vs. 10 bit when you ask us for information on the 300S.)

The right price.

We offer this very attractive graphics terminal at a very attractive price. A price, we're happy to say, that many satisfied users found irresistible. And if you're an OEM, or you order in quantity, we'll make it even more attractive with a nice sizable discount.

Smart Money.

Now that we've given you a peek at our 300S, we expect you'll want to see a whole lot more. So get in touch with us soon, and we'll get back to you with all the literature we have. We're anxious to show you why the smart money is on the Computek 300S: the brightest graphics terminal of the low-priced two.



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software & services

99 copies of this report can be generated. JCL-GEN is priced at \$1,000, and includes a source program tailored to specific installation requirements, an object deck, implementation instructions, and a user guide. COMPUMAIL, Los Angeles, Calif.

FOR DATA CIRCLE 364 ON READER CARD

IMS/360 Aid

UCC TEN is a data dictionary/management program that should make IBM's IMS/360 data base management system more effective both for current and prospective users. It is a central repository for definitions of data bases, data set groups, segments, fields, programs, communication line groups, lines, physical and logical terminals, control units, and pools/subpools. It can show the user which data bases specific programs access, that the hierarchical structure of the data base is, what transactions are secured to specific terminals, what attributes data segments have (and which programs access them), and more. Over 140 different attributes can be defined relating to these elements.

As a data manager, UCC TEN has capabilities for automatic generation

of control statements (DBD, PSB, SSA, PCB, etc.), and can additionally be used to enforce standards, create both test and production definitions, and assist with data base design. On-line operation of UCC TEN requires a 50K message processing region, with batch use doubling that requirement in addition to the normal requirements of the DL/1 component of IMS/360. Approximately 90% of UCC TEN is ANS COBOL, with the remainder coded in assembler. It's available for a one-time charge of \$15K, and can be leased for \$550/month on a 36-month contract. UNIVERSITY COMPUTING CO., Dallas, Texas.

FOR DATA CIRCLE 365 ON READER CARD

360/370 Cobol Aid

A small routine is offered to COBOL programmers in OS/MVT and OS/MFT installations that enables their programs to access partitioned data sets. A subroutine call, executed prior to the OPEN statement for the file, selects the member to be processed; it is then processed as a standard sequential file. The selected member may then be opened for INPUT, OUTPUT, I/O, and normal OPEN, CLOSE, READ, WRITE, and REWRITE statements. The routine also has the ability to determine whether the selected member already exists, whether the file is already open, and,

if so, which member has been selected. Certain system information, such as data set name and volume serial number, and file characteristics such as record length, block size, and related information, can be obtained for any file, whether or not it is stored as a PDS. The module is supplied in object code form for a one-time license fee of \$250. Similar routines are being developed for FORTRAN and PL/I. DIGITAL SOLUTIONS, Albany, N.Y.

FOR DATA CIRCLE 366 ON READER CARD

Operations Management

Grumman is now offering three programs that it has used internally to provide management with better visibility and control of the dp function. The packages, offered separately, include GO*PAC, a computer accounting and installation management program; SURVEY, a resource utilization program, and COPS, a submonitor that gives IBM 360 and 370 console operators enhanced program status information that enables him or her to more effectively manage the machine.

GO*PAC provides most of the information a dp department could need in order to bill its customers, including details on the times jobs went on and came off the system, how many cards were input, how many lines of output were printed, how much core and disc resources were used, and more. Re-

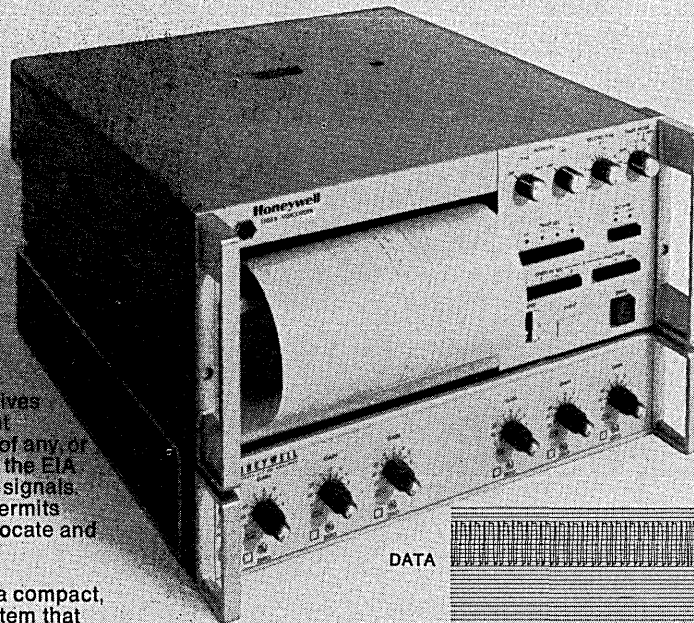
Shoot trouble fast.

Could you solve data communications problems faster and easier if you had a multi-channel memory scope with a 200 ft. wide display?

Ridiculous? Not with Honeywell's communications analyzer system. This system gives you a continuous or intermittent 200 ft. simultaneous recording of any or all of the signals that appear at the EIA interface, plus line side carrier signals.

This continuous recording permits bit-by-bit analysis to help you locate and identify hardware problems or software errors.

And you can do all this with a compact, portable graphic recording system that carries easily from location to location. You can increase the flexibility of this system even more by adding our portable



instrumentation magnetic tape recorder. This allows you to monitor continuously, to capture intermittent problems or very high bit rate data. Then you can transfer to the graphic recorder only the area of interest, with the capability of time scale expansion for increased resolution.

For assistance in applying our system to your problem, write or phone R. L. Shipman, MS 222, Honeywell, Test Instruments Division, P. O. Box 5227, Denver, Colo. 80217. (303) 771-4700.

Honeywell
The Automation Company

CIRCLE 88 ON READER CARD

ports generated by GO*PAC show such information as IPL history; program initiator maps; ABEND (abnormal program endings) reports by abort code and job step; a rerun report; a major account breakdown that shows which departments are using the computer

during what shift and in what mode (local, remote batch, or on-line); what priority levels are being demanded (two-, four-, eight-hour, or overnight turnaround); and how well the installation is satisfying these demands. GO*PAC is an assembler program that only re-

quires 1K of resident memory. It is supplied in source card form for \$13,500 for the first year, including maintenance and updates, with a maintenance charge of \$250/year for all succeeding years.

SURVEY, as does GO*PAC, relies on IBM accounting data (SMF) to generate reports that show cpu, core, disc, tape, and other resource utilization, reporting its findings in bar charts of percentages of availability and usage or each resource for the report period. This 10K BAL program is priced at \$5K.

COPS was developed at Grumman to provide 360 and 370 console operators with more exact information on what is really occurring in the multiprogramming environment, what is about to occur, and even provides suggested resource assignments to avoid conflicts. It is suggested that a second crt console be added to the system in the region of the primary one to show COPS information. An operator using COPS could, for example, delay the printing of a specific job because a priority program is about to begin processing. A 10K assembler program, COPS is priced at \$9,500 on an automatically renewing lease. Maintenance charges for the second and succeeding years are \$95/month. GRUMMAN DATA SYSTEMS CORP., Bethpage, N.Y.

FOR DATA CIRCLE 367 ON READER CARD

software spotlight

Production Job Restarts

Production job blowups, caused by any of a number of sources, are seemingly inevitable occurrences in even the best-run os/360 shops. It often takes a team of operations, staging, scheduling, and programmer personnel hours to determine which files have been affected, which data sets must be scratched, and other pertinent information. UCC FIFTEEN is an attempt to bring order to this chaos by automating the job restart procedure to the point that it can be handled as a routine occurrence by the 360 or 370 console operator.

When the production job fails, the operator tells FIFTEEN which job step has just failed. FIFTEEN then determines the proper restart step, corrects

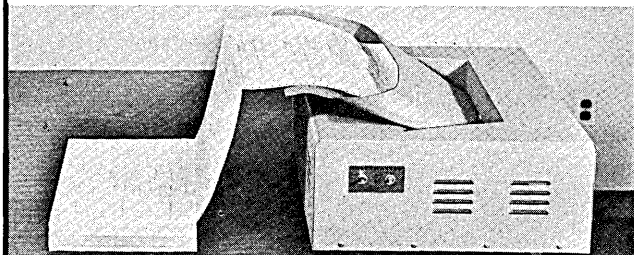
the os catalog to accommodate the restart, scratches unwanted direct access data sets in preparation for recreating them, and corrects the generation data group bias for restart. If FIFTEEN is used in conjunction with UCC's tape management system (UCC ONE), the package will reduce the expiration date of uncatalogued tapes during restart.

Installation of FIFTEEN requires a link edit and allocation of a data set that holds data set information for each job using the restart capability. FIFTEEN is written in assembler language and requires approximately 16K bytes of memory. It can be purchased for \$5K, rented for 12 months for \$240/month, or obtained on a full payout 36-month lease for \$185/month. At these prices it would seem that FIFTEEN could be easily justified by dp managers were it only to be used once a month. UNIVERSITY COMPUTING CO., Dallas, Texas.

FOR DATA CIRCLE 360 ON READER CARD

Shred Continuous Forms Automatically

without supervision

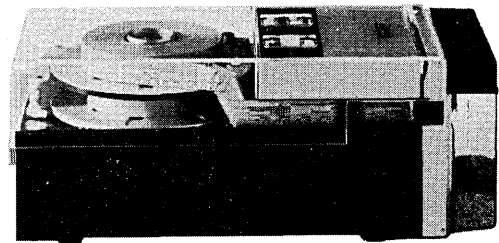


the JET 12

Destroys computer print-outs, punch cards, computer runs, continuous forms and numerous forms automatically at the rate of 500 pounds of paper per hour. This quiet powerhouse also shreds obsolete records, confidential documents, private correspondence or anything made of paper. For full information and free literature write to

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OUR PUNCH FEATURES OUTNUMBER YOUR PROBLEMS

- 75 cps
- 5-8 track standard, 6 track TTS optional
- Automatic tape monitoring system
- Back spacing for accuracy control
- Includes control and drive electronics
- Modular construction
- Powered, wired and space provided for extra PC board
- Built in tape supply and take-up spools
- No routine lubrication necessary
- Very quiet—54 db.
- Lightweight
- Low power consumption
- Immediate delivery from stock

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Secaucus, N.J.

Gentlemen:

I am interested in receiving detailed data on your Tape Punch

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Title _____

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Company _____

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State _____

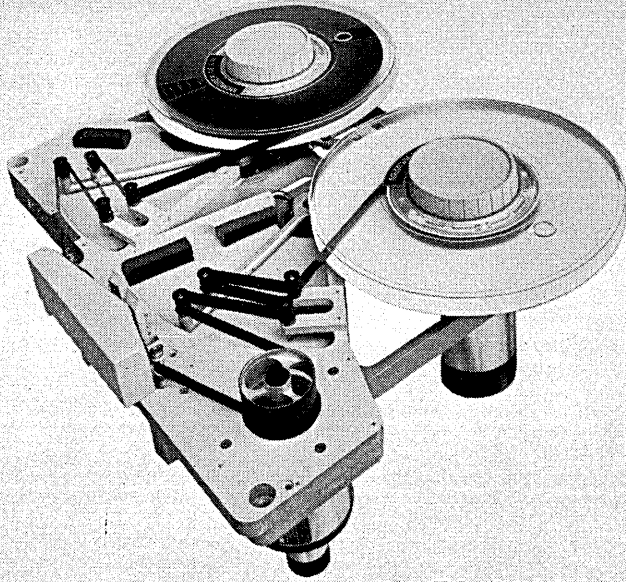
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CIRCLE 86 ON READER CARD

Pure Hardware



PI-1400 Modules

Get only what you need, and get more for your money

Get only what you need.

When you're building an OEM unit, you don't want unnecessary frills. Precision Instrument gives you only as much recorder as you want—from basic transport module to total system. Select the elements and functions necessary for your customized OEM unit. And save money.

Pick your module mix—tape transport, operator control and indicator cluster, power transformer, power input assembly, motor drive assembly, and door assembly. Select heads, density, and tape speed. Add read, write, and motion control electronics. Choose optional controllers, buffers, and formatters. But get only what you need.

Get more for your money.

Every module has the same high performance ratings found in PI-1400 tape systems.

Dual frame and three point isolation mounting allow installation in vertical or tilted orientation, and on a non-precision surface. Dual density 800 bpi NRZI and 1600 bpi phase encode is standard. Dual-gap heads are individually adjusted for minimum skew.

Why pay more and get less? Write for PI-1400 brochure.



PRECISION INSTRUMENT

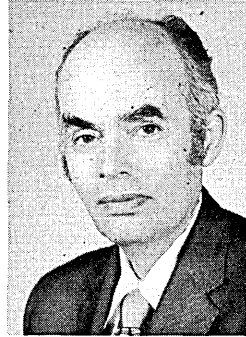
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CIRCLE 81 ON READER CARD

People

Two Different Worlds

Dr. Aaron Finerman views his return to the academic world with mixed emotions. The former manager of the Office of Computing and Information Systems at Jet Propulsion Laboratory, Pasadena, is returning to his post as Professor of Computing Science at the State Univ. of New York at Stony Brook. "Part of me would like to stay here and part



Dr. Aaron Finerman

wants to go back to the university," said Dr. Finerman on one of his last days at JPL.

He has spent his entire professional life in computing, moving back and forth between the academic and industrial worlds. "I enjoy both. I feel comfortable in both."

In his JPL post, Dr. Finerman was responsible for both general purpose computing and all of JPL's Mission Control work. He headed up a staff of 750 using some \$40 million in equipment with an annual budget of \$25 million.

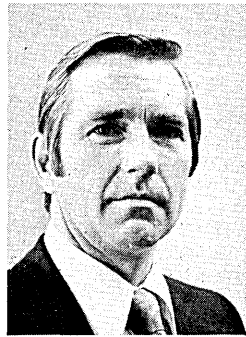
This summer, between JPL and the university, Dr. Finerman will combine both aspects of his professional life, advising groups in Bolivia and Costa Rica on the management and educational aspects of setting up regional computer centers. He will be succeeded at JPL by Bob Stevens from the Laboratory's Telecommunications Div.

Dr. Finerman has been extremely active in the Assn. for Computing Machinery. He recently was elected treasurer, and has served as a member-at-large, as chairman of the editorial board, and as editor-in-chief of *Computing Reviews*. He still is a member of ACM's publications board.

CHARLES E. MACON was appointed General Manager of Burroughs' System Products Group replacing DURAY E. STROMBACK who resigned . . . RICHARD L. GEHRING was named Group Vice President of Sperry Univac . . . JEROME T. PAUL, formerly with New York's Off-Track Betting Corp., has been elected a senior vice president of University Computing Co., responsible for a new banking division . . . JANET L. NORMAN was named vice president of communications for the Business Machines Div. of The Singer Co.

On Moose Meat and Potatoes

A once-over of Olie E. Swanky's resume turns up precisely the kind of fellow who might be expected to be running the Greyhound Corp., which is what Swanky does as the firm's president and chief executive officer. Swanky served ten



Olie E. Swanky

years with IBM and before that served in the Canadian Air Force. But Swanky's first job was not quite according to form: he was a cook in a logging camp in Canada when he was 13. Swanky's father was a teacher on the prairie in upper British Columbia when the younger Swanky was born. "I was born in a real log cabin," Swanky says. "And, like every other kid in the territory, I was raised on moose meat and potatoes. Mum grew the potatoes and Dad shot the moose."

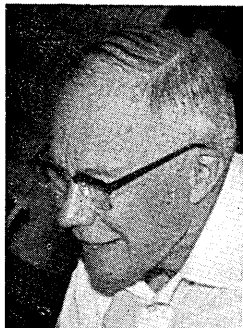
DATAMATION

Swanky, who came down from Greyhound in Canada to take over the reins in Phoenix, looks on himself as a doer and a pusher. His associates concur and point out that since Swanky became president last September, the course of Greyhound has changed markedly. "We don't like to think we're in the computer leasing business anymore," says Swanky. "We're in the data services and the systems marketing business. And we're much more sensitive to supporting our installations than we were in the past."

ALBERT S. KAPLAN has been named vice president/finance and administration, Informatics, Inc. He had been vice president/business operations for an Informatics subsidiary, Computing Technology Co. . . . Amdahl Corp. has named ROBERT W. ARMSTRONG, formerly with IBM, as vice president of marketing . . . ROY STONE, former corporate director, systems and data processing, Allied Chemical, has been appointed a director with John Diebold & Associates Div., The Diebold Group, Inc., responsible for project management for clients in the Northeast . . . JAY P. THOMAS was elected vice president of management information services for Northwest Industries, Inc. He had been director of management information services for Borden, Inc., and is a former director of automatic data processing for the Pentagon.

"Wherever They Want to Send Me"

"I feel ten years younger," said Carl W. Robinson on his return home from a two-month assignment as a data processing advisor to Francisco Wong Chang, S.A., Panama City, Panama, variety store chain. Robinson, who retired a year ago as data processing manager for Bowman Products Div., Associated Spring Corp., went to Panama as a volunteer for the International Executive Service Corps (IESC), a non-profit organization that arranges for retired executives to share their managerial know-how with firms in developing nations.



Carl W. Robinson

Robinson and his wife spent March and April in Panama, and in that time Robinson helped store management figure out what to do with a System/3 acquired a year earlier. The first step was showing them how to install inventory control. "They had been printing out their entire inventory every month and looking at each item." Robinson emphasized that IESC volunteers "don't attempt to do the work for them. We tell them what they can do and how they can do it." He helped the variety chain set up a schedule which should give them a complete system by Jan. 1, 1975, and includes consideration of possible use of pos terminals at checkout stands.

Robinson retired from Bowman, which makes auto replacement parts, in July 1972. "When you get through with American industry," he said, "although nobody means to do it—they make you feel like you're washed up. In a place like Panama, they're so anxious to get what you know, you feel like you're worth something."

Bowman has been "in and out" of data processing since the mid-1930s when he began working with a 285 numeric machine and "butcher paper" reports. He received a B.S. in civil engineering from Case School of Applied Science (now Case Institute of Technology) and holds an M.S. in marketing from Ohio State. He's anxious for another IESC assignment and doesn't care where. "I'll go wherever they want to send me." □

August, 1973

DON'T SIGN AWAY YOUR FREEDOM

If you sign an order for a three-dimensional graphics system before you take a close look at the Evans & Sutherland PICTURE SYSTEM, you will be signing away many of the freedoms available exclusively in this new system. THE PICTURE SYSTEM can be yours for as little as \$55,000.

Don't sign away your...

- ★ **Freedom** to display perspective views of complex objects moving smoothly in real time.
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- ★ **Freedom** to grow to a system where opaque, smoothly-shaded objects can be displayed dynamically.

Protect your freedom to make an informed choice when you buy your three-dimensional graphics system by calling or writing: Del Freeze, Evans & Sutherland Computer Corporation, #3 Research Road, Salt Lake City, Utah 84112. Phone: (801) 582-5847

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Literature

Communications Terminals

A 24-page booklet filled with pictures and diagrams claims that this company's data communications terminals provide a solution to high operating costs in today's corporate communications networks. The equipment moves data at high speed over standard dial-up facilities and replaces low-speed teletypewriters that send data over leased lines. WILTEK, INC., Norwalk, Conn.

FOR COPY CIRCLE 300 ON READER CARD

Modular Programming

Entitled "Implications of Using Modular Programming," this 160-page report of a British research organization is the first in a series of guides dealing with programming and systems techniques. The report contrasts design, maintenance, and management benefits with practical difficulties which have been experienced when implementing modular programming on some combinations of hardware and program language. Modular programming, defined in this report as the "organising of a complete program into a number of small units . . . where there is a set of rules which controls the characteristics of those units," is used in 47% of third-generation computer installations in the United Kingdom. Cost: \$25. HOSKYN'S SYSTEMS RESEARCH, INC., 600 Third Ave., New York, NY 10016.

Audits and Security

A new monthly newsletter, *EDPACS*, addresses the problem of "EDP Audit, Control and Security." Aimed at the individual already trained in the computer field who wishes to keep abreast of recent developments, it contains news items, conference reports, book reviews, evaluations of hardware and software developments, and abstracts of relevant articles in nearly 100 periodicals. The cost is \$48 annually; send a letterhead request for a free sample copy. AUTOMATION TRAINING CENTER, The Newton Building, Reston, VA 22090.

Financial Language

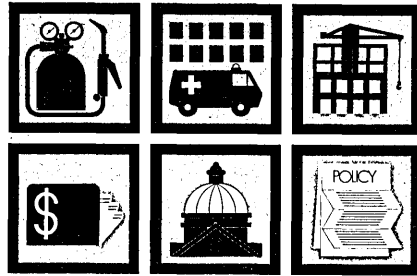
A six-page foldout brochure explains the new Fortran-based Financial Analysis Language (FAL), noting operational features, usage, benefits, and capabilities. Possible uses of FAL, designed for the financial analyst and planner, are with budgets, cash flow statements, risk analysis and modeling, and financial statements. GENERAL ELECTRIC, Springfield, Va.

FOR COPY CIRCLE 309 ON READER CARD

Accounting System

A 12-page brochure details the Nixdorf Series 800 modular computer/accounting system with a memory concept combining magnetic core memory with a new Rod Cell memory. The Rod

NIXDORF SERIES 800 MODULAR COMPUTER ACCOUNTING SYSTEM



Cell memory can store data files such as addresses, product descriptions, unit prices, and other alphanumeric data as well as programs. The series includes a computer/billing system, a magnetic ledger computer, and a dual magnetic ledger computer. NIXDORF COMPUTER, INC., Chicago, Ill.

FOR COPY CIRCLE 301 ON READER CARD

Word Processing

Two brochures discuss Documate, a complete system for the recording, storage, editing, management, and presentation of written communication. The eight-page *Introduction to Documate* explains the system's features and gives step-by-step examples of editing. The four-page *Abridged Functional Dictionary* gives capabilities and sets of instructions for the three Documate subsystems: DMS (Documate Monitor System), EDIT (for file creation and editing), and RUNOFF (text formatter). Documate, Division of INDEX SYSTEMS, INC., Cambridge, Mass.

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NCC Proceedings

Proceedings of the 1973 National Computer Conference (Volume 42) contains more than 160 technical papers and abstracts on a wide variety of topics. The cost of the 920-page hardcover volume is \$40, with a reduced rate of \$20 for prepaid orders from members of AFIPS (give affiliation and membership number). Microfilm and microfiche versions are available at \$25 and \$10, respectively. AFIPS, INC., 210 Summit Ave., Montvale, NJ 07645.

Mass Storage for Minis

This six-page brochure contains specifications and descriptions of seven basic magnetic disc drive systems which range in storage capacity from 7.5 million bytes to 232 million bytes per disc drive unit; selection of either mini or IBM-compatible disc formatting is possible. One section of the brochure is on software—formatter, diagnostic, and I/O driver. DIVA, INC., Eatontown, N.J.

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Portable Keypunch

This six-page brochure describes the Model 402 Vari-Punch, a portable, electric keypunch that prints and punches numeric data on standard 80-column cards or multiple copy tab-card sets. This keypunch, which can be interfaced to other devices, requires no keypunch operator training to use. VARIFAB, INC., Old Greenwich, Conn.

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Company Directory

This 82-page directory of suppliers gives profiles in chart form of 390 companies that supply products and services to computer users. Each entry gives the company's location, size, management, financial status, product lines, and sales and service organization. Cost: \$25. DATAPRO RESEARCH CORP., One Corporate Center, Route 38, Moorestown, NJ 08057.

On-Line Terminal

A 12-page booklet describes the Model 250 Intelligent On-Line Terminal System. This series is a family of self-contained terminals with crt displays configured either as individual stand-alone units or as clusters around a line control unit connected to the communications line via a high-speed modem. SYCOR, INC., Ann Arbor, Mich.

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Disc Drives

A 100-page manual provides the oem systems designer with a guide to the selection and interfacing of Pertec's D3000 series disc drives. In addition to conventional batch processing, information retrieval, and process control application, the D3000 can be used for graphics, point-of-sale, document reader storage, data entry, and small business processing systems. The manual includes mechanical and electrical characteristics, line termination and logical levels, and a description of timing and control logic. For copy, send a letterhead request to PERTEC CORP., Dept. 202, 9600 Irondale Ave., Chatsworth, CA 91311. □

THE UNINTERRUPTIBLE

STRAIN

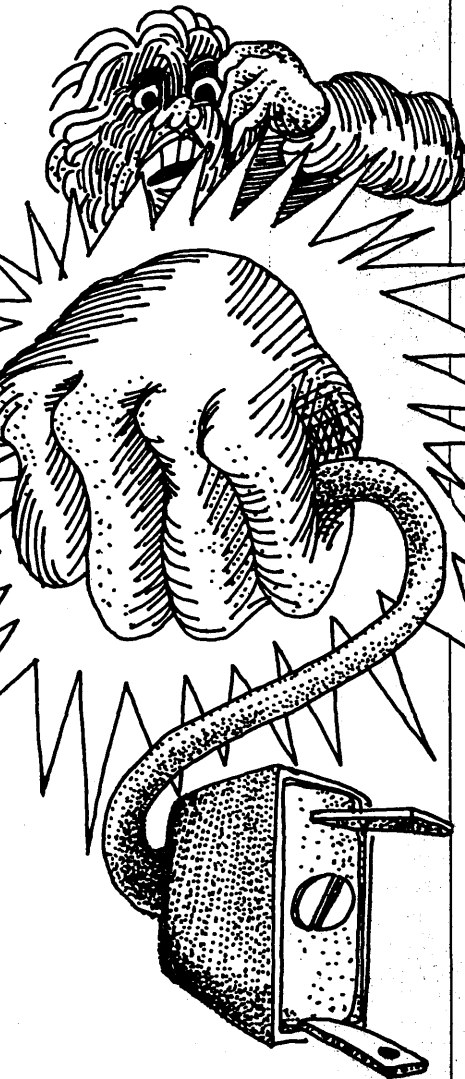
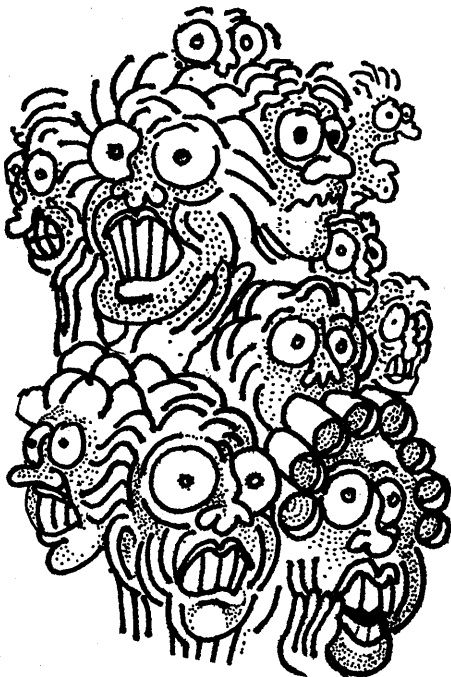
by Michael Cricketon

It seemed harmless enough at the time. A rather simple experiment. Hooking two uninterruptible power sources together. Of course, that was before anyone knew about the kvat factor.

The first indication that anything was amiss came from Poughkeepsie, New York. During the night every electrical device began operating at full power. It didn't seem to matter whether the switches were on or not. Dishwashers sprayed, toasters toasted and popped, automatic garage doors opened and closed. Most alarming of all were the lights. At 2 AM, Poughkeepsie was bathed in billions of candlepower.

The phenomenon was soon repeated all across the country, with a multitude of results, some amusing, many tragic. A plush Los Angeles hotel suddenly found all its heated waterbeds were approaching the boiling point. A computer in Wilmington, Delaware, succeeded in printing out the numerical value of infinity. The continuous glow of every incandescent bulb in the nation caused America to become a nation of insomniacs. Except in Las Vegas, where the problem wasn't even noticed.

A Nation of Insomniacs.



Fortunately, the sleepless nights were turned to advantage by a dedicated group of scientists. They soon traced the problem to the two inter-connected UPS's. Connecting them together at first glance would seem no different than linking two batteries pole to pole. The difference was in the purpose of the devices involved. The purpose of an uninterruptible power source is to provide a continuous supply of power under all conditions, even during electrical failures.

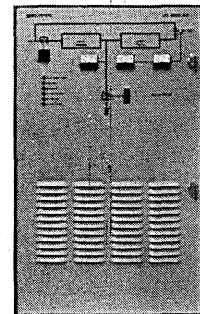
CIRCLE 7 ON READER CARD

When each UPS found it was unable to supply the other with power, it searched for a place to store the unused kva's. The system contained minimal inductance and practically no capacitance at all. Therefore each UPS did the only thing it could. It began storing its power in the dimension of time in kvat's.

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CIRCLE 92 ON READER CARD

Books

Computer Organization and Microprogramming

by Yaohan Chu
Prentice-Hall, Inc., Englewood Cliffs, N.J., 1973.
533 pp. \$16.50

I would like to comment on Professor Chu's book from two aspects: first, a discussion of his *methodology* in presenting the subject, and then the *content* of his textual material.

Judging from the dust jacket blurb, both the author and the publisher wish to stress the importance of a *design language* which can be used to unambiguously describe digital-system organizations ranging in complexity from serial parity generators to stored-logic computers. I believe this emphasis is well-placed. However, I also think there still are some problems with design languages in general—to be effective, they are quite complex—and with Professor Chu's notation, in particular.

Because the concept of a *design language* is not familiar to some people, I will first touch on the history of these languages and then comment on Professor Chu's notation with this perspective in mind.

Since the 1960s, various investigators have attempted to popularize some form of standardized notation and language to accurately describe digital machines and their operations. To date, these techniques have been neither notably successful nor popular with system architects and logic designers. But recently there have been indications that design languages are at about the same stage of development that programming languages were, say, just before the formalization of ALGOL and FORTRAN 15 years ago. For example:

- The president of a computer firm (Kenneth Olson, DEC) is so impressed by a language and notation developed by Bell and Newell (1) that he comments enthusiastically about it in a note associated with every model PDP-11 processor handbook.
- Major universities such as Carnegie-Mellon, MIT, Case Western Reserve, and UC Berkeley encourage students to do graduate work in the area of design languages.
- Textbook writers and publishers are testing common notation and formats to display their ideas in a uniform and comprehensible way. This includes Hellerman (2), Bell and Newell, Chu, etc.
- Technical symposia emphasize the subject's currency and importance by allocating entire sessions to the problems of design and documenta-

tion. For example, see *Language for Design*, COMPCON 72.

- The U.S. Government, through such agencies as the National Science Foundation and the Advanced Research Projects Agency, is funding important studies in this area.
- LSI chip manufacturers are finding it mandatory to develop documentation which allows their customers to define their required sequential and combinational logic on a single chip prior to mask manufacture. The MOS programmable logic array manufactured by Texas Instruments is one example.

All of these examples tend to confirm that this may well be an idea whose time has finally arrived after more than a decade of serious effort.

Iverson (3), in his classical description of a *programming language* (APL), which closely approximates many of the needs of a high-level descriptive language, covers the matter to be outlined in this way:

"... such a programming language should be concise, precise, consistent over a wide area of application, mnemonic, and economical of symbols; it should exhibit clearly the constraints on the sequence in which operations are performed; and it should permit the description of a process to be independent of the particular representation chosen for the data."

Many of his ideas presented in this and subsequent work have begun to percolate into modern texts that describe digital systems. For example, Hellerman (2), a co-worker of Iverson at the IBM Research Center, further describes his extensive use of this notation:

"The power of the language lies in its ability to express manipulations on entire arrays of operands simply and



consistently. Operations available include the familiar arithmetic operations, logical (Boolean) operators such as AND, OR, etc., and relational operators which generate bit maps that indicate where certain relations among variables are or are not satisfied."

Unfortunately, this symbology is necessarily more complex than that provided by an ordinary four-row Teletype keyboard. In fact, it is rather overwhelming the first time one looks at it and this may partially explain its slow acceptance. The keyboard for

generating this notation is APL oriented; it is composed of 88 single-stroke characters; 26 capital letters, 10 digits, 5 arithmetic functions (including exponentiation), 9 logical, and 36 special symbols. In addition, the keyboard provides for shift, tab, lock, return and backspace. This latter operation permits the forming of 12 more composite characters. Examples of this notation can be found in the references.

The character set of Bell and Newell, Darringer, and others make extensive use of this rather special APL-like notation. Others, including Chu, make use of the standard character set available with compiler languages such as BASIC (with 57 symbols), which makes a significant difference in compactness of representation and, hence, visualization of detail.

As previously noted, the work of Bell and Newell is particularly impressive. Their motivation for developing the language from the earlier work of Darringer, Falkoff, Iverson and Sussenguth, was to give their students a uniform set of formats and notations (they use two language levels) as an aid for their textual descriptions of 40 different computing systems, certainly a very substantial undertaking.

In addition to the crucial contributions being made at Carnegie-Mellon, it should be mentioned that considerable work is being supported at Case Western Reserve Univ. where they are investigating methods of defining digital systems. The work emphasizes methods applicable to *computer aided design*, CAD, and is described under the acronym, LOGOS. With this scheme, claims are made that the system is able to represent algorithms which may ultimately be implemented in *either* hardware, software or a combination of both. This is an important concept and one which is shared with most design languages. It is said to be a "graph theoretic representation", which certainly is suitably imposing terminology from the halls of academia. Because the notation, syntax, and semantics of LOGOS is complex, the reference article in *COMPCON 72*, September 1972, is suggested as a good source and should serve as a brief introduction into their "schema".

Returning to the work of Professor Chu, who really is a pioneer in the area of documentation—he has been writing papers and texts on this subject since at least 1962—I must in good conscience say that it is a little presumptuous of this reviewer to offer any critical comments; but with that said, here goes.

In this text, Professor Chu uses his "Computer Design Language" or, more briefly, CDL, extensively. An indication of the special effort that has

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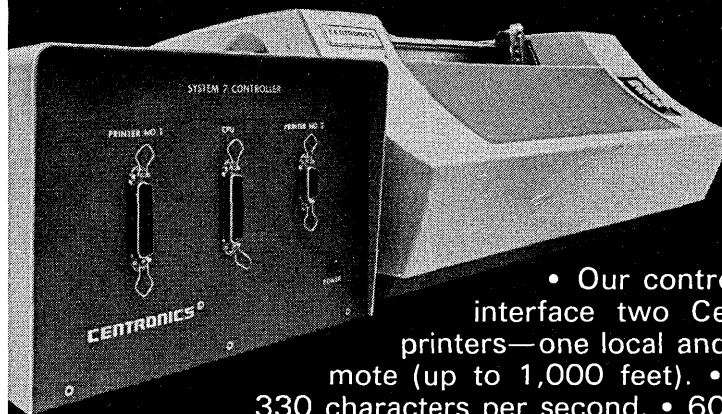
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CIRCLE 90 ON READER CARD

Books

gone into CDL is the fact that a CDL simulator, which accepts a subset of CDL, has been completed. Four versions are said to be available: for the IBM 7094, the Univac 1108, the CDC 6600, and the IBM System/360.

In describing each of his designs using primarily case studies, Chu uses both flow charts and sequence charts as well as the more detailed CDL. His general procedure is to give a narrative explanation of a particular example, usually an algorithm, followed by the charts and, lastly, to describe the timing and control signals with CDL. The

CDL statements follow a relatively simple format: the first section contains comments descriptive of each of the elements within the configuration—register, memory, decoders, switches, clocks and terminal statements where each of the latter terms are descriptive of a logic network. Following the *configuration* statements are the *initialization* statements and these are followed by the *execution* statements, sometimes interspersed with further comments. His character set is much more limited than APL, thereby permitting its understanding after only a few hours of indoctrination, one of the strong plusses in its favor. However, this ap-

parent simplicity can also become a critical problem since in the *real* world of design (i.e., non-pedagogical), his notation is so detailed that its descriptive capabilities are buried in a morass of detail. And finally, some detailed technical criticisms should be made of CDL; some of the operators borrowed from ALGOL are used quite differently, which can be initially misleading; no circuit delays are accounted for in CDL since it is assumed that each statement requires one clock period to operate. These and other limitations imply that CDL is really only suitable for simplified synchronous systems.

Relative to the *content* of the text, I think Professor Chu has chosen well between the compromises imposed by level of difficulty, on the one hand, and level of completeness, on the other, without inundating the reader with the whole spectrum of known digital techniques.

The reader is motivated by an inviting introduction, followed by a full justification and description of CDL, including declaration statements, micro-statements, and sequencing examples. The first section of the book describes an elementary stored-program computer. The next section examines in detail parity generators, comparators, and converters, and ends with an interesting bowling-score computer. Microprogramming, fixed and floating-point arithmetic are covered at an elementary level and then Professor Chu shows the effectiveness of his techniques (after 255 pages of introduction!) in the relative complexity of memory organizations—stack, associative, and virtual; control and computer organizations, including asynchronous; and I/O channel organization, typically the most complex logic in today's computer systems. He completes the text with a good section on microprogramming software. Each of the chapters has 10-15 references and associated problems that are non-trivial.

In summary, the book contains a great quantity of information about a broad and complex subject that still is undergoing extraordinary reaches of sophistication, and it's presented about as well as I think has been done. However, perhaps because of his detail and coverage, the reader should be forewarned that the writing style and form has about the same warmth and humor as a Voter's Precinct Listing. But if the reader can maintain his motivation, he should be rewarded with a contemporary view of this field.

—John Alrich

References

- (1) Bell, C. G., and Newell, A., *Computer Structures: Readings and Examples*, 1971, McGraw-Hill.
- (2) Hellerman, H., *Digital Computer System Principles*, 1967, McGraw-Hill.
- (3) Iverson, K., *A Programming Language*, 1962, Wiley and Sons.

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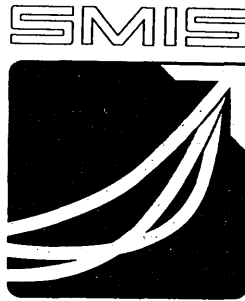
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letters

Continued from page 27

lated fields. These related fields can contain data pertaining to the code or they can contain a cross-reference to another dictionary and code. The programmer, in his random or table access call words, specifies whether he wishes to retrieve the data from the related field or the data from the cross-referenced dictionary specified in the related field. The code file is a variable length file with fixed-length dictionaries. The fields within each dictionary are fixed length from record to record but an adjacent dictionary on the file may have longer, shorter, or more fields being used than its predecessor. Only the fields requested will be passed to the program, not the entire record. In this way, working storage is used as efficiently as possible.

A second feature of our system is the use of segmented dictionaries. If you have a code comprised of several sub-codes, unique dictionary keys are given to each sub-code (segment). These keys are structured in such a manner as to link each dictionary of sub-codes with its predecessor and subsequent sub-code. For example, the financial accounting code for government offices is 19 bytes long including codes for the major transaction type, minor transaction type, fund, department, year, division, appropriation type, class, sub-account, and cost code. Each of these 10 codes is a segment of the larger code—the financial accounting code. Each of these 10 codes has its own dictionary.

The programmer can give, in his call word, a request for any of these 10 dictionaries individually, or he can specify the number of dictionaries (segments) he desires and which dictionary to reference first. The entire 19-byte code can be given and all 10 dictionaries will be referenced by the random module automatically, providing the programmer with a detailed description of the code with only one call. This request would require only a 27-byte CALL word, 23 bytes of which is the requested code (19) and dictionary I.D. (4). As in the first feature outlined above, the call word can request any or all fields of data within each segmented dictionary, or it can request information from a dictionary cross-referenced by the segmented dictionary!

It takes little time to realize that the most important step for the user is to structure his dictionary with a great deal of forethought and imagination.

A third feature we have just implemented relates to the use of the table access module. Two dictionaries on

our code file control the code file itself. The first is a table of contents indicating the names and keys of all dictionaries on the file, record size, number of records in each dictionary and basic control information about each dictionary.

The second dictionary is a usage dictionary. It indicates the table size used by programs, other control information and a record of all programs referencing each dictionary.

One of the uses of this dictionary is monitoring table sizes. Should any dictionary be updated to contain enough records to fill 80% of the table size

reserved by the using programs, a listing of all programs referencing that dictionary is printed so changes can be made to all affected. The table module can load as many entries as indicated in the call or it can load the entire table. The programmer can specify the first key to be loaded if the dictionary is loaded and referenced in pieces.

At this time, only one dictionary is updated by an individual outside the EDP group. During conversion and initialization of tables on the file, the approaches and uses of the file by our systems staff have proven to be so diverse and imaginative that we feel a lot

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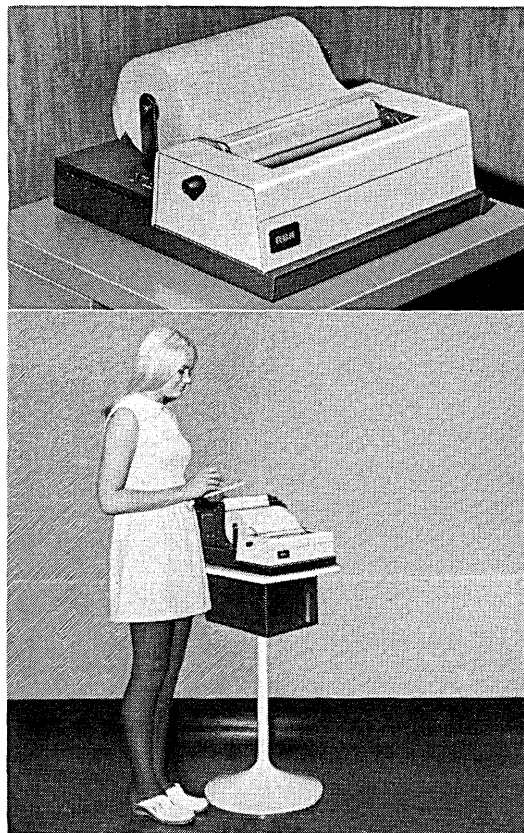
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letters

more documentation is needed before we involve the users. However, as Mr. Guthrie states, user responsibility for table maintenance is a major contributing factor for developing a dictionary system. We are looking forward to the day when we can achieve Mr. Guthrie's current status in this area.

Interested readers may inquire about specifics on the Code File at the address below.

BARBARA KURMAN
County of Westchester
Data Processing Div.
White Plains, New York

Tortoisseries

In a recent letter to the editor (Feb., p. 24), a question was raised as to why the Burroughs 6700 was chosen by New Zealand Universities even though Burroughs was ninth in a field of 19 as to speed. I don't know why the New Zealand decision was made, but consider the following:

1. The Burroughs operating system MCP is the only one in the industry which has been used and tested continuously for 10 or more years.
2. Burroughs machine (assembler) language is Algol. To do a given

task, Algol requires about 1/15th the number of statements required by other assembler languages. There are the same number of bugs in N statements regardless of language, thus there are about 1/15th the number of bugs in Burroughs software as in its competitors.

3. All persons writing in Algol and there are many—some of them seminal thinkers (e.g., Dijkstra)—are, in effect, working free for Burroughs. Their Algol work consists of machine language code for Burroughs hardware.

Such reasons as these may have influenced the New Zealand decision.

HAROLD P. SIEGLAFF
Phoenix, Arizona

Erratum

Mr. Kean's article, "The Computer and the Countess" (May, p. 60), was a joy to read. For the record, however, Lord Byron died in Missolonghi in 1824, not 1823 as stated.

STEVE A. DEMAKOPOULOS
Manhattan, New York

Ten cent rewards

Mr. Williams' "Great New Cause" (June, p. 197), has been around for as long as I have been involved with communications and computers . . . and

I'm sure it was around long before that. The question of whether to slash the numeral zero or the letter "O" seems simple to me. When I was in the Navy, we slashed the zero; as long as I have worked with computers, [we] have slashed the letter "O." Why? In each case, we slashed the one we used the least. What could be more obvious or more practical?

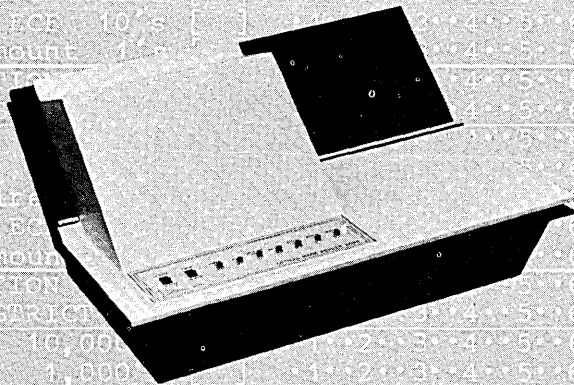
"Which to slash" is a problem, however, only because nearly all typewriters and computer terminals use the same shape for the zero and the "O". The best solution to the problem is not to slash either. Instead, let's follow the example of some printer manufacturers: make the letter "O" very round or nearly square, and make the zero thin or very elliptical. The result is more readable than either alternative with a slash. Many printer and terminal manufacturers offer the square "O"/thin zero combination, including Teletype. I, for one, urge all others to follow suit.

DAN PAYMAR
Newport Beach, California

May I propose a relatively simple looping of the handwritten alphabetical letter "O" . . . sort of an upside-down "Q".

ALAN GELBERG
Rockville, Maryland

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I claim the reward (10¢). After many years of studying this dilemma, I have finally decided that "0" is numeric, and "ø" is numeric. I believe that the alphabetic "O" is simply unnecessary. It is clear that any statement in which it appears can be rewritten, eliminating it. At wrst, ne may have t drp a few letters, but the result is easily understd.

STEVE WRIGHT
Princeton, New Jersey

I submit . . . ANSI Document X 3.6.3/6, 1968 Sep. 20. Military and communications applications began slashing their zeroes long ago. Programmers, for some unknown reason, seemed to prefer slashing the letter "oh". Neither convention bears any resemblance or relation to the digit and the letter involved. The "looped" letter adapted by the (proposed) standard is clearly reminiscent of the usual cursive encoding of the capital letter, and has no relation to the digit. Furthermore, it is much easier to write, as it does not require a second, unconnected stroke. I had hoped the matter was settled by now.

BRUCE A. MARTIN
Upton, New York

So had we.

Dataphilatelics

We have been interested to note that numerous countries have issued postage stamps related to computers or electronic data processing (Feb., p. 74).

Of course, you have only been able to include in your contribution a cross-



section of the total number of stamps dedicated to the above theme by various countries. We noted, for instance, that you failed to mention two Swiss

computer stamps. They are special stamps issued in 1970, one of them marking the 75th anniversary of the Swiss Telegraphic Agency and showing a punched tape, while the second stamp points to the Federal Census of 1970 by depicting an optically readable record.

R. ZURFLUH
Bern, Switzerland

Spreadingout

Re "Tightening sbc" (June, p. 157), you should know that sbc's decision to relocate its headquarters and development laboratory were decisions based on the growth of our business, not a contraction, as the word "tightening" might suggest to some readers. Both moves are consistent with the requirements of an expanding business, and provide immediately for increased floor space and the opportunity for additional expansion for the future as the business continues to grow.

J. F. WILLIAMS
New York, New York

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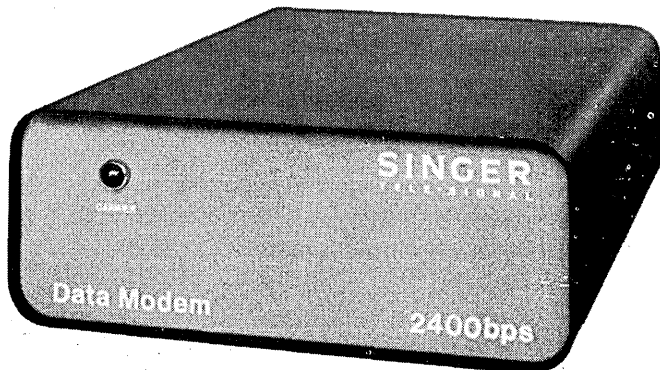
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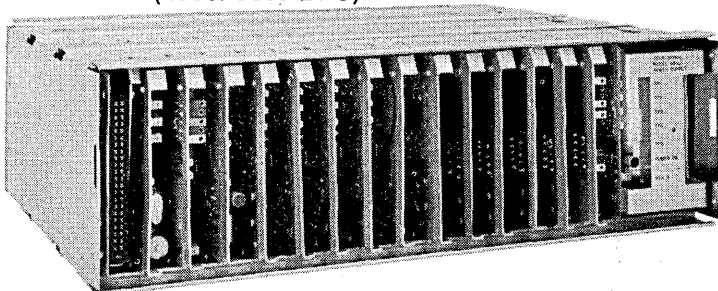
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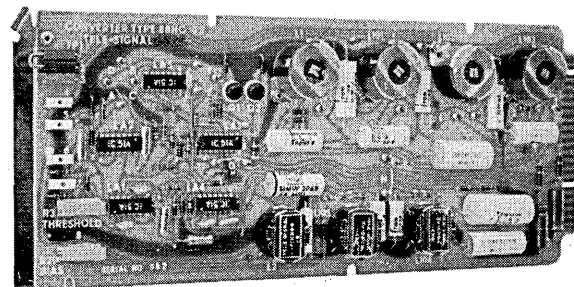
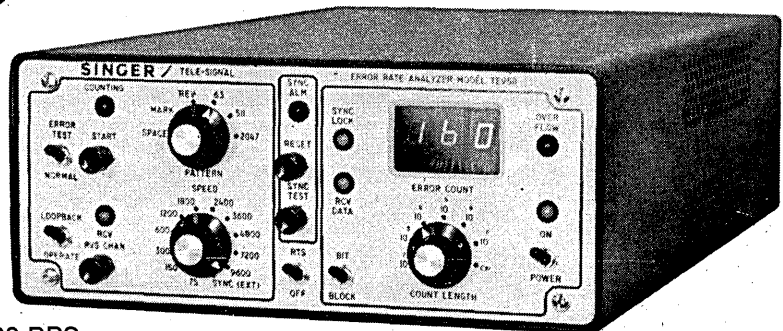
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Look Ahead

(Continued from page 18)

more. They budgeted \$250,000 for a study of registration problems and design of a system to solve them, and RFP's went out last month to some 200 firms, including IBM. Proposals are due back by mid-September.

Maricopa County is closer. Its supervisors have approved a system designed for the county by Howard Wilson Co., a Los Angeles software firm specializing in political and election work. At this writing, the design for the system, which would use an in-place Honeywell 6000 and H6000 keyboard terminals, was being reviewed by the county's registrar-recorder.

AND THEN THERE WAS ONE, MAYBE NONE

There was only one bidder left as the July 30 bid submission deadline neared for the state of California's \$40 million Teale Center, a consolidated dp center to serve 34 state agencies. But this could mean none, since the state's new budget bill requires that there be at least two "qualified bidders" before a contract can be awarded. From an initial field of 12 firms which bought the Invitation For Bid (IFB), only three, IBM, Honeywell, and Control Data, said they would bid. CDC pulled out early last month (see p. 74), followed in a couple of weeks by Honeywell. The Big H said it couldn't meet the mandatory conversion date of June 1974 for the Department of Motor Vehicles, and couldn't bid a fixed price for the conversion, because its subcontractor, Computer Science Corp., wanted it open-ended. Both Honeywell and CDC called the IFB fair and competitive but Univac protested it and the state was to respond Aug. 3. At this writing, the procurement had not been aborted. Vendors and officials were agreed that the next step depends on a legal interpretation of the term "qualified bidders."

SOVIETS DICKERING TO EXPLOIT VIRTUAL MEMORY

A 370/158 with "quite a few 3330 discs" was the system that recently won IBM a multi-million dollar reservation system contract from the Soviet Intourist Agency. So says a source with good contacts inside the ministry that negotiated the deal. The big question now is whether IBM can get a license to export the advanced technology it has offered.

Equally intriguing is the question of whether the Soviet government gave the U.S. government some political quid pro quo so that the U.S., in turn, would be more willing to let them exploit virtual memory and the other goodies in the IBM bid. In any event, if the license is granted, present export restrictions will almost certainly be relaxed considerably for all U.S. mainframers.

RUMORS AND RAW RANDOM DATA

The hush-hush Naval Weapons Laboratory apparently isn't using paper-shredders in its computer security procedures. It does the next best thing to dispose of tons of computer printouts: it gives them to the Boy Scouts. "Each month, a stack of computer output that's five feet tall and ten feet deep," said the laboratory's Herman W. Toombs in a deposition taken June 13, in Minneapolis, in connection with IBM's defense against the Justice Dept.'s antitrust suit...Ampex Computer Products, which makes the DS324 -- a double-density 2314 disc drive -- expects to offer a dual-density 3330, but hasn't set a date. Its first 3330 equivalent is to be shipped late this month or early in September.



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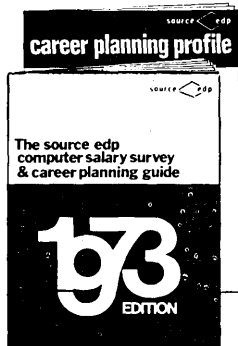
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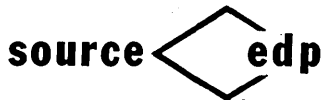
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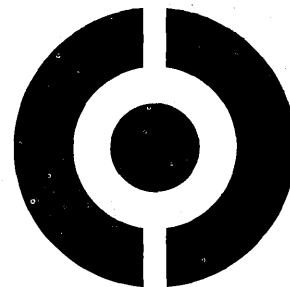
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The Forum

Computer Acquisition Method Analysis: A Response

Mr. Brandon's inclusion of the "breakeven" method in his article "Computer Acquisition Method Analysis" (September 1972, p. 76) can only be justified on the score of demonstrating conclusively why that method should never be used—even for "back of an envelope" calculations. One has only to compare the answers obtained against those resulting from the DCF method to see why.

	Rent	Lease
"breakeven"	52 mths.	81 mths.
DCF	72 mths.	90 mths.

However, those who would persist with the method should be aware of certain short cuts which Mr. Brandon has introduced without identifying or justifying them—in particular the inclusion of only half the "money cost of purchase" (perhaps to compensate for the omission of "money cost" of rental, maintenance etc.). There is also an inconsistency in the assumption regarding insurance where the "breakeven" method equates insurance to .01R (1% of one month's rental regardless of the period) but the DCF method assumes .01 NR/12 (1% of one month's rental for each year). The introduction of discount factors into the "breakeven" method when considering residual values is itself evidence of the impossibility of ignoring the time value of money. Without discounting residual values, the answers to the examples would have been 32 months and 65 months respectively for rental and leasing. The rental answer is clearly nonsense!

The fundamental point about the invalidity of the "breakeven" method is that it will give the same answer regardless of whether rental payments are made progressively, in a lump sum at the beginning or a lump sum at the end.

In the DCF example, I believe Mr. Brandon has misread his own figures from Table 6—purchase is cheaper than rental in six years (not five). He has also confused this reader with his "simplification" of the depreciation calculation. The sum-of-years'-digits method is not used in Australia, but the text books do not give the same answers as appear in Table 5, although the maximum difference of 3% is probably not significant.

Constructive comments

Lest I be thought entirely negative, allow me to make a couple of constructive comments. The problem of estimating residual values is always difficult. A useful approach can be to do the comparisons assuming various likely lengths of life for the system and then calculate what the residual value would have to be to make purchase cheaper than rental or lease. Using Mr. Brandon's example, if one assumes a four-year life, Table 6 shows the post-tax-discounted cumulative costs of rental and purchase after four years as 20.35R and 31.40R respectively. The difference of 11.05R has to be recovered. We assume that any recovery above the depreci-

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Analysis

ated book value is taxable, and noting that cumulative depreciation up to and including year four is almost exactly 30R, the book value is 18R. We can calculate the residual value after four years (V4) as

$$\begin{aligned} .7938 (V4 - 0.5 (V4 - 18R)) &= 11.05R \\ \text{hence } 0.5V4 &= 13.92R - 9R \\ V4 &= 9.84R = \text{just over} \\ &20\% \text{ of the purchase price.} \end{aligned}$$

In other words, if we think we can get 20% or more after four years, we should purchase. Note also that the formula used above is mathematically correct even if, as it happened in this example, the residual value is less than the depreciated book value and we therefore can claim a tax "loss." Using the symbols BV_n to indicate the depreciated book value at the end of year n, V_n the disposal value, D_n the discount factor, and Δ_n the difference in cumulative cash flows, the formula reduces to

$$V_n = \frac{\Delta_n}{\text{taxrate} \times D_n} - BV_n.$$

It therefore becomes a simple matter to calculate the necessary residual values for even several assumed lives, and assess one's chances of sufficient recovery to justify purchase.

The user should also be aware of the distortion caused by using year-end discount factors as in Mr. Brandon's example. In many cases the *relative* distortion is insignificant but there are some circumstances where it cannot be ignored. These are when discount rates are high (e.g., 10% or above) and/or payment terms vary. For example, it is usual for manufacturers to collect rental monthly, but some leasing companies want their payments quarterly in advance. I have looked at one proposition involving lease payments totalling about \$1.8 million where the true cumulative after-tax present value cost was \$60K higher than the cost calculated using year end factors. I suspect leasing companies make more money this way than they are willing to admit!

Strictly speaking, Mr. Brandon's DCF calculations are incorrect in that, by applying a discount factor of 1.0000 to both the first year's rental outgoings and the purchase price, he infers that all the first year's rental is paid on the first day. The more usual (and correct) treatment is to consider the purchase price as being paid in year 0. This is then not discounted, and both purchase and rental outgoings are discounted using, for example, continuous discount factors. However, in the example, the net result of the more correct (and no more difficult) calculation is that purchase still becomes cheaper than rental at the six-year mark.

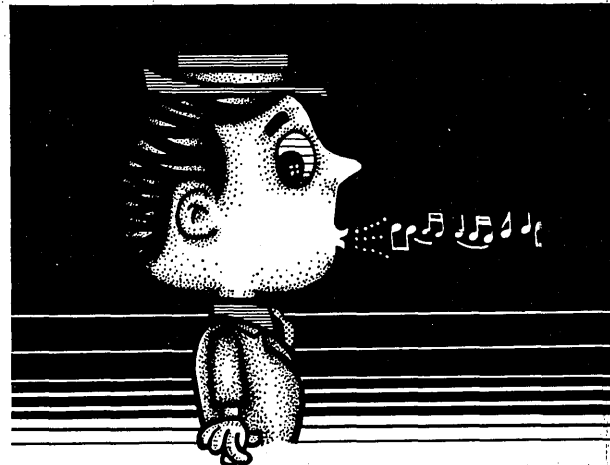
Another option

One other important option not mentioned explicitly in the article is the mixed ownership configuration. Purchase to rental or lease ratios vary quite markedly between various items of equipment. For instance on an IBM 370/158 mainframe with 12 months' free maintenance and excluding extra shift changes, the ratio is just under four years. On an IBM 3211 printer with three months' free maintenance and taking the fixed term plan rental, the ratio is almost exactly six years. Whilst straight purchase to rental ratios are as useless as the "breakeven" method for evaluating alternatives, they at least draw our attention to the possible advantages of, for example, buying mainframes and renting peripherals.

One final comment—DCF may look complicated, but once one has identified all the data required, the calculations themselves are very straightforward, if somewhat tedious. If one has access to an interactive system, the development of

a program to do the calculations is well worthwhile. A well-designed program ensures that no relevant data are left out and enables one to quickly examine multiple alternatives. It also enables one to examine readily some more obscure variations on the "what residual value?" theme mentioned above—for example, one can calculate the discount rate at which purchase and rental would have the same present value cost, all other factors being assumed fixed. This sort of investigation is usually too laborious to be carried out using slide rule or desk calculator.

—C. W. Jones



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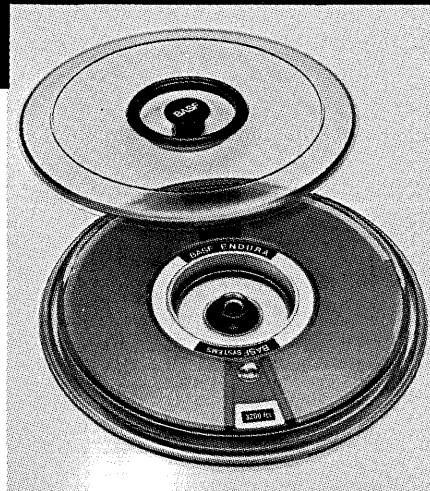
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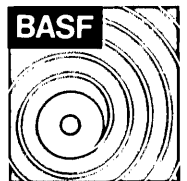
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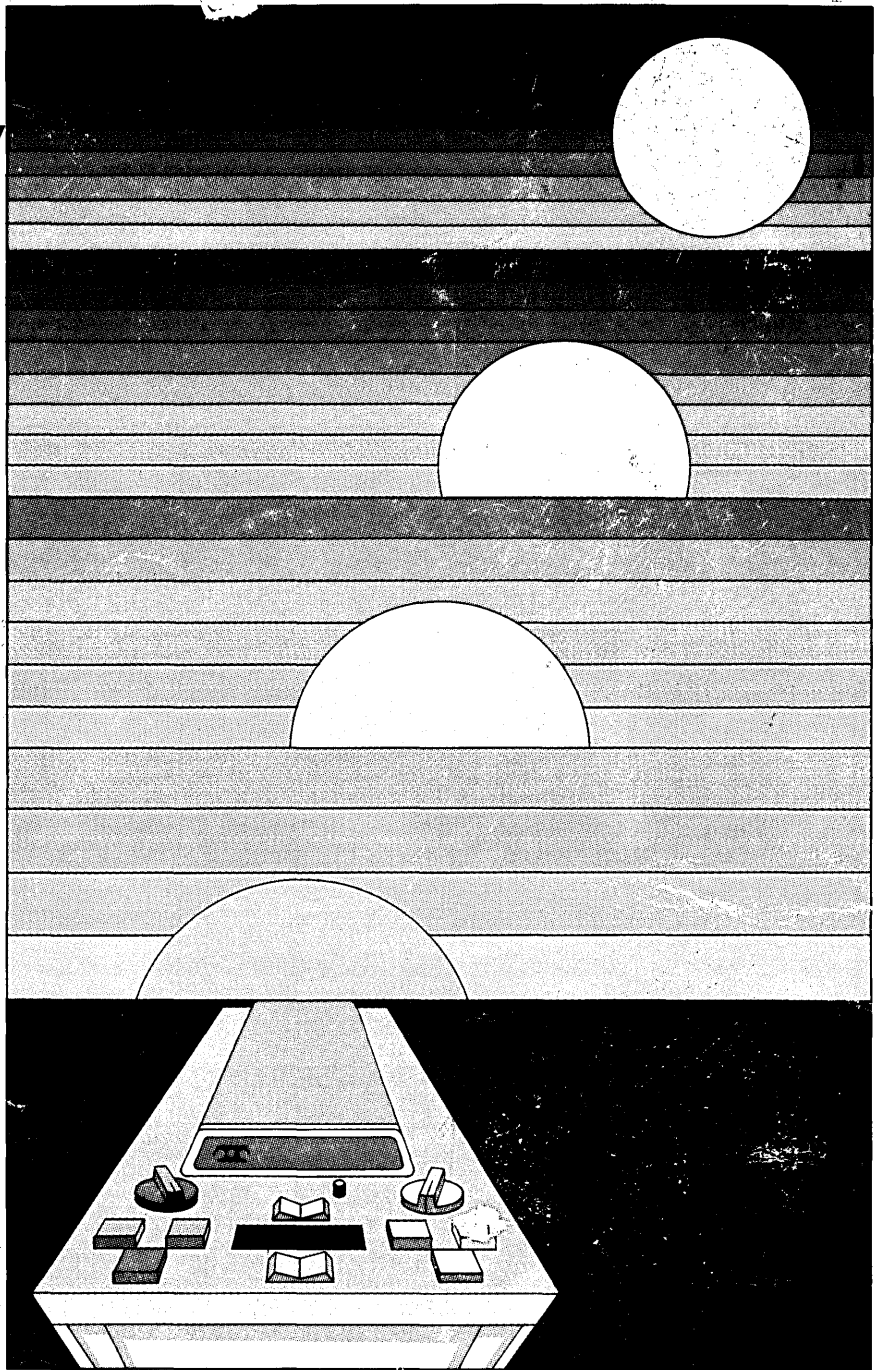
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