MODERN DATA

APRIL 1971

1971 SJCC

ATLANTIC CITY

PREVIEW ISSUE

We've made a great computer a lot better.

Varian's new 620/L has a dramatic price/performance ratio that gives more computer in less space at lower cost. The 620/L is an advanced design of the reliable, field-proven (over 1300 installed worldwide), systems-oriented 620/i computer.

Priced at only $7700, the 620/L has an 8K, 16-bit, high-performance memory that can be expanded to 32K inexpensively. Each 4K memory increment is $2300. What's more, if you don't need 8K, you'll find the basic 4K, 16-bit 620/L very attractive at $5400!

The 620/L is small, so small that when fully expanded—a 32,768-word system with all main frame options and up to eight peripheral controllers—fits into just 21 inches of rack height.

The 620/L is 100% I/O-and software-compatible with the 620/i, and new peripherals and software have been added. All peripherals, software, and application packages (developed for earlier 620 models), as well as the 620/L itself, are off-the-shelf.

You know us. You know that when we say we have something better, we can prove it. Talk to the big company in small computers.

varian data machines
The Big Company in Small Computers

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CIRCLE NO. 1 ON INQUIRY CARD

New

HARD COPY UNIT

4601 HARD COPY UNIT with T4002 GCT

Permanent copies from the Tektronix T4002 Graphic Computer Terminal and . . .

This New Hard Copy Unit produces copies *directly* from Tektronix Storage CRT's. Operation is easy. At the push of a button or upon programmed command, your computer outputs are permanently recorded on reproducible copies. In just 18 seconds a high resolution copy of even complex displays is ready for use.

Now, information from your computer is quickly copied for distribution to management and office personnel. These copies are ideal for portfolios and permanent records—and serve as a quick, inexpensive method to keep business clients and associates informed with current information.

COPY COST is less than 8 cents per 8.5 x 11-inch copy, depending upon usage.

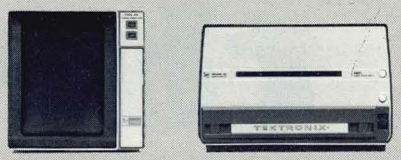
When people who have a need to know can't come to see the computer display, send them a copy. With the 4601 Hard Copy Unit you'll have a quick, easy, low-cost way to record and send information when and where it's needed.

For additional information, contact your Tektronix Field Engineer or Application Engineer: or write to Tektronix, Inc., P. O. Box 500, Beaverton, Oregon 97005.

4601 Hard Copy Unit	$3750
T4002 Graphic Computer Terminal, less interface	$8800

Available in U.S. through the Tektronix lease plan
U.S. Sales Price FOB Beaverton, Oregon

. . . the T4005 Graphic Display



. . . the 611 Storage Display Unit

TEKTRONIX®
committed to technical excellence

No contacts. No reeds. No sweat

Just our unique proximity switching, using a single transistor. Combined with our read only memory encoding, you get a keyboard with fewer parts that requires less than 100 ma at 5 volts. (No – 12 volts required.) It's that damm simple. Other features of the CDK include low profile, light weight and rugged construction.

For a few bucks more, we'll fix it so that if the girl dumps her morning coffee onto the CDK, there's no danger, no problem. And the total price will still be competitive with keyboards that can't match our reliability and long life. If you're using, or planning to use keyboards, write for our keyboard spec kit. We'll send it by return mail.

CONTROL DEVICES, INC.
204 New Boston Street
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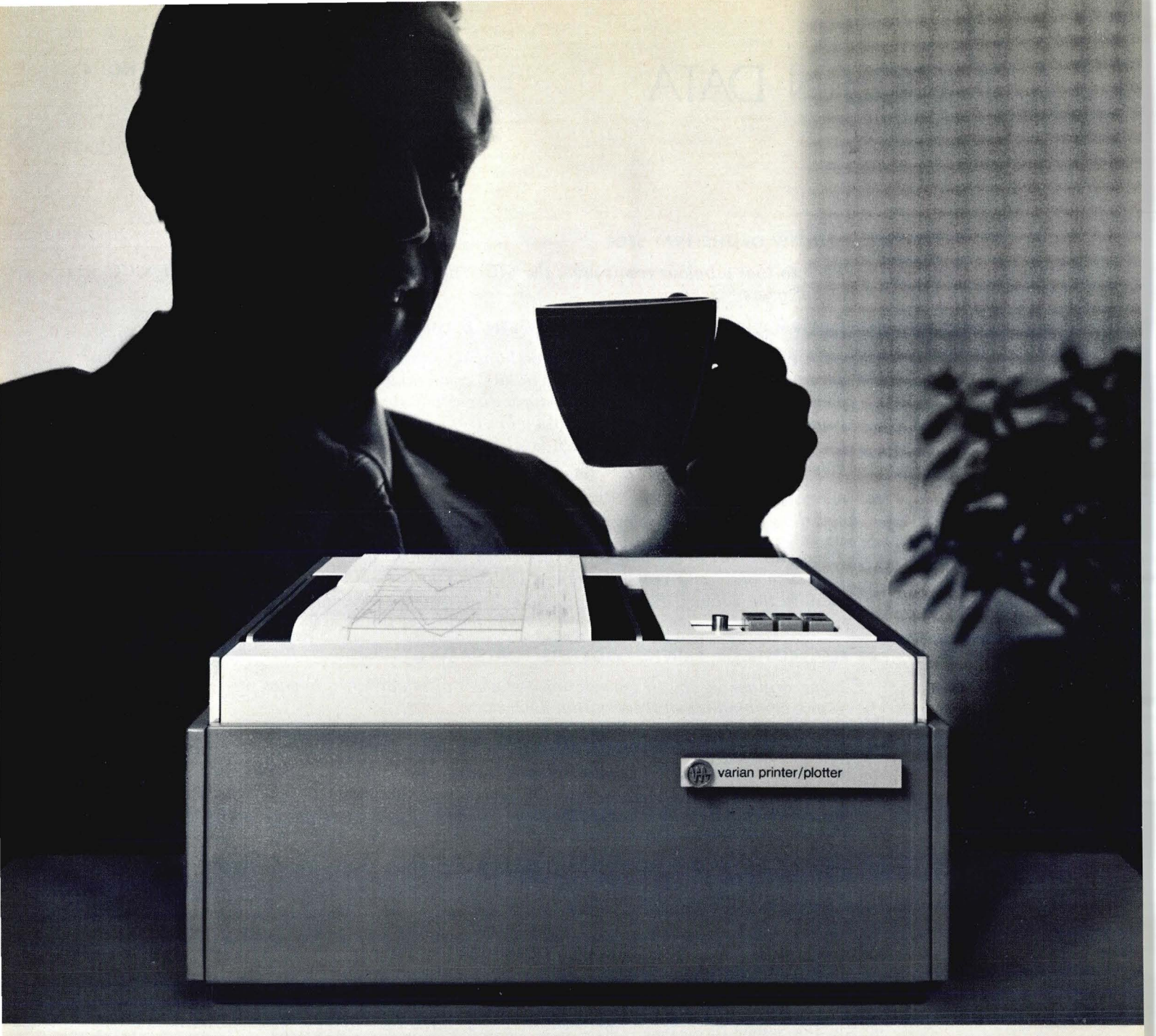
the no-switch switch

MODERN DATA

APRIL 1971 ■ VOLUME 4 ■ NO. 4



Statos 21 will print 300 pages of charts, graphs, and text while the boss has his coffee.

(But he'll have to drink fast!)

This new printer/plotter, latest in a line of electrostatic devices pioneered by Varian, can deliver hundreds of pages of computer-generated text and graphics while you take a 5-minute coffee break. That's four times the speed, at half the price, of most impact printers. And it does it in a 2-foot square without a whisper.

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A problem solving computer peripheral—Statos 21 is plug-to-plug compatible with IBM/360, Varian 620/f and other computers both large and mini. The fact is, nearly every data processing and management information system can benefit from Statos 21. So for more on the story of Statos 21, contact us at 611 Hansen Way, Palo Alto, Calif. 94303. Call (415) 326-4000.

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graphics & data systems division

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Anybody can sell you a "low-cost" box of hardware for processing data, but have you considered that it might take another six months and $20,000 for the software to get it on-line?

That's why Raytheon Computer developed an extensive software library for our 700-Series 16-bit processors. With over 600 fully documented programs available off-the-shelf, you'll never have to write a systems program again.

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LETTERS TO EDITOR

To The Editor:

Referencing your "Astrogyp" article in October's MODERN DATA: You may have seen a different advertisement for "Zodiascope" then the one I've enclosed. However, please note that the picture shows a Hewlett-Packard 2000A computer and a Hewlett-Packard 303OG tape drive, not a Honeywell System.

My compliments on an otherwise beautifully written and timely expose.

Frank Del Monte,
Leasco Response, Inc.,
Washington, D.C.

To The Editor:

At the recent A.C.M. meeting in New York City, F.B.I. agent D. R. Roderick described the steps taken to prevent National Crime Center (N.C.I.C.) data ("wanted" lists, stolen cars, and in the future, arrest records) from getting into unauthorized hands. He also stated that the security of the N.C.I.C. system primarily rests with the local police authorities – the intended users of the system.

It is, however, not clear to me what is to keep an insurance agent who is also a deputy sheriff (or a moonlighting policeman) from accessing the system for private gain. When I presented this hypothetical situation to Mr. Roderick, he suggested that the F.B.I. may deny service to those authorities who misuse their responsibilities.

As a private citizen as well as a computer professional, I believe that this is insufficient. Since the "Secrecy" Clause of the Communications Act of 1934 makes it a crime to divulge this sort of information outside the system, the F.B.I. should vigorously prosecute unscrupulous law enforcement officials who misuse N.C.I.C. data to the same extent that it would prosecute any other individual found to be making unauthorized use of this data.

Martin Minow
Research Group for
Quantitative Linguistics,
Stockholm, Sweden

To The Editor:

Your February Technology Profile on line printers prompted me to ask you this question, since nobody else seems to know the answer: Does anybody make a printer with a little processs-control machine attached that will automatically receive the output of the printer, burst it, fold it up, stuff it in an envelope, seal the envelope, address it, and toss it in a mail bag?

And if not, why not? One of the small lunacies of the computing world today is the number of people I see who are "slaves to a computer." In this case, it is the anonymous warm bodies who run around attending to the computer's digestive functions. What an appalling job! Isn't this what the computer was supposed to rid us of in the first place?

Ward D. Maurer, Asst. Prof.
Dept. of Elec. Engrg. &
Computer Sci.
Univ. of California
211 Cory Hall
Berkeley, Cal. 94720

The Editor's Reply: *There are, of course, a number of automatic bursters, stuffers, sealers, and stampers on the market. But if we read you correctly, you want an on-line system that collates and addresses as well – in one continuous process. We're sorry, but we can't think of a system of this type either. Perhaps some of our readers know of one.*

It takes special data terminals to fill special data terminal requirements.

And special data terminals are our specialty.

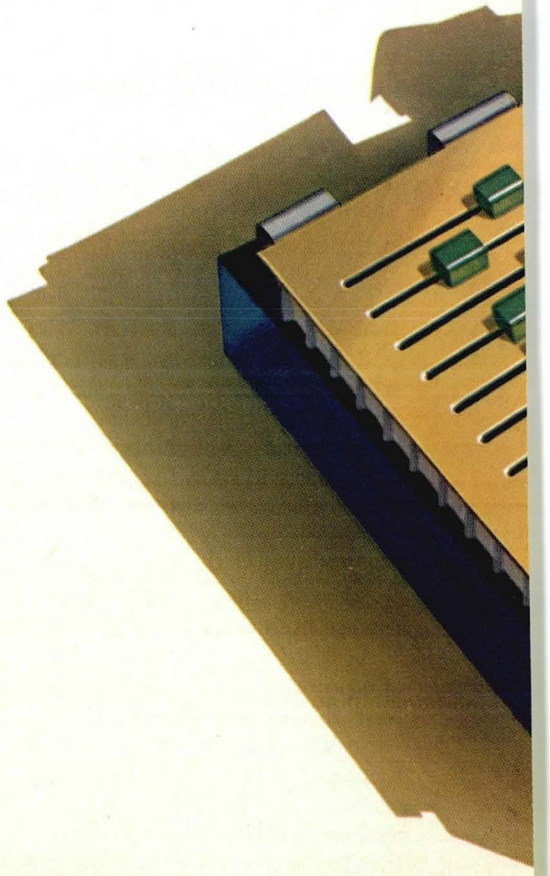
Since we make most of the components that go into data terminals anyway, we can design and make the whole terminal, to meet your custom requirements.

And you'll be happy to hear that our typical turnaround for a prototype is normally less than four months.

If you prefer to put your terminal together yourself, we can supply you with do-it-yourself components such as card readers, switches, scanners, logic, indicator lights and all the connectors you'll ever need.

But you'll save time and money if you let us do the whole thing. And we'll treat it as special as you would.

For more data on our data terminals, write to
Industrial Div., Dept. SYS,
AMP Incorporated, Harrisburg, Pa. 17105



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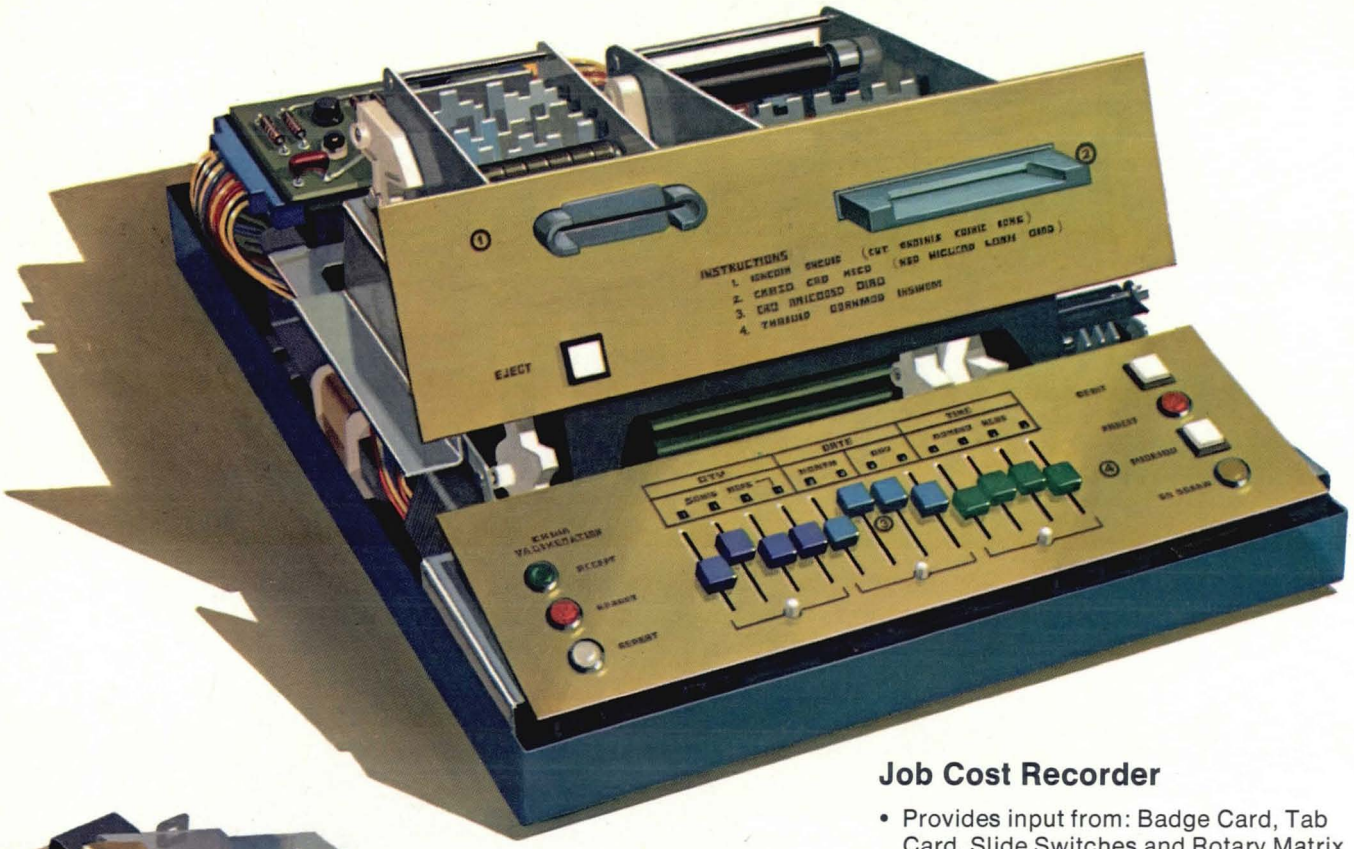

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- Provides input from: Badge Card, Tab Card, Slide Switches and Rotary Matrix Switches
- 10 or 11 level ASCI output +5 −0 level
- ASR-33 compatible
- Output data rates from 10 characters per second to 500 CPS
- Lamps to indicate reject, repeat, error, standby
- Case designed to your specifications

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- Automatic dialing of computer telephone number
- Computer answer-back lamp
- Provides 12 digit inquiry number
- Three answer-back lamps can indicate valid credit,
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Has your memory system become a bottleneck? Has it put you further and further behind while your computer sits and waits for data transfers? Data processing equipment thru-put time costs money. That's why the DISKSTOR 510® was designed. This new operator replaceable disc storage system from General Instrument will add fast access memory capacity to your computer. Double-surfaced discs, which store up to 5 million bits per surface, can be changed simply and quickly. And the head-per-track design of the DISKSTOR 510 provides quick average data access times of 8.7 milliseconds! So, when you need additional capacity and flexibility for your mini-computer, auxiliary memories, process control, automatic test systems, data acquisition, message concentration, data multiplexing, and output data accumulation for transmission, look in DISKSTOR Country! Write now for a new 8-page brochure describing the DISKSTOR 510, or call for application assistance.

When you need high-speed, head-per-track access (8.7ms.) combined with the flexibility of removable discs....

Look in DISKSTOR Country!

DISKSTOR 510

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CIRCLE 50 ON READER CARD

Announcing: MODERN DATA's **TechFile** Updates

NOW KEEPING UP WON'T TAKE SO MUCH KEEPING UP

Which subjects or products in the list below concern you most? Would you like to be kept up-to-date on the new products, new services, new developments every three months?

***STEP ONE* IS TO ✓ CHECKMARK YOUR CHOICES:**

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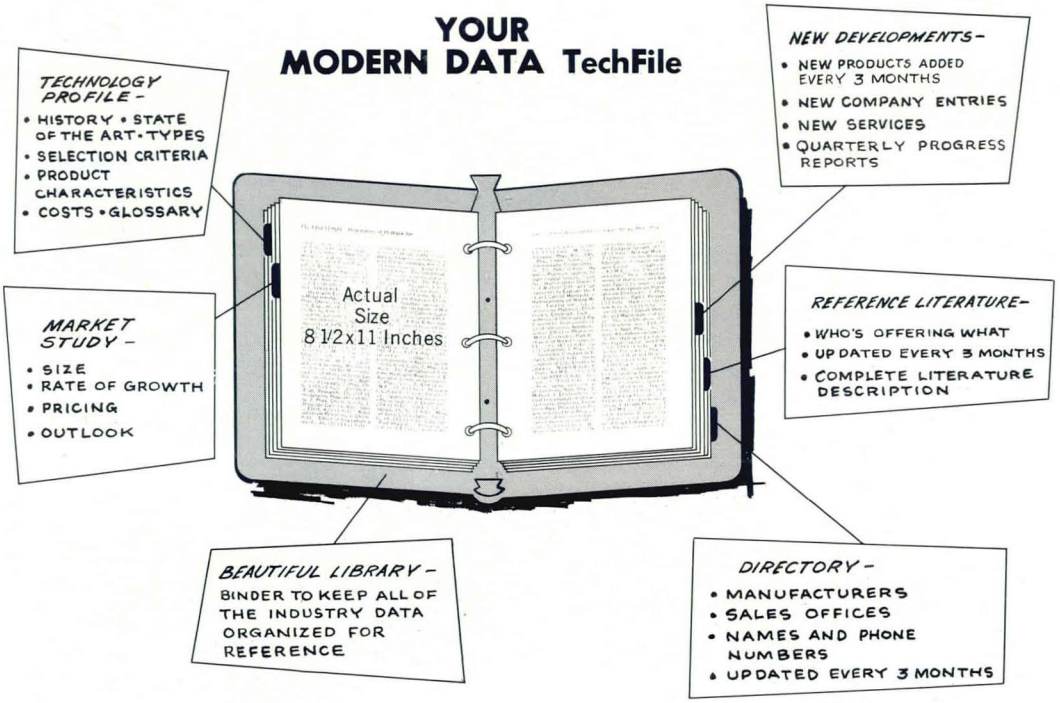
____(422)	Interactive CRT Display Terminals
____(423)	Cassette-Cartridge Tape Transports
____(424)	Computer Output Microfilm
____(425)	Acoustic Couplers
____(426)	Optical Character/Mark Readers
____(427)	Disk/Drum Memories
____(428)	Teleprinters
____(429)	Computer Printers
____(430)	Modems/Multiplexers
____(431)	Minicomputers

INQUIRY CARD NO.	
____(432)	Magnetic Tape Transports
____(433)	Digital Plotters & Drafting Machines
____(434)	Graphic Digitizers
____(435)	Key-to-Tape/Disk Systems
____(436)	Time-Sharing Services — S. Atlantic & S. Central States
____(437)	Time-Sharing Services — N. Central States & Central Canada
____(438)	Time-Sharing Services — Mountain States, West Coast & W. Canada
____(439)	Time-Sharing Services — Northeast States



MODERN DATA's Technology Profiles are probably no stranger to you. In accordance with MODERN DATA's policy, they're written **by** computer people **for** computer people. Now the TechFile updates will let you **stay** abreast of the changes in the subjects or products that concern you most. Publication for a number of the titles is imminent. The cost will run from $45 to $60 a title for a **full year's service** once they're published. Inquire **NOW** and you can **save up to 44%.**

STEP TWO IS TO CIRCLE THE NUMBERS ON THE READER INQUIRY CARD THAT ARE LISTED BESIDE YOUR CHOICES IN THE LIST ABOVE.

By return mail you will receive complete details, including contents, publication dates, prices, and how you can *save up to 44%* by ordering *before* publication.

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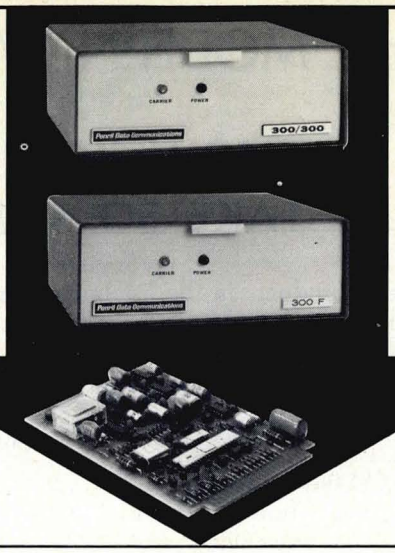
MODEMS by Penril



300 BPS
(Bell 103A/E)

300 BPS
(Bell 103F)

1200 BPS
(Bell 202C)

110 BPS
(Bell 101C)

Our modems are better; our prices are lower.

Our 4800 bps modem has a fully automatic equalizer, but it sells for only $3500. We are prepared to demonstrate its performance on your lines, in competition with any other modem, even the most expensive.

At 2400 bps we offer two modems - one for dial applications; one for dedicated lines.

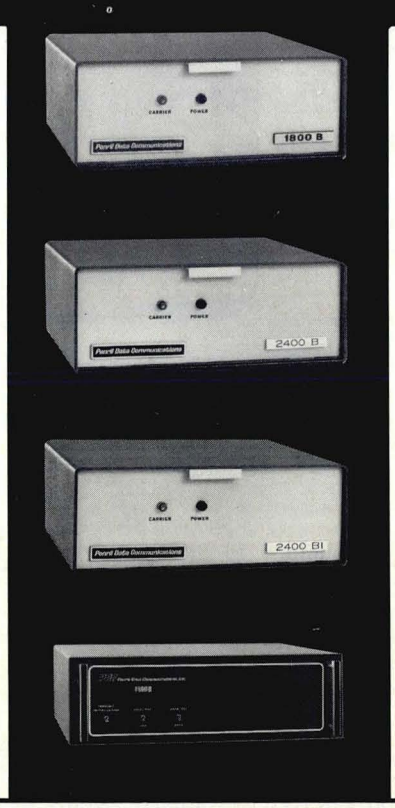
Our 202C equivalent incorporates MOS/LSI design. The complete modem, including control functions, is on one 4" x 4" pc card. The reverse channel will go to 150 bps. There is nothing else quite like it.

We have a complete family of Bell 103 equivalent modems and a Bell 101C equivalent that's in a class by itself.

Need a modem . . . a better modem?

Give us a call . . . that's our business.

SJCC Booth 1345



1800 BPS
(Bell 202D)

2400 BPS

2400 BPS
(Bell 201B)

4800 BPS

Penril Data Communications, Inc.

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Let Honeywell take a load off your mind. When it comes to real-time data acquisition and control, we have more to offer than anyone. And our Series 1600 systems start as low as $12,900 — complete with computer, interface, and operating software.

There is a variety of field-proven systems, peripherals, and communications subsystems (which tie together a hierarchy of 1600's). There are plenty of analog and digital subsystems, too, that handle up to 2,048 analog inputs and 4,096 digital inputs and outputs.

There is a powerful foreground/background monitor. A real-time executive. And functional software packages for data acquisition and DDC.

There are attractive quantity discounts plus world-wide sales and continuing field support that you know you can count on.

Find out why Honeywell is your best way to get away from real-time and control problems. Write: Honeywell Information Systems, MS(061), 200 Smith Street, Waltham, Mass. 02154.

The Other Computer Company:

Honeywell

CIRCLE NO. 10 ON INQUIRY CARD

4800 bps effective throughput over dial-up lines with no errors

That's up to four times the effective throughput of "competitive" modems.

Yes, the Paradyne MARQ-48 gives you an effective throughput of 4800 bps on either dial-up or leased lines. This is achieved through such innovative features as a 5112 bps bit rate, automatic adaptive equalization, and powerful error control*.

Benefits of MARQ-48 usage include • **system throughput improvements** due to elimination of error-recovery overhead and data-blocking restrictions • **improved reliability** through the use of powerful error detection codes and self-contained buffering • **operational efficiencies** through line quality and throughout monitoring.

Yet, the Paradyne MARQ-48 costs no more than ordinary "competitive" modems which merely modulate and demodulate.

Want to learn why the MARQ-48 will do what no other modem will do for your system?

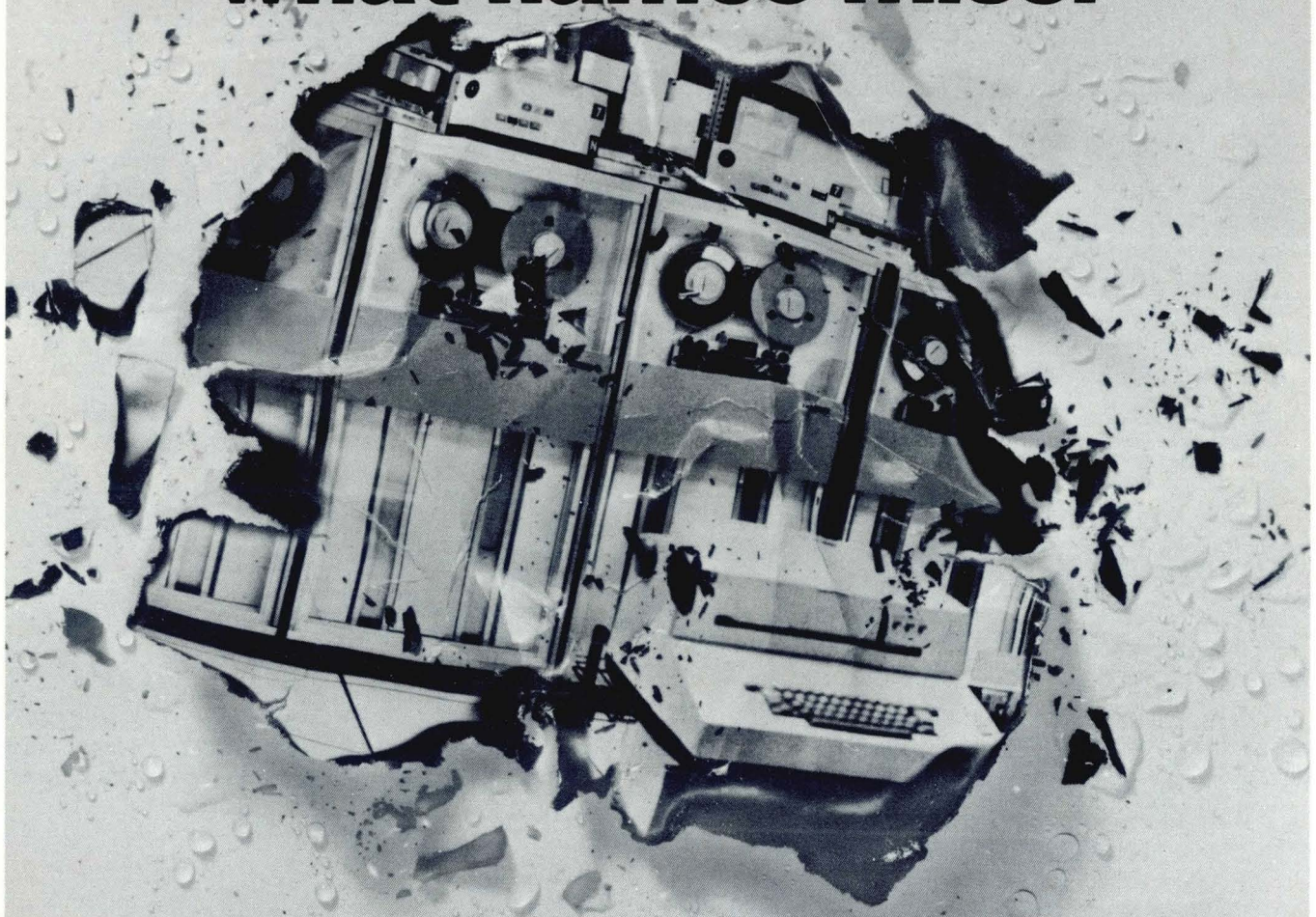
*continuous transmission ARQ using a simultaneous ACK/NAK "reverse channel" which eliminates line turnaround.

paradyne

Paradyne Corporation • P.O. Box 5144 • Clearwater, Florida 33518

CIRCLE NO. 11 ON INQUIRY CARD

Stop fires dry in seconds before water damages what flames miss.



A computer center is no place to fight fire with water. Or with any other corrosive or conductive suppressant.

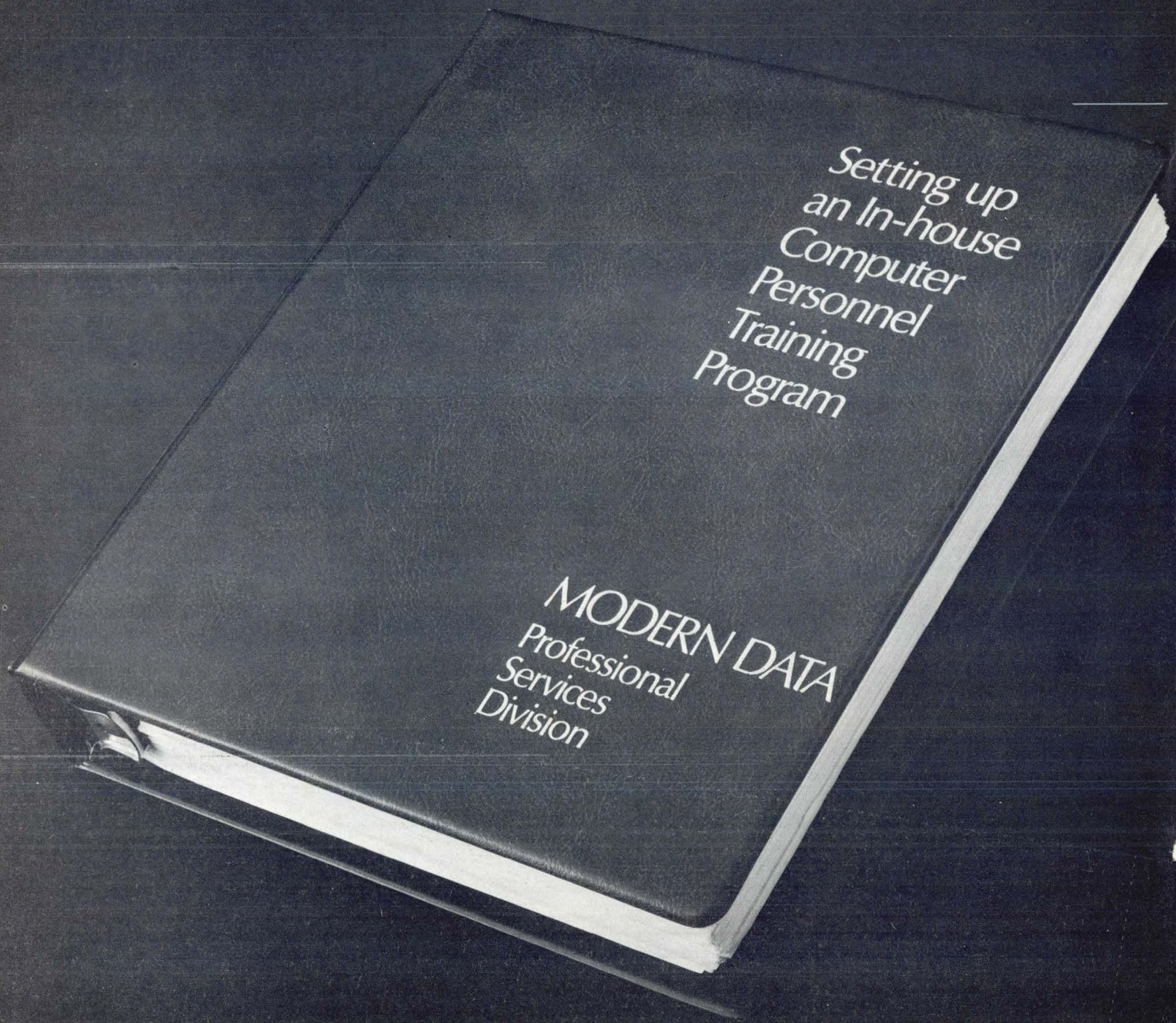
So Fenwal, leading developers of explosion suppression systems for industry, came up with an absolutely dry idea. The Fenwal high-speed fire suppression systems.

Using super-sensitive, solid state detectors to spot fire, smoke or temperature rise, these sensors instantly activate the discharge of a dry, colorless, non-corrosive gas to knock out fire in seconds! This leaves the entire area clean, dry, safe-for-people. In short, ready for immediate reuse. Which eliminates downtime, equipment loss, and costly increases in insurance rates. Now doesn't that make sense?

We'll be glad to show you this system in action. Just call Mr. George Grabowski, Division Manager, to arrange a showing of the color film, "The Fireaters," at your plant or office. Fenwal Incorporated, 411 Main Street, Ashland, Mass. 01721. Phone (617) 881-2000.

FENWAL

If a consultant told you half the things
in this book,
it would cost a lot more than $150.



Written for the Modern Data GEM Report by Oyer Professional Computer Services, this 250 page indexed volume offers a complete systems approach to training. It is offered to you on a 10 day trial period for just $150.

This Modern Data GEM Report shows how to:

- Train top management
- Train the non-EDP professional
- Develop your own courses without incurring high consulting costs
- Transform poor installations into good installations
- Good installations into excellent installations
- Excellent installations into outstanding ones.

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Fill out the attached coupon and order yours today.

NEWS ROUNDUP

CPMA PROTESTS TARIFF 260 AMENDMENT

The Computer Peripheral Manufacturers Association (CPMA) has formally protested to the Federal Communications Commission against what it considers to be "unfair and monopolistic practices" on the part of the Bell System Operating Companies. The protest is in regard to an announced amendment application to Tariff 260 which includes a requirement that protective devices must be used on private leased line data communications service beginning on July 1, 1971.

CPMA's arguments that the proposed amendment would result in an increased and unnecessary financial burden to both end users and manufacturers are several: (1) There is no clear past evidence supporting the need for special protective devices; (2) The protective devices have not been defined either operationally or functionally; (3) The devices could restrict the use of equipment presently available from independent manufacturers which is technically superior to comparable Bell System offerings.

To the first point, CPMA points out that private leased line service has been successfully provided for years by the common carriers without the use of protective devices. Furthermore, notes CPMA, the profit margin attained by the current tariff appears sufficiently attractive to have warranted the emergence of competitive carriers.

CPMA believes that the mystery surrounding how the device will operate and what it is supposed to prevent is in itself enough reason for objecting to the tariff amendment. Not only could the device be designed to obsolete many current in-service equipments, but it could also end up doing exactly what it is alleged to prevent, i.e., degrade service rather than improve it. In any case, the requirement for the device "must be interpreted as punitive to independent equipment manufacturers" since it would force data communications users "to return to the Bell System as a source of supply" in the face of the less expensive and higher-performance equipment presently offered by Bell System competitors.

The Washington, D.C.-based organization dramatized this last point with an allusion to the Bell System's aura of pre-eminency in the data communications field: "The CPMA seriously doubts that AT&T is the only source of advanced technology in the communications industry. In fact, the implementation of equipment that allows data communications speeds in excess of 2400 bits per second on Tariff 260 lines has just begun by the Bell System. On the other hand, technically superior equipments which operate to speeds of 9600 bits per second have been available from independent manufacturers and successfully used for over three years." It is precisely such state-of-the-art equipments, claims CPMA, that would likely be made unusable by technical problems resulting from the as yet undefined protective device.

LATEST PRIVACY INVASION

Latest item in the controversy surrounding government-maintained data banks involves an alleged directive requiring certain upper-level government employees to take part in psychological, "encounter-type" sessions. In an address to a Dickenson College Public Affairs Symposium entitled "Privacy and the Constitution," Senator Sam J. Ervin (D-N.C.), whose Senate Subcommittee on Constitutional Rights has been probing such excesses, stated that "A record of refusal to cooperate with this program is grounds for a charge of disobedience, all of which is reduced to the minimum for cold computerized entry in personnel data banks, with no indication of the justice of the employee's protest against unwarranted privacy invasion."

Our new alpha-numeric terminal does everything you wanted it to do.

$36.80 a month.

The CT 264 conversational communications terminal gives you better cost/performance than any alpha-numeric unit around.

The cost is self-evident. The performance starts with an electronic printer that gives hard copy verification of all data sent or received. It prints 64 ASCII characters plus ASCII control codes on a ½" paper tape. And there's no ribbon, no noise, no moving parts. It all adds up to top quality.

There's a built-in modem that eliminates costly data sets. You get complete plug-in compatability with any computer. And you can carry this new terminal almost anywhere, relocate it anytime. It weighs less than 20 pounds.

This is what $36.80 a month buys with off-the-shelf delivery. Lower price with volume orders. And when you consider our options, like a plastic card reader, automatic answering, acoustic coupler, and several others, your system capabilities increase manyfold.

But this is only part of our story. At Transcom, we've been taking the systems approach to data communications from the very beginning.

We manufacture a family of compatible communications devices that at one end of the system includes a variety of remote communications terminals, card and paper tape readers. And at the other end, inside data central, we offer a line of receiving interface units for card and paper tape that makes for a complete, consistent peripheral system of data collection.

All our products are wholly electronic, solid state, portable and noiseless. They offer low cost/high performance operation. Everything considered, they're unbeatable for versatility and price.

If you want to know more about products that do what you want them to do, or if you want to tell us what you think our terminals ought to be doing, call or write: Transcom, A Division of Hi-G, Inc. 12 Tobey Road, Bloomfield, Connecticut 06002 (203) 243-1486.

Transcom

We know what you need.

CIRCLE NO. 14 ON INQUIRY CARD

CSMA TO HAVE FIRST NATIONAL MEETING

The Communications Systems Management Association (CSMA), formed in 1970, has scheduled its first national meeting to be held in New York on May 21 and 22. With attendance open to both members and non-members, the meeting will feature discussions of some of the many controversial issues confronting the field of communications in both voice and data services.

CSMA was founded by graduates of AT&T's Cooperstown advanced communications school, but membership is open to anyone with a direct interest in voice or data communications whose participation would benefit the industry and the Association. More than half of the present membership consists of communications management people outside of the Bell System.

Further information on CSMA and the spring meeting can be obtained from: **Mr. Thomas Malatesta, Executive Director, CSMA, Suite 303, 1102 West Street, Wilmington, Del. 19801**

ORDERS AND INSTALLATIONS

The Data Products Division of Lockheed Electronics Co. will supply more than $7.5 million worth of computer memories to Western Electric Co. in Greensboro, N.C.

Sanders Associates, Inc. has received a more than $7 million order from the Avis Rent-A-Car System for several hundred automated hard copy terminals, more than 100 CRT displays, and six communications processors for Avis' new "Wizard of Avis" system that will handle reservations, check-outs and check-ins, car control, and various types of business reporting.

Collins Radio has received an award valued at more than $1.5 million from American Airlines for processors and equipment to link American's SABRE II passenger reservation system with its ticket agent stations across the nation.

Montgomery Ward has announced a multi-million-dollar order for more than 1500 NCR Model 280 electronic point-of-sale data terminals to be delivered to Ward stores by the National Cash Register company in 1971 and 1972. The first installation will be in a Chicago area retail store in late summer.

The Systems Application Center of TRW Inc. has been awarded a $214,750 contract to develop a computer model that will simulate the nation's payment mechanisms by the Federal Reserve. The computer model will portray the flow of checks and other cash items within and among the cities where the Federal Reserve maintains offices.

The first IBM S/370 to be delivered to a customer is now operational at the Natick, Mass. headquarters of Zayre Corp., a retail store chain. In addition to the new Model 155, Zayre has a 360/50 and six S/3, Mod 10s installed at various distribution centers.

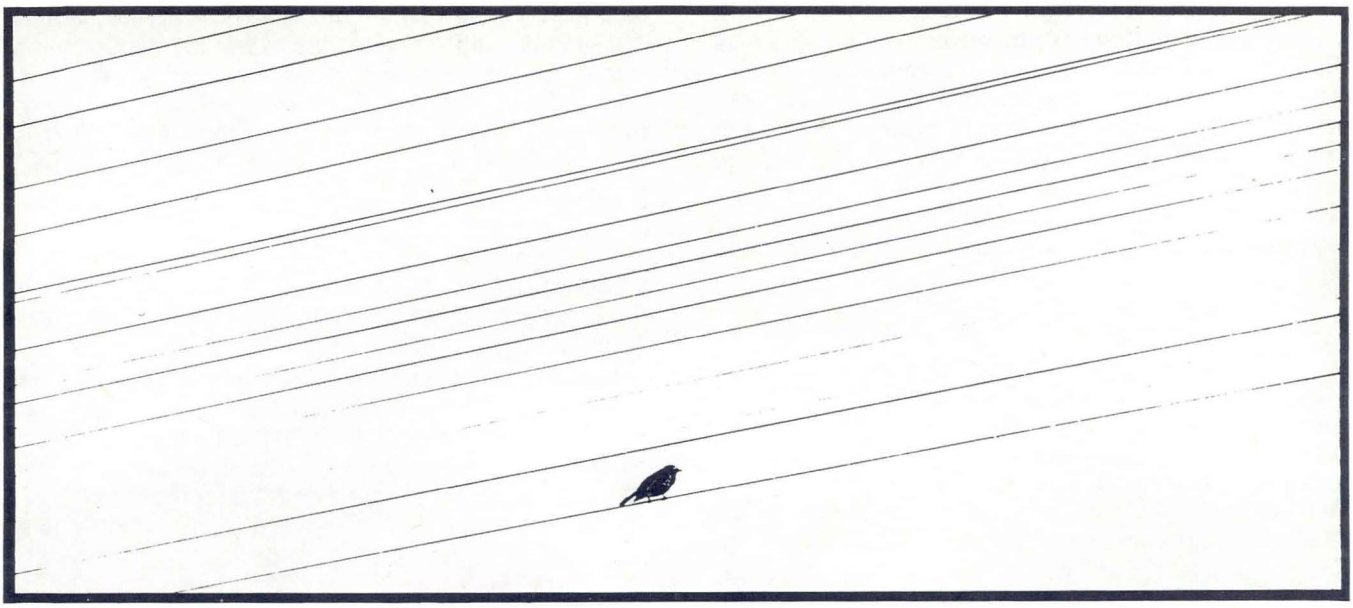
The Kingston, Jamaica firm of Compuentry Co., Ltd. has been named subcontractor on a major data processing contract awarded by the City of New York. Prime contractor is Volt Information Sciences, Inc. of N.Y.C., which will keypunch and key verify data required for rent control programs of the City's Housing and Development Administration.

Athena Systems, Inc. of Bedford, Mass. will supply 5,000 credit card readers to American Regitel Corp. of San Carlos, Cal. under a recently-signed $500,000, three-year contract. The Athena devices, which read the embossed numbers on standard plastic credit cards, will be incorporated into American Regitel's point-of-sale electronic sales register.

A contract for disk memory systems with an initial value of $430,000 and potential value of over $4,000,000 has been awarded to Informaiton Storage Systems, Inc., Cupertino, Cal., by Trans-A-File Systems Co., Cupertino. The ISS disk drives will be used with Trans-A-File's document storage and retrieval system.

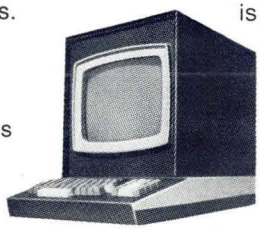
Scan-Optics, Inc. of E. Hartford, Conn. has received lease contracts for delivery of four new optical scanning systems, two to a major New England bank, and one each to two publishing firms. The new contracts bring Scan-Optics' backlog to more than $4 million.

For years we've been making equipment that measures the quality of telephone lines.



You'll find all that experience behind our new Data Modem.

The new Bowmar/ALI data modem has a lot of knowledge behind it. As you might expect from the people who used to be Acton Laboratories, Inc. and who make the world's most widely used equipment for data line evaluation and conditioning. Considering how much we understand about the quality of what passes over the telephone lines, it isn't surprising that the 6000A modem contains some unique circuits. They were developed specifically for this set so that it provides superior performance with respect to phase dispersion and noise encountered on the DDD network. Naturally this assures that the data being transmitted will get through with less chance of being garbled.



The modem operates at 2400 bits per second Fast enough to take advantage of the DDD capability, the speed is an ideal compromise between line use charge and equipment cost. Lower speeds require excessive line charges while the ratio of equipment costs to bit rate becomes excessive for higher speeds. The 6000A can be adjusted easily for 1200 BPS where required.

The unit is a completely solid state phase modulated set. It is offered in an attractive desk-top enclosure so it is suitable for office use. Other versions are available to suit the packaging requirements of terminal manufacturers so they can be incorporated into existing cabinetry. The 6000A is designed for EIA interface standards.

We'd like to send you complete details. Write or call: Bowmar/ALI, Inc., (formerly Acton Laboratories, Inc)., 531 Main St., Dept. MD-4, Acton, Massachusetts 01720. Telephone 617-263-7711.

BOWMAR

CIRCLE NO. 15 ON INQUIRY CARD

INTERNATIONAL NEWS

EXPORT VIOLATIONS — The Dept. of Commerce has imposed fines totalling $10,000 on Calcomp N. V. of Amsterdam, California Computer Products' Dutch distributor, for violations of export control laws. The Netherlands firm was charged with having made sales to customers not previously approved by the Office of Export Control in the Department's Bureau of International Commerce (BIC). However, BIC said no sales were made to parties prohibited from dealing in U. S. goods, there was nothing to indicate security violations, and no employees of the California company were involved. Half the penalty has already been paid, and BIC indicated the balance may be waived after further examination.

TRADE WITH HUNGARY — Although the 1971-75 trade accord between Budapest and Moscow should result in more scientific cooperation between these countries, Hungary's interest in the products of Western technology is not expected to slacken. The **Journal of Commerce** reports that little information has leaked out so far on Soviet-Hungarian collaboration in the computer field. In fact, the paper said, "Hungary has been West to acquire such technology and likely will do so again due to the East-West know-how gap."

UK DP IMPORTS UP — United Kingdom imports of computers in 1970 continued to diverge quite rapidly from exports, leaving imports further ahead than ever before. According to **The Financial Times of London,** 1970 exports were up 45 percent over 1969, while imports were up 52 percent in the same period. The main reason for the discrepancy is believed to be the import of large amounts of peripheral equipment to be used with imported or home-built computers, rather than the import of computer systems themselves. The situation in Britain is unlikely to change very much until after 1972, when the effects of the installation of new manufacturing plants for computer peripherals in Britain by U. S.-based companies begin to be felt.

UNDERWEAR VS. HARDWARE — A computer expert at Leeds University in England reports that static electricity generated by women's nylon underwear can cause computer circuitry problems. Harry Eastwood, Manager of Leeds' computer laboratory, notes that "the more delicate new computers are particularly prone." Some firms using computers, he said, have asked their women to wear cotton underwear and not nylon.

BRITISH RAILS — British railroads are expected to invest about $24 million by 1975 on a centralized computer service expected to be the largest multiple-access installation in the United Kingdom. **The Financial Times of London** reports that the central installation will service the various departments within the organization (freight, manpower allocation, passenger service), as well as the normal payroll and management functions included in business computing. Savings of up to 15 percent are predicted in some areas.

COMPUTERS IN INDIA — Computers are playing a major role in accelerating India's development, **The Asian Student** reports. India is not only manufacturing computers but is exporting them to developed countries. IBM, for example, exports computers valued at over $2 million annually to 46 countries from India. There are currently 100 computers in the country, one-half of them added since mid-1967. The use of computers is credited with providing jobs for some 20,000 Indians working in DP establishments. It was estimated five years ago that by 1975 India will need some 500 medium-size and 5,000 small computers. Most people today consider that forecast conservative.

QUICKLY AROUND THE WORLD

Among the commodities licensed for export to Eastern Europe by the U. S. Department of Commerce in the third quarter of 1970 were computers and peripherals valued at $5 million ($3.3 million to East Germany, $700,000 to Czechoslovakia, and $600,000 to Hungary).

The impact of information technology on developing countries is the theme of the Jerusalem Conference on Information Technology, Aug. 16-20. One panel covering computer-aided agricultural planning will be held at a kibbutz settlement. Information can be obtained from the **Jerusalem Conference on Information Technology, Post Office Box 7170, Jerusalem, Israel.**

The British Civil Service is training blind people to be computer programmers. The programmers will be trained for 12 weeks at the London center of the Civil Service College in cooperation with International Computers, Ltd. and the Royal National Institute for the Blind.

It had to happen ...and it did.

By design—and to your benefit. Ampex was sure to offer direct-access memory in the form of Disk-Drive and Controller. Your gain is the new Ampex DM-312 Disk Drive and DC-314 Controller, plug-interchangeable with the IBM 2314 Disk Files for 360 and 370 Systems. First in a family of Direct Access Memories from the *one* company that deals helpfully with computer peripherals and comes up with the better answer.

IT'S FAST ACCESS. Reliable voice coil head positioning, as opposed to hydraulic. Optical position sensing, combined with a closed-loop servo, further increases reliability and decreases access time. Average of 32 msec access. Minimum access is 8 msec, maximum is 58 msec. This means less waiting for data on the 20 recording surfaces... faster throughput and greater time and dollar savings.

IT'S PLUG-INTERCHANGEABLE. Direct replacement for the IBM 2312 Drive and 2314 Controller combination, identical in format density, ...and program compatible. One DC-314 controls up to 8 DM-312 Drives, with an optional 9th service module. All solid state for maximum reliability.

IT'S PRICED RIGHT—AND SERVICED. If you could benefit from a faster access replacement for your IBM disk drives, you'll save money with the Ampex DM-312 and DC-314, with worldwide site installation and maintenance service. Typically helpful and economic Ampex attention to OEM requirements, the familiar Ampex approach to helping the customer get the most out of a product.

AND IT'S ONLY THE BEGINNING. The pioneer company dedicated to providing a complete line of computer peripherals *has* to offer something better in direct-access memory. Our brochure spells out just how much better. Yours for the asking. Call or write Ampex Corporation, Computer Products Division, 9937 West Jefferson Blvd., Culver City, Calif. 90230, (213) 836-5000.

Visit Ampex, Booth 2217, Spring Joint Computer Conference.

Your computer counts on us.

AMPEX

CIRCLE NO. 16 ON INQUIRY CARD

HAROLD V. SEMLING JR., Washington Editor

DC DATASCAN

LARGEST DEFENSE T-S SYSTEM — Honeywell announced Air Force acceptance of a computer system that will be the Defense Dept.'s largest time-sharing network when it is fully implemented this November. The system, which the Air Force calls CREATE (Computational Resources for Engineering And Simulation, Training and Education), is centered at the Air Force Logistics Command headquarters at Wright-Patterson Air Force Base, Dayton, Ohio, and currently links 39 remote terminals to 10 Air Force bases from coast to coast. By November, 94 terminals will be hooked up with the central site at Wright-Patterson. J. J. Renier, vice president of Honeywell's Data Systems Operations, said the system's major function is to provide computational services for approximately 5,000 engineers and logisticians who plan and control the Air Force's vast industrial-type supply network. Renier described the current hardware configuration as a dual 615 with four remote-batch GE115s, two graphic display terminals, and 13 Teletype terminals located at Wright-Patterson. The two multiprogramming/multiprocessing central processing units have 256,000 words of memory, six characters per word, and there are approximately 480 million characters of removable disk storage and a billion characters of on-line archival disk storage.

PROGRAM PATENTS — Although recent court decisions have held certain computer programs to be patentable, the requirement that inventions be non-obvious will probably prevent the majority of programs from being patented. "This," says Patent Commissioner William E. Schuyler, Jr., often "causes businesses to resort to secrecy," producing a situation "certainly not conducive to progress." Commissioner Schuyler believes a new system to protect inventions of lesser importance should be created to supplement the present patent system. "Japan, an industrial power to be reckoned with now, not to mention the years to come, is just one of many foreign industrial powers which already have similar systems in operation," he said.

HELP FOR JOBLESS — Speedy enactment of legislation to curb unemployment of jobless scientists and engineers by creating up to 200,000 jobs has been called for by Sen. Walter F. Mondale (D. Minn.), one of the sponsors of the Emergency Employment Act. Sen. Mondale said, "It is ironic that we have permitted thousands of scientists and engineers to join the ranks of the unemployed while many of our public programs are desperately in need of additional technological input and manpower. We have ample evidence that Defense and aero-space industry skills can be adapted to civilian technology." One area hardest hit by the layoffs of skilled scientists and engineers, he said, was the computer industry.

NATIONAL SCIENCE DP CENTER — Congressman R. C. Pucinski (D. Ill.) has re-introduced legislation to establish a National Science Research Data Processing and Information Retrieval System. The bill (H.R. 1040) was referred to the House Education and Labor Committee. It is aimed at avoiding unnecessary and costly duplication in scientific research and assuring quick access to science research data. The nationwide system would "include close voluntary cooperation with, and utilization of, on a contract basis wherever practical, all existing science research DP and information retrieval facilities in the U.S." The system would be "available to any scientist or researcher, either privately, publicly, or self-employed, through an appropriate communications network."

HIGHWAY RESEARCH — At the recent annual meeting of the Highway Research Board in Washington over 3,000 persons heard reports on the application of computers to highway problems. C. V. Kroll of the Cornell Aeronautical Laboratory (CAL) reported on a modified version of the Bureau of Public Roads-CAL computer simulator of automobile dynamics, which is used to investigate driver behavior in emergency "pre-collision" situations. CAL researchers E. Donald Sussman, Robert C. Sugarman, and James B. Knight, in a study of driver alertness, concluded that the rate of steering wheel corrections made by a driver decreases linearly with time over four hours and, on a per-subject basis, there is a significant negative correlation between position error and steering wheel correction frequency.

MAG TAPE CASSETTES — A digital magnetic tape cassette program is being conducted by the National Bureau of Standards in cooperation with the American National Standards Institute's Committee on Computer and Information Processing (X3). The program will include development and maintenance of a national amplitude reference tape for cassette applications, and the development of a related system for evaluating the characteristics of digital cassette tapes. Initial efforts will be directed to the 150-mil-wide tape employed in "Phillips-type" cassettes.

IN BRIEF

National Science Foundation has requested $17,500,000 in fiscal 1972 to develop a national base of computer science knowledge which will "make possible innovative approaches" for the use of computers in education. This was $2,500,000 more than was funded last year.

Mentally retarded persons are being trained as computer assemblers under a U. S. Dept. of Labor contract with the National Association for Retarded Children.

The President's proposed 1972 budget calls for expanding the Dept. of Labor's computerized job bank program to provide up-to-date listings of job vacancies. By the end of 1972 it is anticipated that employment operations in all 50 states will be using the job banks.

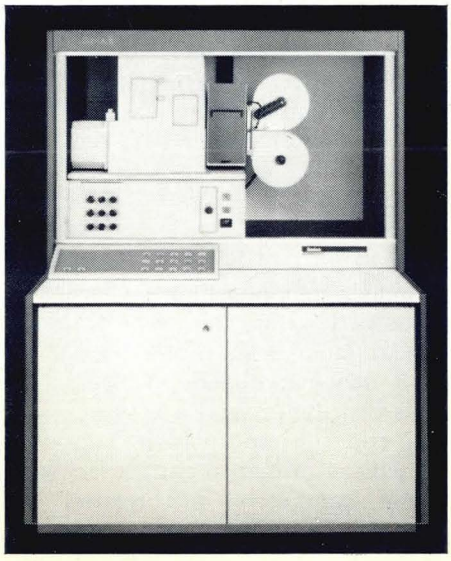
Kodak

Kodak introduces the COM starter set.

Modestly priced and designed to get you started in computer output microfilming, the new Kodak KOM-80 microfilmer is easily adaptable to operate at any of three speeds. As your computer volume grows, the recording capability of the KOM-80 microfilmer can be easily increased from 60,000 to 90,000—even to 120,000 characters a second.

The KOM-80 microfilmer can also be equipped with the new Kodak Versaform camera that lets you record information in a variety of microforms—including microfiche.

See how easy it is to get started with COM. Contact your Kodak microfilm systems expert or write for free information on the KOM-80 microfilmer. Eastman Kodak Company, Business Systems Markets Division, Department DP 541, Rochester, N.Y. 14650.



Kodak Microfilm Systems

CIRCLE NO. 17 ON INQUIRY CARD

CORPORATE AND FINANCIAL NEWS

Computer Operations Inc. of Costa Mesa, Cal. has filed a petition for voluntary bankruptcy. COI president Peter Warkenton said the company had exhausted all known sources of additional financing essential to the production of its large-scale, "Gemini" computer systems. The prototype Gemini, a wholly-integrated system in the $3 to $12 million price class, was to have been completed late this spring. The 2½-year old company employed a peak of 108 persons when it exhausted its operating capital early last November, after promised long-range financing failed to materialize. The entire work force was furloughed November 13, but most of the employees continued to work through January without pay. Warkenton said COI executives were continuing their efforts to help employees secure jobs elsewhere. About 35% of the work force has relocated in other companies.

The employment picture for engineers and scientists ended on a gloomy note in 1970 with a further downturn in December. The December figure, 35.3, represents still one more record low in the ten-year history of the Engineer/Scientist Demand Index maintained by Deutsch, Shea & Evans, New York manpower agency. It was a 2.6 drop from November. By comparison, the 1969 December figure was 80.3 and the highest December on record was 1965, when the ESDI showed 169.0.

In a major reorganization, Clary Datacomp Systems, Inc., San Gabriel, Cal., announced a new president, a new nation-wide business systems distributor, and a new operating concept under which Datacomp will be primarily a manufacturer of computers and related equipment. The Clary Corp., previously an 88% stockholder in Datacomp, has sold 38% of the outstanding common stock to the new distributor, Business Machines and Computers (BMC), Inc. of Los Angeles. Under this arrangement, Clary Corp.'s holdings are reduced to the point that Datacomp ceases to be a consolidated subsidiary. According to John D. Sessions, Datacomp's new president, the agreement appoints BMC exclusive U.S. sales, distribution, and service agents for Datacomp products.

Transamerica Computer Co. of San Francisco and Data Instruments of Sepulveda, Cal. announced an agreement whereby Transamerica Computer will purchase up to $4.5 million of Data Instruments' "Dataplex" systems for subsequent lease to Data Instruments' customers. As part of the transaction, Data Instruments issued to Transamerica Computer warrants to purchase 125,000 shares of Data Instruments stock at $7.125 per share over a five-year period.

BOX SCORE OF EARNINGS

Company	Period	Revenues	Net Earnings (Loss)	Earnings (Loss) per Share
Ampex	9 mos. 1/30/71	221,913,000	2,730,000	.25
	9 mos. 1/30/70	229,601,000	11,444,000	1.06
Anderson Jacobson	9 mos. 12/31/70	1,609,847	(116,556)	(.06)
	9 mos. 13/31/69	3,042,002	388,309	.21
Boothe Computer	12 mos. 12/31/70	46,045,000	2,812,000	1.50
	12 mos. 12/31/69	42,294,000	2,536,000	1.37
Bradford Comp. & Sys.	12 mos. 12/31/70	8,500,277	1,206,659	.40
	12 mos. 12/31/69	4,570,795	537,036	.19
Burroughs	12 mos. 12/31/70	893,434,035	66,542,161	3.83
	12 mos. 12/31/69	759,335,910	55,198,755	3.32
Computer Instruments	12 mos. 12/31/70	4,774,808	(773,214)	(–)
	12 mos. 12/31/69	6,833,240	(292,426)	(–)
Computer Sciences	9 mos. 12/25/70	83,005,000	3,649,000	.29
	9 mos. 12/26/69	74,699,000	8,521,000	.67
Data General	3 mos. 12/19/70	2,259,000	220,000	.11
	3 mos. 12/20/69	1,122,000	88,000	.05
Diebold Comp. Leasing	12 mos. 12/31/70	33,465,000	1,902,000	.48
	12 mos. 12/31/69	30,947,000	1,441,000	.35
Electronic Assoc.	12 mos. 1/1/71	30,960,000	(8,995,000)	(3.51)
	12 mos. 1/1/70	41,224,000	(2,222,000)	(.86)
Foxboro	12 mos. 12/31/70	144,989,662	5,486,870	1.31
	12 mos. 12/31/69	119,625,422	4,424,103	1.05
Greyhound Computer	12 mos. 12/31/70	49,175,000	3,281,000	.76
	12 mos. 12/31/69	49,665,000	4,566,000	1.05
Inf. Storage Sys.	12 mos. 12/31/70	24,247,000	3,088,000	1.36
	12 mos. 12/31/69	647,622	(2,934,000)	(–)
Interdata	12 mos. 12/31/70	6,458,400	43,353	.02
	12 mos. 12/31/69	5,603,000	257,695	.16
Logicon	9 mos. 12/31/70	7,117,436	317,007	.37
	9 mos. 12/31/69	5,028,209	241,392	.30
Nat. Cash Register	12 mos. 12/31/70	1,420,576,000	30,246,000	1.37
	12 mos. 12/31/69	1,264,942,000	46,167,000	2.11
Optical Scanning	6 mos. 12/31/70	3,445,137	(337,994)	(.62)
	6 mos. 12/31/69	5,143,516	187,668	.34
Sierra Research	12 mos. 12/31/70	8,542,886	186,922	.23
	12 mos. 12/31/69	7,348,656	242,387	.33
Systems Assoc.	6 mos. 12/31/70	1,753,737	85,246	.06
	6 mos. 12/31/69	1,061,428	3,334	–
Systems Engr. Labs	6 mos. 12/25/70	8,044,120	38,724	.02
	6 mos. 12/25/69	9,159,220	615,724	.27
Western Union	12 mos. 12/31/70	399,500,000	23,350,000	2.28
	12 mos. 12/31/69	393,700,000	22,774,000	2.37

The Digital Systems Div. of Texas Instruments, Inc. has reduced the price of TI's Models 960 and 980 industrial control minicomputers by more than 40 percent — from $14,500 to $8,450 for the 960; and from $16,700 to $9,580 for the 980.

RECENT ENTRIES IN THE COMPUTER FIELD: **Automation Services Corp.**, with offices in Braintree, Mass., will offer contract engineering, programming, and consulting services in addition to a computer service bureau operation . . . A neurosurgeon in Baton Rouge, La., capitalizing on his own experience with a small computer, has established a company to develop and market small computer systems for group medical practices, legal firms, and small businesses. Systems now offered by his firm, **Edelman Systems, Inc.**, are built around Digital Equipment's PDP-8/I minicomputers . . . The Chase Manhattan Bank has formed a new operating service subsidiary, **Chase Econometric Associates, Inc.**, which will specialize in computerized econometric analyses and forecasts . . . **International Mathematical and Statistical Libraries, Inc.** has been formed in Houston, Texas, to provide services on a monthly lease basis, that utilize an extensive computer library of mathematical and statistical procedures . . . **Major Data Corp.**, Costa Mesa, Cal., has succeeded the S. S. & S. Company and plans to extend S. S. & S.'s present engineering consulting operations into the engineering, design, and manufacture of computer peripheral products.

MERGERS AND ACQUISITIONS: **Computer Communications, Inc.** of Culver City, Cal., and **Micromation Technology Corp.** of Chicago, Ill., have approved in principle the acquisition of MTC by CCI . . . **Computer Sciences Corp.** has completed the acquisition of **Commonwealth Services Inc.** of New York by the issuance of 450,000 additional shares of its common stock . . . **FAIM Information Services Inc.**, a full service information management and corporate communications company, has acquired **United Systems, Inc.**, a management and data processing consulting firm, and the **Vernon Pope Co.**, a New York-based pr firm . . . **Optimum Systems Inc.** of Palo Alto, Cal., a computer services company, has purchased 61.7 percent of the outstanding common stock of **E.B.S. Data Processing, Inc.** E.B.S., a former **Computer Applications, Inc.** subsidiary, is headquartered in Burlingame, Cal., and offers computer services through four wholly-owned subsidiaries.

COMPUTER STOCK TRENDS

MONTH ENDED MARCH 12, 1971

	EXCH	COMPANY	PRICE					VOLUME (IN 100'S)			EARNINGS	
			1970/71 RANGE (1)	1 YEAR AGO	CLOSE MAR.12 1971	MONTH NET CHG.	MONTH % CHG.	THIS MONTH (3)	LAST MONTH	AVG. VOL-UME (2)	PER SHARE LATEST 12 MONTHS	PRICE–EARNINGS RATIO
COMPUTERS	N	BECKMAN	19- 52	43	38 5/8	+2 5/8	+7.2	1658	3199	1777	1.39	28
	N	BURROUGHS	80-173	133 5/8	115 1/8	-10 3/8	-8.2	12898	11237	9523	3.83	30
	N	CONTROL DATA	30-123	64 7/8	63 3/4	+2 1/2	+4.0	8113	11750	8336	-0.39	-
	O	DATA GENERAL	16- 36	N/A	32	+4 5/8	+16.8	(3)	-	-	0.37	86
	O	DATACRAFT	3- 20	N/A	6 3/8	+ 3/8	+6.2	(3)	-	-	-	-
	N	DIGITAL EQUIPMENT	50-124	105 1/2	63 5/8	-9	-12.3	6619	7444	5809	1.39	46
	N	ELECTRONIC ASSOC	4- 12	8 3/8	7 1/2	+ 1/4	+3.4	1052	2478	1011	-1.94	-
	O	GENERAL AUTOMATION	9- 42	34 1/4	22 1/2	+6 1/2	+40.6	(3)	-	-	-0.44	-
	N	GENERAL ELECTRIC	60-110	71 3/8	108 5/8	+2	+1.8	8095	14717	8451	3.63	30
	N	HEWLETT-PACKARD	19- 46	45 5/8	41 3/4	+4 3/8	+11.7	2793	3624	3817	0.87	48
	N	HONEYWELL	66-152	124	105 5/8	+5 5/8	+5.6	4608	6703	5024	3.58	30
	O	INTERDATA	3- 22	N/A	8 5/8	+ 5/8	+7.8	(3)	-	-	0.02	431
	N	IBM	223-387	328 3/4	354	+14 1/2	+4.2	5380	8628	8750	8.92	40
	N	LITTON INDUSTRIES	15- 38	26	28	-1 5/8	-5.4	11463	24667	12441	1.45	19
	N	NCR	30- 63	66 3/8	43 5/8	+3 1/8	+7.7	14485	17742	9171	1.37	32
	N	RCA	18- 35	30 5/8	34 1/2	+ 5/8	+1.8	10200	19303	9305	1.26	27
	N	RAYTHEON	16- 39	26 7/8	38 3/4	+2	+5.4	6563	8985	3754	2.32	17
	O	REDCOR	4- 34	30 1/2	8 3/4	+ 7/8	+11.1	(3)	-	-	-2.81	-
	O	SCIENTIFIC CONTROL	1- 9	N/A	1 5/8	+ 1/8	+8.3	(3)	-	-	-	-
	N	SPERRY RAND	19- 40	38 1/8	33 7/8	+ 7/8	+2.6	11324	34528	12757	2.22	15
	A	SYSTEMS ENGRG LABS	11- 49	37	16	+ 1/4	+1.5	3368	6960	5282	0.57	28
	N	SYSTRON DONNER	8- 29	19 7/8	14 1/8	+ 5/8	+4.6	1761	2338	892	0.59	24
	N	VARIAN ASSOCIATES	10- 29	26 1/4	16 7/8	- 1/8	-0.7	4835	9342	4355	0.51	33
	O	VIATRON	1- 51	27 1/4	1 5/8	- 7/8	-35.0	(3)	-	-	-	-
	N	WANG LABS	19- 52	40 5/8	37 1/4	+2 1/4	+6.4	1237	1620	1749	0.85	44
	A	WYLE LABS	3- 10	7	6 3/8	+1 3/8	+27.5	1534	1635	918	-0.04	-
	N	XEROX	66-116	91 1/4	101	+4 5/8	+4.7	8440	17448	14765	2.40	42
PERIPHERALS & COMPONENTS	O	ADVANCED MEMORY SYS	10- 38	N/A	30	-2 1/2	-7.6	(3)	-	-	-	-
	N	AMP	41- 67	51 7/8	62 1/8	-4 1/2	-6.7	2372	2620	2314	2.00	31
	N	AMPEX	13- 49	35	20 5/8	- 3/8	-1.7	8968	9805	5981	0.53	39
	O	APPLIED MAGNETICS	9- 26	18 1/4	15 1/4	0	0.0	(3)	-	-	0.50	31
	O	ASTRODATA	1- 35	N/A	1 1/4	0	0.0	(3)	-	-	-	-
	O	ASTROSYSTEMS	2- 9	6 1/2	4 1/8	- 1/4	-5.7	(3)	-	-	-	-
	N	BUNKER RAMO	6- 15	12 3/4	14 3/8	+2	+16.1	9680	9550	4616	0.39	37
	A	CALCOMP	11- 36	27 3/4	27 5/8	+ 3/4	+2.7	4101	5574	4927	0.49	56
	O	CHALCO INDUSTRIES	1- 5	N/A	2 1/2	0	0.0	(3)	-	-	-	-
	O	CODEX	3- 38	N/A	7 1/8	0	0.0	(3)	-	-	-	-
	O	COGAR	37- 94	74	55	-5	-8.3	(3)	-	-	-	-
	O	COGNITRONICS	3- 14	10 1/4	8 1/8	- 1/8	-1.5	(3)	-	-	-0.30	-
	N	COLLINS RADIO	10- 37	25 1/4	18 1/4	- 3/8	-2.0	2391	3779	2096	-0.90	-
	O	COMCET	4- 50	37	7 3/8	+ 7/8	+13.4	(3)	-	-	-	-
	O	COMPUTER COMM	5- 36	30	13 1/2	+3 1/4	+31.7	(3)	-	-	-1.02	-
	O	COMPUTER CONSOLES	6- 22	18 1/4	9	- 5/8	-6.4	(3)	-	-	-	-
	A	COMPUTEST	12- 28	23 7/8	17 7/8	- 7/8	-4.6	807	1400	600	0.98	18
	N	CONRAC	11- 32	23 1/2	24 3/8	+ 1/8	+0.5	393	1297	496	1.12	22
	O	DATA 100	5- 17	12 1/2	10 5/8	-1 3/4	-14.1	(3)	-	-	-	-
	A	DATA PRODUCTS	5- 26	17 7/8	8 1/2	+ 1/8	+1.4	(3)	-	-	-1.30	-
	O	DATARAM	1- 16	N/A	1 5/8	+ 1/8	+8.3	(3)	-	-	-	-
	O	DATA RECOGNITION	1- 10	N/A	5 1/2	0	0.0	(3)	-	-	-	-
	O	DATASCAN	4- 27	21 1/2	5 3/8	- 3/8	-6.5	(3)	-	-	-	-
	O	DIGITRONICS	3- 14	8 1/4	6	-1	-14.2	(3)	-	-	-0.71	-
	A	ELEC ENG OF CAL	4- 15	10	7	- 7/8	-11.1	278	671	218	-0.58	-
	N	ELEC MEMORIES + MAG	7- 40	24 3/4	11 3/4	+ 5/8	+5.6	6628	11145	6713	-2.68	-
	N	EXCELLO	17- 28	25	22 1/4	-1 5/8	-6.8	1200	2702	1162	1.82	12
	O	FABRI-TEK	2- 8	6 1/2	2 3/4	- 1/4	-8.3	(3)	-	-	-0.09	-
	O	FARRINGTON MFG	1- 17	11	1 1/2	- 1/8	-7.6	(3)	-	-	-2.16	-
	A	GERBER SCIENTIFIC	9- 39	19 1/4	11 7/8	-2 5/8	-18.1	992	433	428	-0.17	-
	O	GRAPHIC SCIENCES	8- 42	23 1/2	20 1/2	-1 3/8	-6.2	(3)	-	-	-0.82	-
	A	HI-G	5- 17	15 1/4	6 5/8	+ 1/2	+8.1	(3)	-	-	-0.45	-
	O	INFORMATION DISPLAYS	4- 20	15 1/2	5 3/8	-1 1/8	-17.3	(3)	-	-	-	-
	A	ITEL	6- 26	15 3/8	19 3/4	+ 5/8	+3.2	(3)	-	-	1.00	20
	O	LOGIC	4- 14	10 1/2	6 3/8	- 1/4	-3.7	(3)	-	-	-	-
	A	MILGO	15- 41	32 3/8	19 1/4	-2 1/4	-10.4	3501	6654	10025	0.84	23
	N	MOHAWK DATA SCIENCES	19- 87	61 3/8	34 3/8	+4 3/8	+14.5	5600	5845	5999	1.25	28
	O	NORTH ATLANTIC IND	2- 8	6 1/2	4 1/4	- 1/4	-5.5	(3)	-	-	-	-
	O	OPTICAL SCANNING	11- 52	33	15 3/4	- 3/8	-2.3	(3)	-	-	-0.53	-
	A	POTTER INSTRUMENTS	15- 43	40	22 1/2	+1 7/8	+9.0	2316	3569	3022	0.94	24
	O	RECOGNITION EQUIP	12- 84	53 1/2	24	+1 1/2	+6.6	(3)	-	-	-1.03	-
	N	SANDERS ASSOCIATES	7- 30	18	19 1/4	+1 7/8	+10.7	3708	4718	1909	0.19	101
	N	SANGAMO	9- 29	24 3/8	18 7/8	+1 1/4	+7.0	1866	2573	1308	0.64	29
	O	SCAN-DATA	5- 53	26	7 5/8	-1 1/4	-14.0	(3)	-	-	-	-
	A	SEALECTRO	4- 13	8 3/8	5 1/4	- 1/2	-8.6	202	325	230	0.07	75
	O	SYKES DATATRONICS	2- 9	8 1/2	5 3/8	+1 7/8	+53.5	(3)	-	-	-	-
	O	TALLY	10- 23	20 1/2	14 7/8	+ 7/8	+6.2	(3)	-	-	0.11	135
	N	TELEX	10- 26	23	19 1/8	+2 3/8	+14.1	19779	36767	30419	0.78	25
	N	TEXAS INSTRUMENTS	62-135	113 1/4	100	+11 3/8	+12.8	2905	4142	3774	2.71	37
	O	VARIFAB	1- 5	4	1 5/8	- 3/8	-18.7	(3)	-	-	-	-

FOOTNOTES: (1) TO NEAREST DOLLAR
(2) AVERAGE MONTHLY TRADING VOLUME SINCE JANUARY 1, 1970
(3) VOLUME IS NOT REPORTED FOR OVER-THE-COUNTER ISSUES AND NEW LISTINGS

EXCH: N=NEW YORK EXCHANGE; A=AMERICAN EXCHANGE; O=OVER-THE-COUNTER; L=NATIONAL EXCHANGE;

All statistics compiled, computed and formatted by TRADE*QUOTES Inc., Cambridge, Mass. 02139

	EXCH	COMPANY	PRICE					VOLUME (IN 100'S)			EARNINGS	
			1970/71 RANGE (1)	1 YEAR AGO	CLOSE MAR.12 1971	MONTH NET CHG.	MONTH % CHG.	THIS MONTH (3)	LAST MONTH	AVG. VOL-UME (2)	PER SHARE LATEST 12 MONTHS	PRICE–EARNINGS RATIO
SOFTWARE & SERVICES	A	APPLIED DATA RESCH	4- 24	9 1/8	11 5/8	+ 7/8	+8.1	2386	1495	940	-0.22	-
	O	APPLIED LOGIC	1- 18	N/A	1 5/8	+ 1/8	+8.3	(3)	-	-	-	-
	O	ARIES	1- 8	3 3/4	1 7/8	- 1/8	-6.2	(3)	-	-	-	-
	N	AUTOMATIC DATA PROC	22- 56	40 1/8	55 3/4	+7 1/2	+15.5	1165	1955	3119	0.75	74
	A	BOLT, BERANEK, NEWMA	5- 11	10 1/4	7 5/8	+ 1/4	+3.3	(3)	-	-	0.24	32
	O	BOOTHE COMPUTER	8- 26	22 1/2	18	- 1/4	-1.3	(3)	-	-	1.50	12
	O	BRANDON APPLIED SYS	1- 10	N/A	3/8	- 5/8	-62.5	(3)	-	-	-	-
	O	COMP ENVIRONMENTS	1- 15	N/A	1 1/4	0	0.0	(3)	-	-	-	-
	O	COMPUTER EXCHANGE	3- 9	6 1/4	6 1/4	-1 1/4	-16.6	(3)	-	-	-	-
	A	COMPUTER INVESTORS	4- 13	8 5/8	12 3/8	+2 3/4	+28.5	779	593	338	0.61	20
	O	COMPUTER METHODS	1- 4	N/A	1	+ 1/2	+100.0	(3)	-	-	-	-
	O	COMPUTER PROPERTY	4- 15	N/A	7	- 1/2	-6.6	(3)	-	-	-	-
	N	COMPUTER SCIENCES	6- 34	22 7/8	12 5/8	+1 1/8	+9.7	9724	8968	9687	0.03	421
	O	COMPUTER TECHNOLOGY	2- 13	N/A	7 1/4	+ 5/8	+9.4	(3)	-	-	-	-
	O	CTC COMPUTER	1- 19	14 1/2	4 1/4	+1 1/2	+54.5	(3)	-	-	-	-
	O	COMPUTER USAGE	2- 13	6 3/4	10 1/4	+3 3/4	+57.6	(3)	-	-	-2.05	-
	A	COMPUTING + SOFTWARE	18- 76	54 5/8	37 5/8	+3 1/2	+10.2	2895	2629	2001	1.25	30
	O	COM-SHARE	3- 15	N/A	5	0	0.0	(3)	-	-	-	-
	O	CYBERMATICS	5- 14	13 1/2	10 5/8	+1 5/8	+18.0	(3)	-	-	-	-
	O	DATA AUTOMATION	1- 24	N/A	1 7/8	+ 1/2	+36.3	(3)	-	-	-	-
	O	DATA DYNAMICS	1- 4	N/A	3 1/2	+1 3/8	+64.7	(3)	-	-	-	-
	N	DATA PROC FIN + GEN	7- 32	21 1/2	16 1/8	+1 7/8	+13.1	5718	8727	4022	0.26	62
	O	DATA SYSTEM ANALYSTS	2- 12	N/A	2	- 1/4	-11.1	(3)	-	-	-	-
	O	DATRONIC RENTAL	2- 8	5 1/2	2 3/4	-1 1/4	-31.2	(3)	-	-	-	-
	A	DEARBORN-STORM	10- 34	21 1/2	33 1/2	+4 5/8	+16.0	1114	2214	743	2.11	16
	O	DECISION SYSTEMS	1- 5	N/A	1/2	- 1/8	-20.0	(3)	-	-	-	-
	O	DIGITAL APPLICATIONS	1- 7	4 5/8	1 3/8	- 1/4	-15.3	(3)	-	-	-	-
	O	DIGITEK	1- 5	N/A	2	- 1/8	-5.8	(3)	-	-	-	-
	A	DPA, INC	3- 10	6 7/8	6 7/8	+1 1/8	+19.5	1512	1347	781	0.59	12
	O	EFFICIENT LEASING	1- 5	5	1	- 5/8	-38.4	(3)	-	-	-	-
	A	ELEC COMP PROG INST	3- 12	10 3/4	5 1/2	+ 3/8	+7.3	369	863	385	0.01	550
	N	ELEC DATA SYSTEMS	31-161	157	80 3/8	+3 7/8	+5.0	(3)	-	-	0.75	107
	A	GREYHOUND COMPUTER	5- 14	12 5/8	10 3/4	+1 3/4	+19.4	896	927	429	0.76	14
	O	INFORMATICS	4- 21	15 3/4	9 3/8	- 5/8	-6.2	(3)	-	-	0.13	72
	O	INTL COMPUTER	1- 30	5	5 1/4	+ 1/4	+5.0	(3)	-	-	-	-
	L	INTL COMPUTER SCI	1- 4	N/A	1 3/4	+ 1/4	+16.6	(3)	-	-	-	-
	N	LEASCO	7- 31	19 3/4	20 1/2	+1 1/8	+5.8	7973	17298	8970	0.03	683
	O	LEVIN-TOWNSEND	3- 19	8 5/8	6 1/8	+ 1/4	+4.2	(3)	-	-	-0.74	-
	O	LMC DATA	1- 4	N/A	7/8	- 1/8	-12.5	(3)	-	-	-	-
	O	MGMT ASSISTANCE	1- 4	N/A	1 3/4	+ 5/8	+55.5	(3)	-	-	-	-
	A	MANAGEMENT DATA	7- 26	23	9 5/8	- 3/4	-7.2	438	318	252	0.56	17
	O	NATIONAL COMP ANAL	1- 9	7 1/2	1 1/2	- 1/8	-7.6	(3)	-	-	-	-
	N	PLANNING RESEARCH	14- 53	38 1/4	20 3/4	-2 3/8	-10.2	4207	8238	3337	0.68	31
	O	PROGRAMMING METHODS	9- 29	21	21	-4	-16.0	(3)	-	-	-	-
	L	PROGRAMMING SCIENCES	1- 17	N/A	1/4	-1 3/4	-87.5	(3)	-	-	-	-
	O	PROGRAMMING SYSTEMS	2- 6	4 1/4	2 1/2	-1	-28.5	(3)	-	-	0.14	18
	O	SCIENTIFIC COMPUTER	1- 4	3 3/8	2 1/8	- 3/8	-15.0	(3)	-	-	0.09	24
	O	SCIENTIFIC RESOURCES	1- 15	8 1/8	1 5/8	+ 1/2	+44.4	(3)	-	-	-	-
	O	SYSTEMS CAPITOL	1- 8	5 3/4	4 1/8	-1 3/8	-25.0	(3)	-	-	-	-
	O	TIME SHARE	1- 9	N/A	1 1/2	0	0.0	(3)	-	-	-	-
	O	TRACOR COMPUTING	2- 8	5 7/8	3 7/8	+ 3/8	+10.7	(3)	-	-	-0.89	-
	A	URS SYSTEMS	5- 21	20 3/4	10 1/2	- 5/8	-5.6	(3)	-	-	-0.07	-
	O	UNITED DATA CENTERS	1- 5	4 3/4	4	+ 1/2	+14.2	(3)	-	-	-	-
	N	UNIVERSITY COMPUTING	14- 99	49 5/8	25	-1 1/8	-4.3	8612	11536	12831	0.97	26
	O	US TIME SHARING	1- 14	N/A	1 3/4	- 1/4	-12.5	(3)	-	-	-	-
SUPPLIES & ACCESSORIES	N	ADAMS MILLIS	8- 19	12 5/8	18 1/2	- 1/2	-2.6	1398	2083	656	1.17	16
	O	BALTIMORE BUS FORMS	6- 21	N/A	8 3/4	-1 1/4	-12.5	(3)	-	-	-	-
	A	BARRY WRIGHT	6- 25	14 1/8	11 5/8	- 1/4	-2.1	750	1839	680	0.44	26
	A	CAPITOL INDUSTRIES	12- 54	48 1/2	19 7/8	+1 1/8	+6.0	2074	1781	1577	0.92	22
	A	DATA DOCUMENTS	15- 36	30 1/2	28 3/8	+2 1/8	+8.0	176	288	134	1.51	19
	O	DATA PACKAGING	5- 29	22 1/2	8 3/8	-1 1/8	-11.8	(3)	-	-	0.22	38
	N	DENNISON MFG	11- 28	20 1/4	26 3/4	-1	-3.6	2083	3817	1574	1.82	15
	N	DUPONT	93-145	96 3/4	139 1/2	-1 1/4	-0.8	3168	3924	3781	6.76	21
	N	ENNIS BUSINESS FORMS	9- 19	17	11 7/8	- 7/8	-6.8	875	925	437	0.85	14
	O	GENERAL BINDING	14- 31	26 1/2	29 3/4	- 1/4	-0.8	(3)	-	-	0.86	35
	O	GRAPHIC CONTROLS	5- 17	14 3/4	7 7/8	- 5/8	-7.3	(3)	-	-	0.27	29
	O	LEWIS BUSINESS FORMS	10- 20	17	11 1/2	-1 1/2	-11.5	(3)	-	-	0.79	15
	N	MEMOREX	46-167	123 1/2	68	+8 3/4	+14.7	5828	8251	11906	1.53	44
	N	3M	72-115	106	108 3/4	+5 1/4	+5.0	3909	6198	5293	3.35	32
	O	MOORE CORP LTD	25- 39	N/A	38 3/4	+ 1/8	+0.3	(3)	-	-	-	-
	O	REYNOLDS + REYNOLDS	25- 49	47 1/2	47 1/4	+4 3/4	+11.1	(3)	-	-	1.52	31
	A	SAFEGUARD INDUSTRIES	7- 16	14 1/2	14 1/2	+ 1/2	+3.5	1260	1995	697	0.78	19
	O	STANDARD REGISTER	17- 31	28 1/2	22 5/8	+1 5/8	+7.7	(3)	-	-	1.82	12
	N	UARCO	22- 39	36 3/4	27 1/4	- 7/8	-3.1	1079	346	256	1.92	14
	N	WALLACE BUS FORMS	9- 22	20	21 1/8	+ 5/8	+3.0	(3)	-	-	1.18	18

AVERAGES	COMPUTER STOCKS	12–36	32.20	22.12	+0.55	+2.54		0.72	30.7
	DOW JONES INDUSTRIALS	631–899	784.12	898.34	+9.51	+1.1		3.12	17.6

CORPORATE PROFILE

Featured this Month:

CONSOLIDATED COMPUTER LIMITED (Over-the-Counter, Toronto)

Toronto, Ontario, Canada

OFFICERS: **Mers Kutt,** president and director, Consolidated Computer Ltd.; **William G. Hutchison,** senior vice president, Consolidated Computer Ltd.; **Geoffrey H. Bennett,** vice president of finance; **Jeffrey M. Donahue,** executive vice president, Consolidated Computer International, Inc.

BACKGROUND: Consolidated Computer Ltd., formed in Toronto in 1968, manufactures a shared-processor data-preparation system called Key-Edit. The company also offers a time-sharing system for purchase and has time-sharing services available through its own centers in Canada. The company's wholly-owned subsidiary, Consolidated Computer International, was formed in 1969 to provide marketing and support services in the United States.

FACILITIES: Corporate headquarters are in Toronto, where international administration, marketing, engineering, and some production facilities are housed in 15,000 sq. ft. A new 40,500 sq. ft. corporate headquarters facility located in Don Mills, Ontario, is scheduled for occupancy in June. Main production operations are located in 42,000 sq. ft. in three plants in Ottawa. Canadian sales offices are located in eight cities in six provinces. European offices are in London and Frankfurt. Consolidated Computer International is operated from Waltham, Mass., where marketing, marketing support, field engineering, and administrative services for the U.S. are headquartered. Sales offices are located in Boston, Chicago, Cleveland, Detroit, Los Angeles, New York, Philadelphia, San Francisco, and Washington, D.C.

PRODUCTS/SERVICES: Consolidated Computer's Key-Edit system is a shared-processor system designed to provide time-sharing of multiple key-station operations for simultaneous editing and data preparation. Hardware consists of a high-speed computer, mass storage devices, a control console, and up to 32 keystation terminals. Options include line printers, card readers, paper tape equipment, and communications devices.

Consolidated Computer's time-sharing system, designated the 2100, accepts up to 16 terminals simultaneously for conversational time-sharing. Employing the Basic language, the 2100 system is primarily for use as an in-house system by large companies.

CURRENT POSITION: Since installing its first Key-Edit system in Canada in late 1969, the company has become a significant force in the shared-processor data-preparation marketplace. By January 1971, the company had installed nearly 100 Key-Edit systems with over 1,000 keyboards attached, as well as a substantial number of time-sharing systems. Revenues for the year ended December 1969, the first year of Key-Edit shipments, were $650,000.

OUTLOOK: According to Consolidated's marketing analysts, about 300 of all makes of shared-processor data-preparation systems were installed worldwide at the end of 1970. By the end of 1971 cumulative industry installations are expected to increase 133 percent to 1000, valued at $100 million. Annual industry shipments of $200 million are anticipated by 1973 when more than 4,000 systems will have been installed. The company believes there are currently about 500,000 keypunch machines and 30,000 key-to-tape devices installed worldwide. It is possible that 15 to 20 percent of these may be converted to shared-processor systems over the next four years.

FINANCIAL SUMMARY: Consolidated Computer, the first company in Canada to manufacture computer equipment, has been granted financing by the Canadian Government of 90 percent of its requirements up to $12 million. In addition, Canada is underwriting 50 percent of the company's development costs. In 1970, Consolidated announced a 3-year sales agreement valued at more than $50 million with International Computers, Ltd. London.

Most significantly, the company recently announced the formation of Consolidated Computer Leasing, in conjunction with Ford Motor Credit Company. This is an important consideration in evaluating the following operating statistics, which do **not** reflect sales made to the new leasing organization. By the end of 1970, Consolidated had equipment with a sales value of over $10 million in the field.

CONSOLIDATED COMPUTER LTD.

	Revenues	Net Income	Earnings/Share
6 mos. 6/30/69	$63,262	($352,145)	($.30)
12 mos. 12/31/69	$650,520	($921,000)	($.75)
6 mos. 6/30/70	$199,000	($1,991,000)	($1.63)

The information presented here has been obtained from sources believed to be reliable, but its accuracy is not guaranteed.

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INNOVATION IS ALIVE AND WELL

Communications Clinic is a regular monthly column written by the staff of **Berglund Associates, Inc.**, consultants in telecommunications. Readers are invited to submit questions on any aspect of communications or suggestions for future Clinics to:

Communications Clinic
c/o Berglund Associates, Inc.
1060 Kings Highway North
Cherry Hill, New Jersey 08034

Every so often we find ourselves biting our tongue (though not so often, we suspect, as our patient publisher) over things said in this column. In our January commentary on the state of the industry, we bemoaned the lack of truly innovative and well-conceived new product or service offerings. This month we are pleased to report that innovation is alive and well in at least two cases.

In the first, Western Union continues their transition from singing delivery boys and Candygrams to the Communications Age with their very attractive service offering, Datacom. In the second case, Paradyne has greatly cost-reduced and simplified remote batch or remote job entry with their new peripheral interface extender. We commend both of these to your attention.

WESTERN UNION'S DATACOM SERVICE

Last fall Western Union introduced a new and interesting service called Datacom, offered under Tariff FCC 257. The service is the provision of narrowband channels derived from a voice channel through the use of channel subidivision (multiplexing) equipment. Datacom is offered on a two- or three-point basis in any of the 45 major U. S. cities designated in the tariff as "terminal" cities. This means that service can be provided between any two terminal cities, plus (optionally) any other one city intermediate to the first two. Customers with terminal locations in non-terminal cities may access the service by leased line to the nearest terminal city. For example, a customer with a CPU in Wilmington, Del. and a number of terminals in Providence, R. I. could go leased line from Wilmington to Philadelphia and Boston to Providence, and Datacom between Philadelphia and Boston.

This service is unique and interesting in that it makes user-multiplexing economies available without the user bearing the responsibility of selecting, installing, and maintaining the mux equipment. A second advantage is that the common carrier bears end-to-end responsibility for the channel, and this would not be the case with COAM (Customer Owned And Maintained) multiplexers. A third advantage is that the service is offered on a one-month minimum basis. Hence, system changes which might be unpleasant because of owned but unamortized multiplexing hardware, can be made more easily.

The service also includes some provisions for joint usage. "Authorized users" may be designated by the "customer," and there is no surcharge as in the case of tariffed joint use. An offsetting constraint is that the customer and authorized users must be "in the same line of business." Counter to tariffed joint use, however, traffic may flow **between** users. That is, if A & B are authorized users, each may send to itself and to each other.

In fact, the only apparent drawbacks are the need to go leased line to a terminal city and a restriction that there be only one speed-code system per service. That is, the speed-code system of

TABLE 1

Channel Derivation Charges For Western Union's Datacom Service

Where the Baud Speed Is:	And the Transmission Code Used Is:	Channels Provided:	Monthly Charge per Channel: Two-Point Service	Monthly Charge per Channel: Three-Point Service
75	Baudot	For each channel 1-12	$22.00	$33.00
		For each add'l channel over 12 up to 24 ..	10.50	16.00
110	ASCII	For each channel 1-10	24.00	36.00
		For each add'l channel over 10 up to 20 ..	10.50	16.00
135	BCD	For each channel 1-7	30.00	45.00
		For each add'l channel over 7 up to 14 ..	10.50	16.00
150	ASCII	For each channel 1-6 .	33.00	50.00
		For each add'l channel over 6 up to 12	10.50	16.00

all sub-channels in a given two- or three-point service must be one of the four combinations shown in Table 1.

The leased-line-to-terminal-city requirement can be traded off against the advantages of common carrier maintenance, end-to-end responsibility, and month-to-month rental. The single speed-code requirement should not be much of a problem.

The costs consist of some conventional interstate charges plus fees related to the multiplexing. Conventional interstate rates apply to the airline mileage between the terminal cities for the full-duplex multiplexed voice channel, and to the service terminal (and station arrangements for 110 to 150 baud channels) for each narrowband channel provided per terminal city. Only one such charge, however, is applied per narrowband channel per terminal city if the customer's terminal is within the city's corporate limits. Two sets of charges (as well as the charge for a voice channel service terminal) would probably be required if the mux were COAM. Furthermore, all narrowband service terminals in a terminal city after the first are charged at the less expensive "each additional" rate. The multiplexing fees are a flat $400 per month for any two-point service; $600 per month for a three-point service. Finally, a per-channel derivation fee is charged according to the schedule shown in Table 1. These fees are per Datacom service. If a customer and an authorized user each needed seven, 75-baud channels, they would pay at the fourteen channel rate.

PARADYNE'S PERIPHERAL EXTENDER

Paradyne Corp., Clearwater, Florida, recently announced a very interesting, unique, and attractive device for use in data communications. For originality in concept, it is very impressive and stands out amongst the chaff of new product releases. Notwithstanding all that hyperbole, it also seems to have economic appeal.

Paradyne's new device, called the PIX-600 Parallel Interface Extender, looks and acts like a peripheral controller. However, it is designed to operate its peripheral device over a communications link. Fig. 1 is a block diagram of the system. Its beauty is three-fold. In terms of hardware, it combines the communications controller, data set adaptors, and high-speed modem in one unit; and the remote terminal can be a standard peripheral device instead of a full-blown remote terminal. From a software point of view, the remote terminal now looks like any locally resident peripheral device. The only difference is that the peripheral seems to operate much slower because of the throughput ceiling imposed by the communication channel. Operating at a data rate of 4800

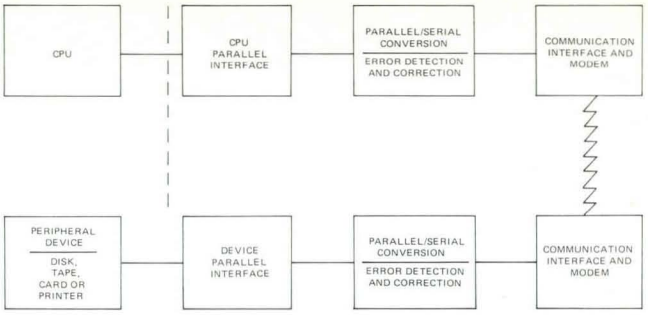

Fig. 1—Block Diagram of Paradyne's PIX-600 Parallel Interface Extender.

bps, the PIX-600 appears as a 600 byte-per-second peripheral. Finally, from an operating point of view, the potential throughput rate is substantially improved over many other systems. This is because of two factors. First, the communication sub-system is self-contained within the Paradyne equipment. Hence, the sub-system can block data for optimum transmission efficiency without regard to the blocking characteristics of the terminal. (The effect of optimum block length on throughput is discussed in Saul Stimler's article on Page 68 in this issue.) The second factor in improving throughput is Paradyne's use of a simultaneous reverse channel for conveying ACK/NACK, which eliminates turnaround time on a dialed-up connection.

Actual line transmission rate is 5112 bps. The difference between 4800 and 5112 is allocated to error-detection coding and to overhead characters for line coordination/control. In a noise-free channel, then, the data throughput is a full 600 bytes/second. Paradyne's press releases guarantee no errors attributable to the communication environment. We debated that one with their marketing VP, James Wylie, giving him a chance to qualify it. He backed off only to the still-remarkable position that the PIX-600 would produce an undetected error rate of 1×10^{-12} on a "worst-case" channel. That is, for a system operating at 1×10^{-6}, he felt they would operate at 1×10^{-12} on the same channel. Of course, the cost of this is throughput degradation, which has to be assessed for all competitive systems in any individual application.

In certain systems (probably those with few remote terminals requiring simultaneous access), the total hardware package of $6000 per end, $12,000 per link, will be very cost-effective. Overlaid on this, however, are the savings in core and software: no telecommunications access method, and no special terminal handlers. Being a more familiar I/O system, it should be infinitely easier to program and to cope with bugs and operating problems. Even in systems requiring "several" simultaneous channels, the $6,000 price will be attractive compared to the $5000-$6,000 necessary for 4800 bps modems alone. ▲

What happened to the model 19?

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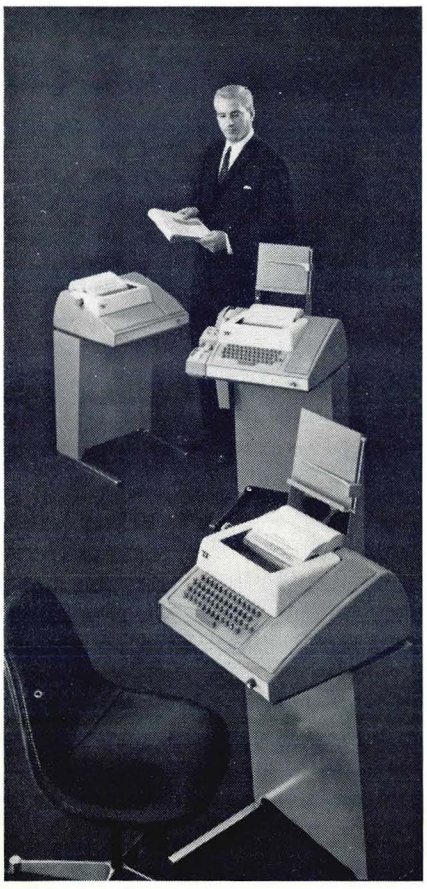
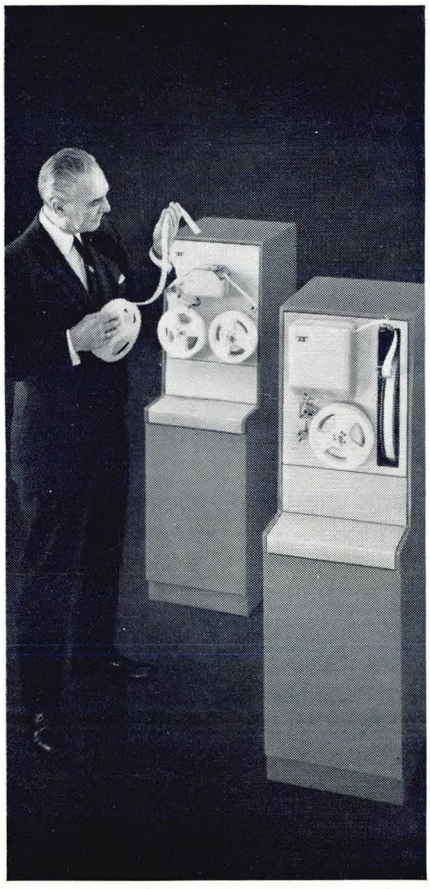


model 33 series: *An extremely economical 100 wpm terminal line. Has 4-row keyboard, uses 8-level ASCII code. The most widely used terminal in time-sharing systems today.*

model 35 series: *A rugged, heavy-duty line of 100 wpm terminals. Uses ASCII. Units in foreground are self-contained paper tape punch and paper tape reader.*



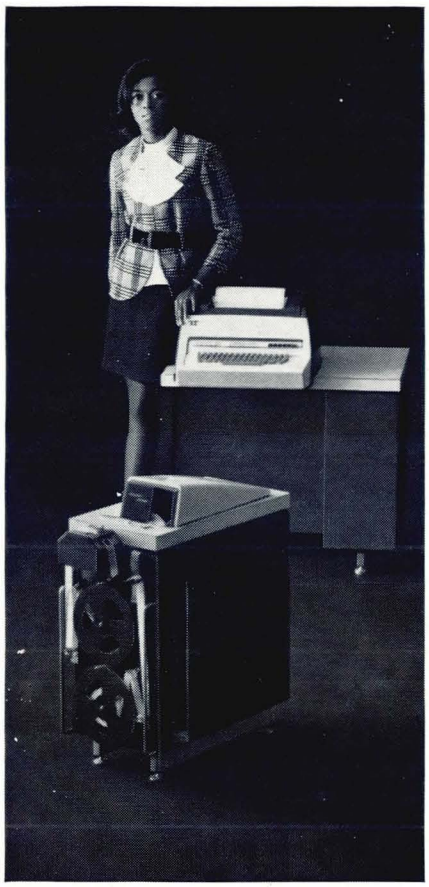
Telespeed™ equipment: *A line of high-speed tape-to-tape terminals capable of sending and receiving at speeds of 750, 1050 (shown above), or 1200 words per minute.*

DATA COMMUNICATIONS

equipment for on-line, real-time processing

keep data flowing faultlessly. Options such as pin-feed platens and form feed controls that make it possible to fill multiple copy business forms on-line. And many, many more. What did happen to the model 19? Believe it or not, there are still some of these old, die-hard terminals around. And that's another advantage your data communications dollar buys when you specify Teletype equipment. It lasts. Moves data reliably, economically, for a long time. On a price/performance basis, Teletype equipment is in a class by itself.

Teletype data communications equipment is available in send-receive capabilities of up to 2400 words per minute. If you would like specific information about any of the equipment described here, write: Teletype Corporation, Dept. 40-17, 5555 Touhy Ave., Skokie, Ill. 60076.



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Inktronic® data terminals: *A unique electronic, solid state terminal. Prints up to 1200 wpm. Forms characters through electrostatic deflection (no typebox). ASCII compatible.*

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machines that make data move

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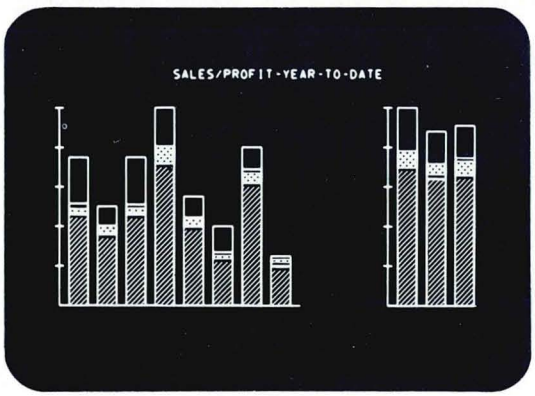

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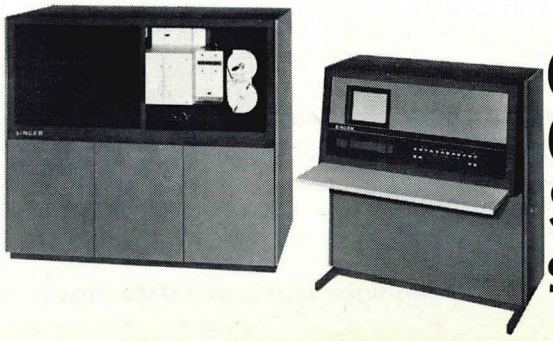

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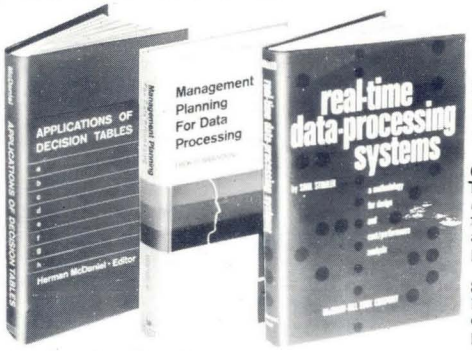

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We have stared into the navel of our computer long enough to know what it looks like. Let us now go forth and do something with it . . . .

Efficiency experts and procedures analysts first got into the computer game when they (we) got control of a bigger adding machine than the bookkeepers had. The valiant bookkeepers fought tooth and toenail, but the sub-ledgers gradually gave ground to the flanking maneuvers of the tab-runs and the battle was won, piece-by-piecemeal. When the bookkeepers realized they were licked, they joined us and that is how the computer profession got started.

Like Gettysburg, everything seems to have been done to preserve the ancient battleground as it was when the battle was fought. Income and expense information, the pulse rate of the company, is generally still run on those obsolete and most ancient of piecemeal systems, as originally designed. It is a shame that the most vital systems were done first when hardware/software limitations were so punishingly restrictive. It will be a frustration for future historians who will have to explain why none of us ever had time to go back and re-design any operational system. Maybe they will conclude that we weren't aware of the profit concept.

PAY NOW OR GO LATER

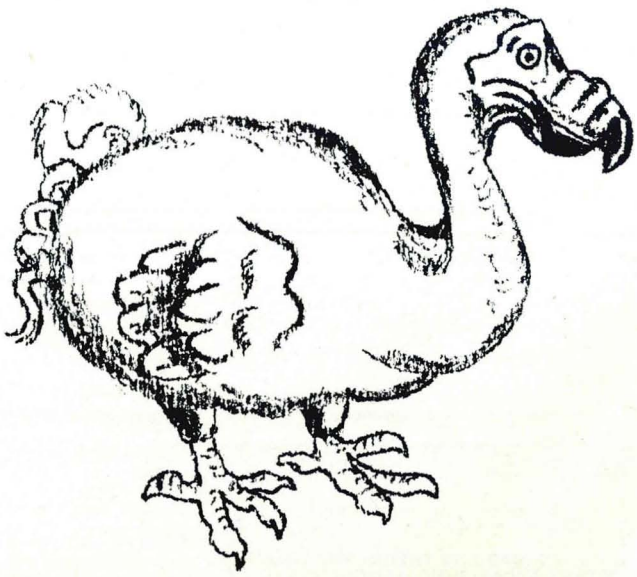
In view of the obvious potential of present hardware and software, it is unfortunate that EDP professionals were among the hardest hit by the current economic squeeze. The situation is the economic consequence of the marginal, sometimes negative, rate of return on computer installations during recent years. EDP professionals had better get their heads back into the game.

It would seem that the situation justifies some rethinking of basic approaches from EDP managers. Looking back, it's worth recounting that the bookkeepers didn't come to the systems people requesting that bookkeeping jobs be eliminated. Nor in the old days did anyone insist that the comptroller know how to wire a board in order to communicate with his systems and procedures people.

It's just possible that the EDP managers who escape extinction during the coming generations will be those who display some of the adaptive instincts of their primitive predecessors. They'll be men who actively search out and develop successful business applications, rather than merely attempting to respond to "user" requests.

THINK NOT WHAT YOUR COMPANY CAN DO FOR YOU . . .

The modern EDP installation is a hungry resource consumer-costwise and isn't readily cut back or stretched out. It's doubtful that management's cur-



DODO BIRD AWAITING MANAGEMENT'S PERMISSION TO TAKE OFF. (CIRCA 17TH CENTURY)

Mr. Kinderhaufen is a regular contributor to Up The System Down Time.

rent curtailment of development projects will last very long in the face of recurring, fixed facility costs. The slowdown is a temporary result of economic shock and will evaporate with a revitalized search for profitable ways to use the computer.

The real adjustment will take place in the make-up of EDP management. It can be anticipated that the EDP manager who has primarily billed himself as a technical genius will find himself promoted sideways into a staff position in order to make room for a technical ignoramus who happens to understand corporate systems, methods, and goals.

It can also be safely predicted that the current economic wrench will be remembered as the one that flushed out introverted computer specialists and subsequently replaced them with men who were willing to learn the details of their company's business processes. For those who don't know how the company functions, there is little room for complacency.

STRICTLY FOR THE BIRDS

The anthropologists have the advantage of hindsight in explaining why dodo birds and various other remarkable species are no longer with us. The common thread is the inability of a species to adapt to the surrounding environment. Despite the tremendous respect which we obviously have for specialization, it is nonetheless a damning handicap when specialization loses touch with the day-to-day problems at hand.

It is fair to say that first-generation software systems, which are converted to run on more expensive hardware, should be improved upon. In a fast-developing technology (changing environment), it is apparent that developing applications (adaption) will govern our degree of success, or our capacity for failure (extinction).

THE TEST

You are invited to test yourself on your knowledge of extinct species which failed for the following reasons:

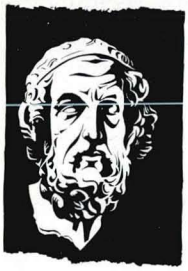
- The objectives were never made clear; ☐
- Inadequate support from colleagues; ☐
- Unstable responses from the environment; ☐
- Insufficient power; ☐
- Sudden change of climate; ☐
- Lack of favorable management intervention. ☐

Yes, dear reader, you guessed it! The reasons for failure are almost universally applicable. We have heard such excuses applied to many recent systems failures and are forced to conclude that the only two things which never change are the **constant state of flux** and **the excuses for failure.**

The remedy, of course, is to find out a little more about the environment in which we are trying to apply our computer. We have spent almost all of our resources during the past five years polishing our skills in manipulating computer systems. We know much about how to use the big machine and pitiably little about the problems we should be solving with it. Even the dodo birds were smarter than that!

An old systems expert named Charles Darwin observed that survival belongs to the fittest. If we don't do a better job of fitting our computer to the environment, we won't get a better job. You can quote me. ▲

TIME-SHARING: THE JURY IS STILL OUT



J.P. TIRESIAS • New York, N.Y.

Chaos in a negative growth area is the way most Wall Streeters characterize the current time-sharing segment of the data processing industry. There are two universes of time-sharing: the one created by the time-sharing entrepreneurs; and the one depressing the value of investors' portfolios.

Before we discuss these universes further, let's describe what we mean by time-sharing. We are referring to remote batch processing by terminals, interactive processing between computer and terminal on a real-time basis, and access to large data banks of information via terminal. In addition to these types of services, there are independent time-sharing services; those run by computer manufacturers; utilities run by companies in other aspects of the data processing industry (straight data services, peripheral gear, software, data facilities management, etc.); those provided by companies in a business or industry which derives its main revenue from a source other than data processing; and universities and institutions. Another dimension to this universe is the diverse area of application. Programs are shared by various customers or custom-made. They do everything from solving complex engineering and mathematical problems, to business and financial processing. Most of the interactive mode processing, in particular, has been done in the scientific areas, there being a lack of good business programs.

In the mid-'60s, the time-sharing entrepreneurs, particularly the independents, were loudly tooting horns about the great future potential of their business. They were aided and amply abetted by Wall Street with what seemed like grand sums of money in the form of private placements and ultimately public offerings that were overpriced in the main. In general, investors were bathed; giving too many dollars to companies which, as it turned out, didn't know what they were doing.

From the beginning, the great hue and cry was "nationwide utility." "Time-sharing for everyone!" But what happened? Where did it go? How many housewives have terminals in their kitchens? A vice president of a large New York advertising agency once told me of a multi-million dollar nationwide television advertising campaign for a major computer manufacturer which would show commercials during sports events extolling the virtues of time-sharing and predicting a terminal in every home by 1970. Needless to say, this did not happen (and neither did he get the account). It does illustrate the extremes to which people were convinced of the viability of this new "toy." And to many, that's exactly what it was – a toy!

The past year has seen a lot of terminals yanked out of offices and a lot of orders not written. The "frill" is gone. Of the estimated 70 companies engaged in commercial time-sharing a year ago it is opined that there are perhaps only 20 left. And some Cassandras on the Street are predicting only 10 will be left by the end of this year. Obviously, somebody underestimated the difficulty involved in getting into this business.

Of the companies currently performing time-sharing services, it is difficult to discern how these in multiple businesses or facets of the industry are doing financially, the current reporting rules being what they are. Of the independents we know of at least two whose overhead expenses appear to have increased at a rate much faster than revenues in spite of drastic cost cutting. In other words, the cost of getting new business and doing the work is

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J. P. Tiresias *is a pseudonym for an individual at home in both the industrial and financial communities. This column, which represents opinions garnered from many specialists, interprets significant trends in the EDP marketplace.*

greater than the fees obtained. Three claim to be in the black within recent quarters: Tymshare (OTC), National CSS (OTC), and Keydata (OTC). On the other hand, the individual yardsticks used to analyze accounting procedures must be taken into consideration.

Now the two universes are polarized. The company presidents (who have survived) are still boasting at how successful they are (becoming), over-inflating the current status and potential of the commercial market, and barely scraping along. Simultaneously, the financial community and investors denounce time-sharing as a bad investment and refuse to come to the rescue or even salvage a lot of the good work which has been done to date. The two are worlds apart; and nothing will happen until something brings them together. What will this be?

Several alternatives have been put forward. For the major manufacturers in the business, the solution is to drop unproductive divisions. But who is to say that GE and IBM aren't making money in time-sharing? The real trouble lies with the independents. To many, the obvious solution is for some independents to merge. Without the financial backing of a large company with many divisions or investment bankers with faith behind them, they cannot survive. They can only merge with other time-sharers who have compatible equipment and programs (without entailing horrendous expenses). The main problem is that the independent entrepreneurs have come to believe their own wild, bullish tales. Merger is difficult to achieve. When someone aproaches them with a realistic offer, they are often affronted with an inflated idea of what the company is worth. Then too, most entrepreneurs are unwilling or psychologically unable to accept a lesser role than that of chief executive officer. Here we have an impasse. Although there are some attractive combinations in the offing, it is unlikely that they will come about.

Another theory, put forth by Mike Perkins of White, Weld, is based on the concept of the vertical, multiple data processing company along the lines of University Computing. This means that a company with several divisions, such as straight data processing services, equipment sales, programming services, data facilities management capabilities, etc., can come in and pick up a time-sharing entity and make it viable. Good thinking Mike, but who's available? The trend seems to be toward larger time-sharing organizations with a broad range of services.

Now a more radical solution is being discussed in certain circles: the idea of a national utility. After all, what are these companies selling other than computer power? How about a regional grid of utilities similar to those in electric light and power, and gas utilities? The precedent was set by these companies many years ago. Why not just let the time-sharers sit down together and thrash the whole thing out with each one taking his share of the pie? These utilities, like power and gas, would, of course, be regulated by state commissions. Rates would be structured to take into account cost/performance ratios, and everybody would be happy.

This would correct the absurd pretentions of the undercapitalized entrepreneur who expects to build a nationwide service and sales organization. The whole thing could be linked through the communications networks and you would then have a series of viable businesses, rather than a mish-mash of floundering companies. Regionally monopolistic, government regulated, computer utilities! Some say that's the answer, but I am not one of them. To me, it's just a bit too ambitious for the realistic near-term.

Another major area of concern regarding time-sharing is equipment. Many time-sharing veterans have discovered there are few computers specifically designed to meet commercial time-sharing needs. Of the IBM 360 line, only the Model 67 is specifically designed for time-sharing, and less than 100 of these models are on order to date. The next generation of time-sharing hardware will have to take the cost/performance ratio of the equipment into closer account.

Then too, there is the threat of the mini-computer, which rears its ugly head from time to time like sex in the Victorian novel. Some of these have been designed with time-sharing capabilities in mind and are being used or considered for use in in-house situations. If this hardware and software is attractively priced and made widely available, it could give commercial time-sharing a run for its money.

Consider a moment the areas of application. We have mentioned a deficiency in the areas of business applications. Keydata is currently marketing a management reporting system that's supposed to work. Tymshare has a number of interesting applications. Four of the "big ten" accounting firms have specialized programs available to branches which calculate how much money you can save by using their copier. Simple, but effective. An instrument manufacturer plans to process data from its machines on time-shared computers to encourage sales. These are excellent examples of advanced and proper uses of time-sharing.

According to Jack Lukin, of Burknam and Co., "If time-sharing provides a valid and needed service, total usage will grow rapidly in the future. The public has been completely disenchanted by time-sharing, but if you believe in the long term value of the industry, now is the time to get involved." He didn't say whether or not **he** was getting involved. ▲

PORTABLE DATA RECORDERS

LAWRENCE A. FEIDELMAN, Vice Pres. • Information Spectrum Inc., Cherry Hill, N.J.

The main object of all source data automation equipment is to capture data at the source—the initial point of data generation. The physical location of the source can vary from the well-lit comfortable office to the rainy outdoors. SDA equipment must, therefore, be designed to meet the user requirements of both location and the method of data recording.

Previous SDA columns have described keypunch replacement devices which are usually found in an office environment, such as optical character readers and keyboard-to-tape systems. We now are concerned with situations in which a need exists to record low-volume data, or data in an outdoor environment or at numerous locations within a plant. The portable data recorder is specifically designed to meet such user requirements.

Portable data recorders are small, lightweight, low-cost, source data automation devices. Data is entered by means of switches, dials, keys, or, in the case of the IBM Port-A-Punch, by a stylus. Keyboards vary from numeric-only (most common) to a complete alphanumeric character set. Since on-site data entry is usually performed by non-professional data processing personnel, the procedure is kept simple.

Data is recorded on cards, paper tape, or magnetic tape. The present trend is towards recording data onto a cartridge or reel of computer non-compatible tape, requiring the user to have some form of local or remote conversion capability.

Portable data recorders employing card and paper tape punches are considerably less expensive than those with magnetic units. Prices range from $17.75 for the IBM Port-A-Punch to $2,000 for portable magnetic tape systems. Recent developments are underway to produce a recorder which will generate printed OCR-readable data.

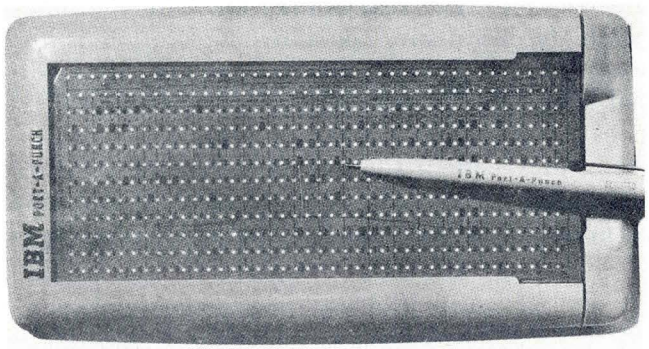

Fig. 1 — IBM's inexpensive "Port-A-Punch" requires die-cut cards.

Since portable data recorders are utilized in situations where data recording can only be accomplished once, they must be accurate. Yet, until recently, portable data recorders did not provide for data verification or hard copy printout. Several new data recorders, however, employ a strip printer or small display.

Portable recorders usually weigh less than 15 pounds, occupy less than ½ cubic foot, and are designed for some protection against weather. Recorders are available which are capable of being operated in a temperature range of 0° to 120°F in up to 100% relative humidity.

BEFORE YOU BUY

There are many types and models of portable data recorders available from many manufacturers, and choosing the right one for your needs is not easy.

Mr. Feidelman is a regular contributor to Source Data Automation.

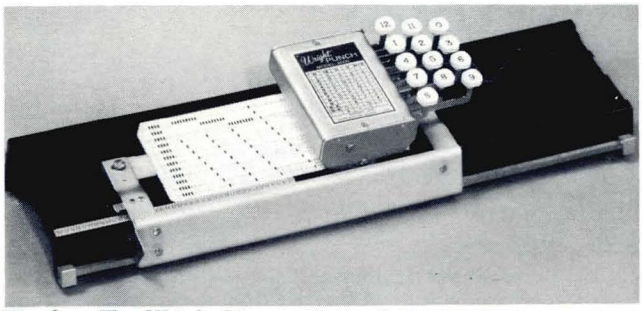

Fig. 2 — The Wright Line card punch, Model 2600, uses standard tabulating cards.

Fig. 3 — Varifab's transportable (plug-in) "Vari-Punch" simultaneously prints and punches on single cards, multiple-part sets, aperture cards, and plastic cards. A wide range of models are available for use with customer-specified input devices, e.g., time clocks and badge readers.

Fig. 4 — The "data-kap" Model 806 from Electronic Laboratories, Inc. is completely portable (battery-powered) and records numerics on magnetic tape cassettes. An optional, built-in strip printer provides immediate data verification as well as a hard copy record.

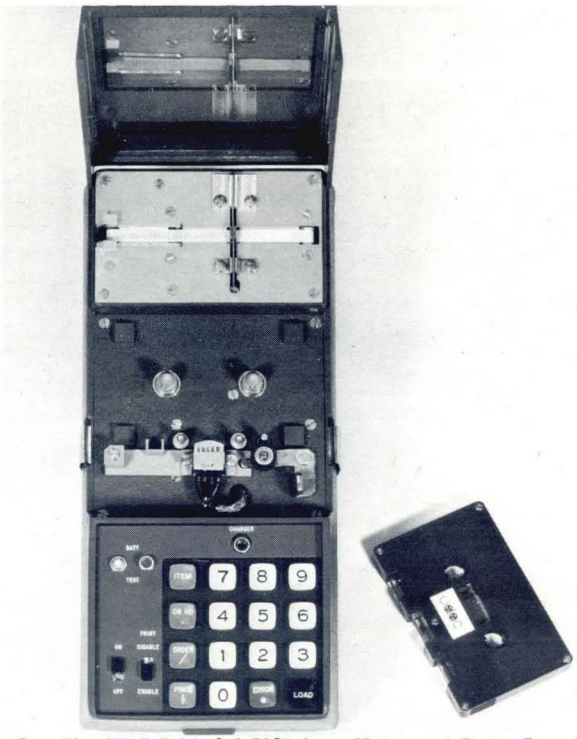

Fig. 5 — The UDAC Model 5021 from Universal Data Acquisition Co. is a battery-powered alphanumeric device which records on magnetic cassettes and an integral strip printer. Used in conjunction with a UDAC transmitter, receiver/converter, and modem, it constitutes a complete data acquisition system.

The representative models shown in this article have been selected only to indicate the range of capabilities offered. Once you have narrowed down your choice to those units which meet your overall cost and system requirements, insist on having them demonstrated in actual working conditions. The size, portability, and simplicity of these devices makes this possible to a degree unrealizable with almost any other class of equipment. If you do not intend to be the actual user of the recorder, give it to the individual who will be. If you intend to use it outdoors, step outside, preferably when the weather is less than perfect. Have the actual user reload it under realistic conditions (with dirty hands, in a moving vehicle, etc.). Ask about service and backup facilities. Be critical. If you are told the reason the particular unit you are testing is malfunctioning is because it is a "demonstrator's sample" and "your unit will work better," don't buy it. Portable data recorders have a special requirement for reliability. Remember: there'll be no salesman around when your employee is out in the North Woods somewhere counting trees. ▲

THE PERSONNEL SITUATION

RICHARD PETTERSEN • European Editor

France is currently concerned about a potential shortage of EDP personnel. COPEP (Permanent Commission On Electronics Planning) gave to BIPE (Office of Economic and Planning Information) the task of determining the status of the computing industry and computing personnel. The results: France had 2,500 EDP specialists in 1960, currently has about 40,000, and will need 220,000 by 1975 (that is to say, another 180,000 within five years). It is further predicted that 300,000 will be needed by 1980, and the technical schools are not keeping pace. French-speaking Americans take note.

BIPE also found the median salaries for EDP types in France. Note that the table shows base salaries — take-home cash, so to speak — which are supplemented by no end of additional benefits such as full medical and dental expenses, family allowances, transportation, rent (sometimes, at least in part), retirement, and a minimum of 28 vacation days per year. And most of these additional benefits are non-taxable!

MONTHLY SALARIES IN FRANCE

Category	Experience	Paris	Elsewhere
Assistant Operator	6 mos	$180	$153
	18 mos	216	180
	2 yrs	270	216
Operator	2 yrs	306	270
	3 yrs	396	288
Applications Programmer	1 yr	252	180
	2 yrs	324	252
	3 yrs	356	306
System Programmer	4 yrs	540	450
Applications Analyst	2 yrs	450	360
	3 yrs	540	450
Systems Analyst	4 yrs	630+	540+

Another survey, this time under the auspices of HEC (l'Ecole des Hautes Etudes Commerciales) has compared the types of EDP training given in the U.S. with those offered in Europe. Result: despite the bulldozer role of the U.S., most European countries (England an exception) offer better all-around training.

Mr. Pettersen is a regular contributor to European Report.

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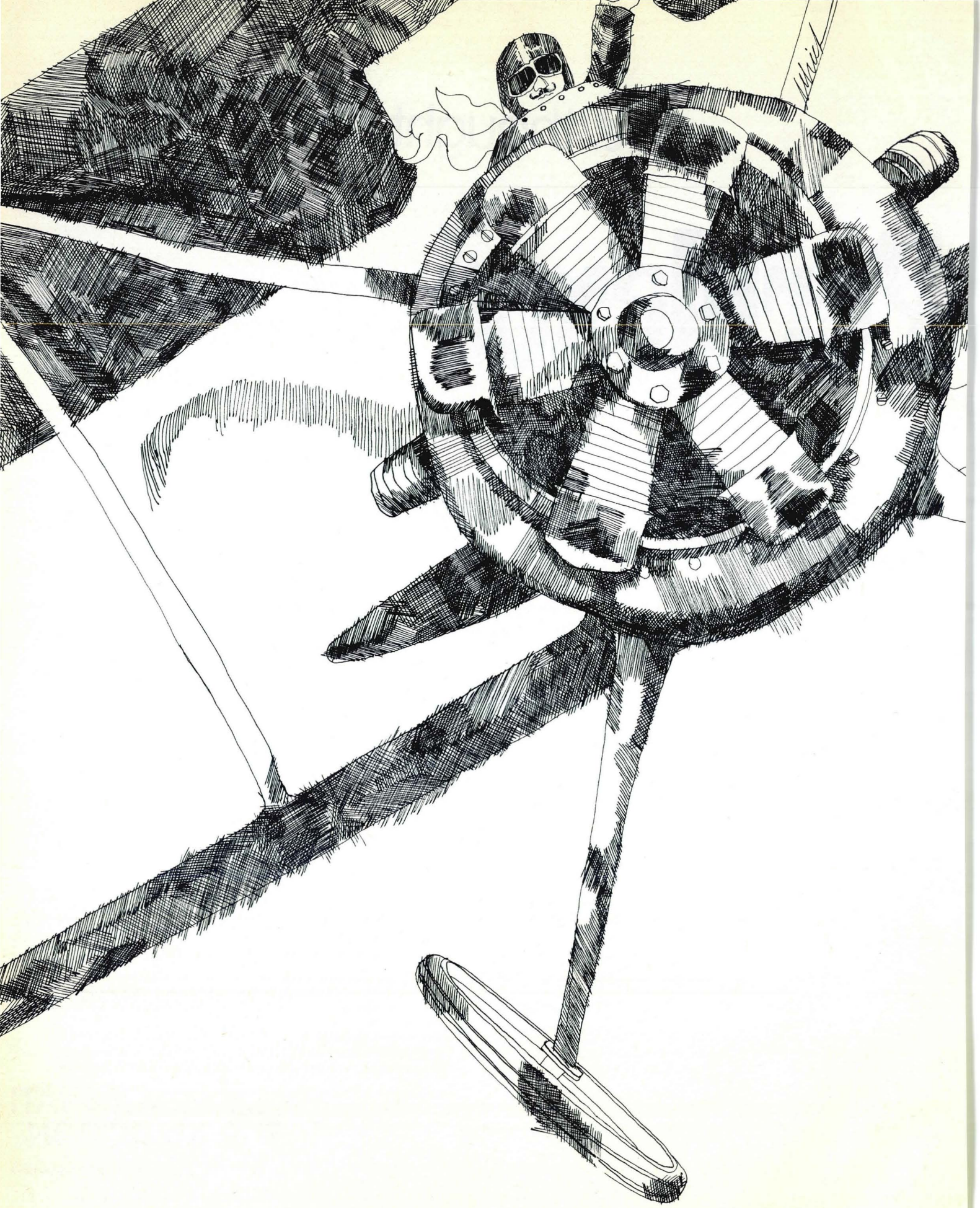

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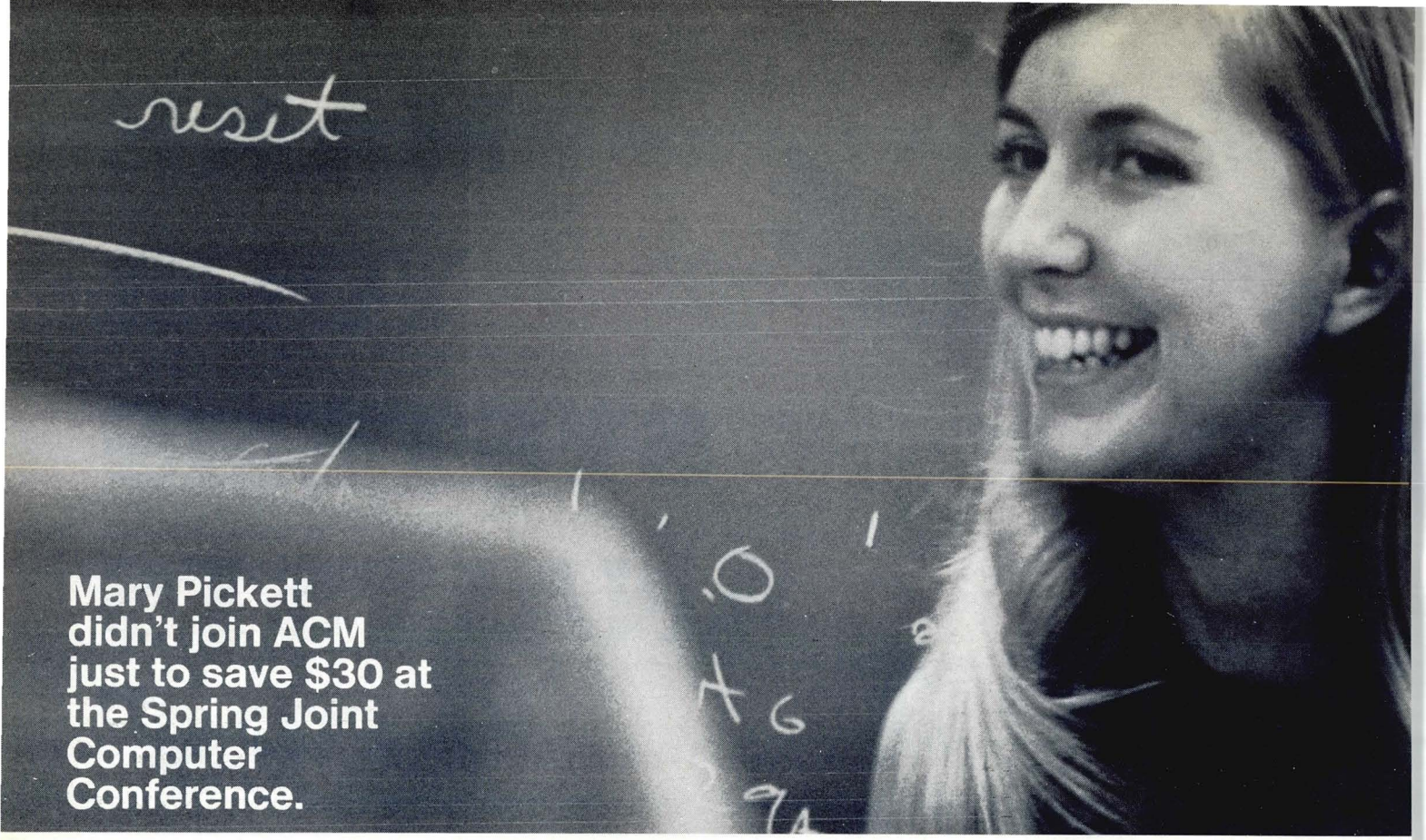

Mary Pickett didn't join ACM just to save $30 at the Spring Joint Computer Conference.

But it helped.

Mary Pickett is an associate systems programmer with RCA Computer Systems in Cinnaminson, New Jersey. Not too far from Atlantic City, site of this year's Spring Joint Computer Conference. She joined ACM in 1969, while a student at Purdue. With RCA since last August, she's getting involved in our Delaware Valley Chapter and recently switched from student to regular membership.

She's looking forward to the Spring Joint. "It's a chance to attend good lectures, see the exhibits and renew a lot of friendships," says Mary. "And my ACM membership helps. I save $30 on admission, more than enough to cover my annual dues."

ACM membership is a lot more than conference discounts. It's technical publications, lectures, seminars and special interest groups. A chance to get involved. And the professional pride of belonging to the oldest and most respected association in the computer field.

If you're going to the Spring Joint and don't belong to ACM, join now and save $30 at Atlantic City. Send in the coupon today!

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1133 Avenue of the Americas
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I would like to consider joining ACM.
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WHAT HATH BABBAGE WROUGHT Dept.

QUIT RIBBIN' RUBIN

The following classified advertisement appeared in the "Public Notices" section of the *New York Times,* Feb. 17, 1971.

> **MORRIS as in Morristown, N.J., is the surname, Ruben** R/U/B/E/N is the first. It is not Rubin nor it is Reuben or even Rueben. It is not even George Morris or Morris Ruben or even Morris Rubin. Computers, please notify your programmers. Mister Ruben Morris, Ninety Five Old Broadway, Apartment Nineteen B as Bravo, New York, New York 10027 (that's) Manhattan. After some several years it's getting circular and boring.

Submitted by:
Joel Shprentz
Irvington, N.Y.

ASSUME AWAY

I found the attached note while searching for information about a system that we were going to update. It was written by a girl in our input data department.

Re Source Deletion: Computer will record information from 11x orders before source is deleted. It will assume I know what I'm doing.

Submitted by:
Stanley Zygarowicz
Monroeville, Pa.

SEX ONLY ON HOLIDAYS

While checking the output of a new computer program for our payroll system, we discovered that all of the required information was not being printed all of the time. Employee records were not being identified as to "male" or "female" except seemingly at random. Debugging then revealed that our computer would only permit an employee to have "sex" if he also had a "holiday."

Submitted by:
R. W. Cantwell
Anderson, Ind.

THE HOLE TRUTH

The plague of the computer bill for $0.00 has been extended by the system into new areas for which we must all be watchful, not allowing ourselves to be overcome. Recently while getting some parts at a local business I noticed a clerk putting some new stock away. He opened a small envelope with a pink card attached to it and tried to empty the contents onto the counter. When nothing came out he checked the envelope carefully, then the counter top, then the nearby floor area, and finally the counter top again. Having found nothing he read the card on the envelope, smiled, handed it to me and went about his work. The card read, "Part number 9900020, Quantity 1, Name HOLE. Complete the reverse side on any complaint with this part."

Submitted by:
Dick Belaustegui, Consultant
Reno, Nevada

A REASONABLE EXCUSE

During my previous employ, a co-worker submitted a test to the mercies of our computer as he was leaving work for the day. Owing to the urgency of his assignment, he anxiously sought the output on his return the next morning. One might imagine his dismay when he read the operator's bold scrawl across the top of the JCL listing from his aborted run: "Job cancelled by operator—unable to mount tape on disk drive."

Submitted by:
William L. Bowers, Sys. Analyst
The Wm. S. Merrell Co.
Cincinnati, Ohio

MODERN DATA will pay $10.00 for any computer- or EDP-related item published in our **WHAT HATH BABBAGE WROUGHT Dept.** Humorous 'information' for consideration may include weird memos or operating instructions, unusually incongruous documentation, and off-beat items of a general nature (for review by our off-beat editors). Send all submissions to:
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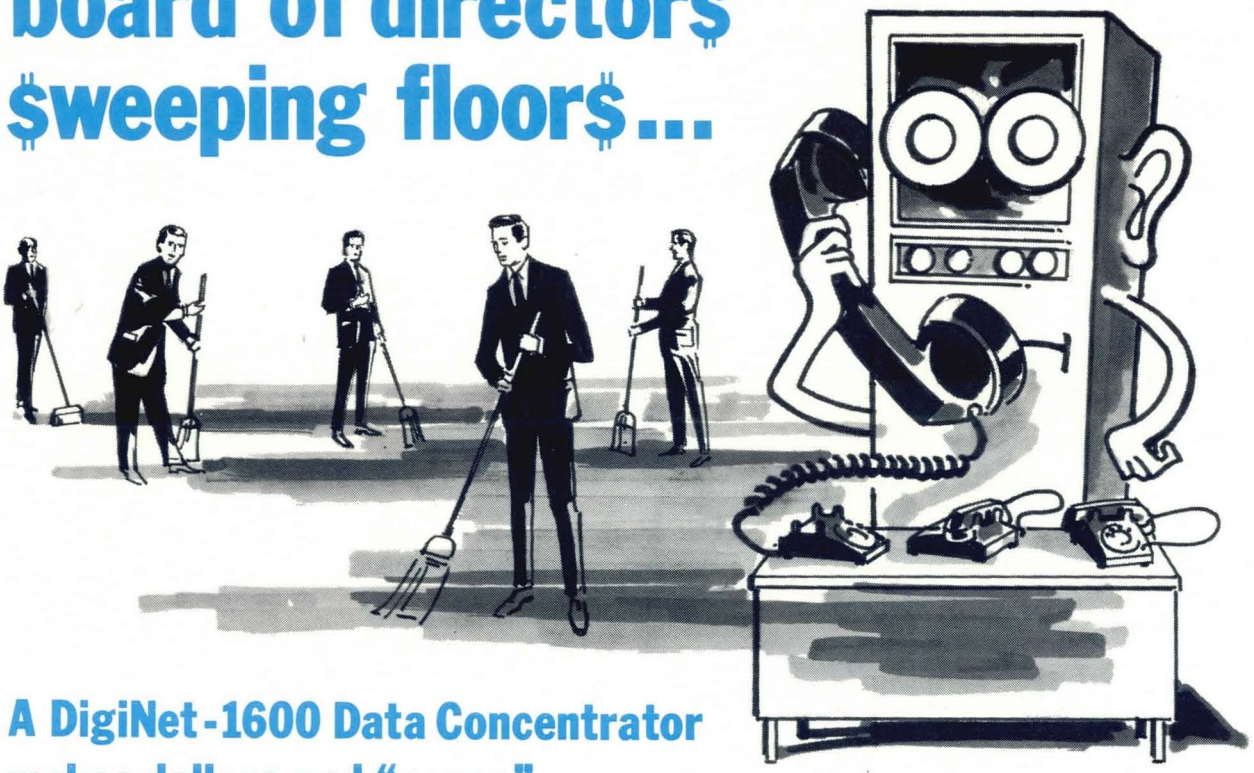
your computer an$wering phone$ make$ a$ much ene a$ your board of director$ $weeping floor$...



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GENERAL ELECTRIC

1971 SPRING JOINT COMPUTER CONFERENCE

May 18, 19, 20, 1971

Convention Hall

Atlantic City, N.J.

Atlantic City once again plays East Coast host to the American Federation of Information Processing Societies. This Spring's JCC theme is "Responsibility."

KEYNOTE ADDRESS AND LEAD-OFF SESSION

Starting the SJCC on its journey to explore AFIPS' "obligations to colleagues, clients, and customers – and its duty to society at large" will be keynote speaker Sir John Wall, Chairman of the Board of International Computers, Ltd. Sir Wall will discuss the increasing responsibilities of the information processing field during the '70s and the need for expanded communication among manufacturing and user communities.

The first program session, "Computing Machines – Menace or Messiah?", immediately follows the keynote address and will be chaired by Stanley Winkler of IBM. Moderator will be Herbert Grosch of the National Bureau of Standards. The controversial Dr. Grosch is himself considered a menace by some and a messiah by others.

THE MAN IN CHARGE

General chairman of the conference will be Dr. Jack Moshman, president of Moshman Associates, Inc., a management consulting firm with offices in Washington, D.C. A nationally recognized authority on the use of computers in election projection and in the solution of management problems, Dr. Moshman was an active participant in the formation of AFIPS in 1961.

MINI-PAPERS

Short technical notes (papers of less than 2000 words) will be read at special sessions held in addition to the regular, presently-scheduled sessions. The purpose of these "mini-papers," according to Dr. Nathaniel Macon, technical program chairman, is to enable specialists to discuss innovations which could not otherwise be covered because of the relatively early deadlines established for the review of regular session papers. Schedules for mini-paper sessions will be posted at the convention.

SPECIAL ACTIVITIES

To supplement the 36 technical sessions (3 more than were given last spring), the SJCC program committee has scheduled:

- An **ECOLOGY FORUM** chaired by Lawrence J. Fogel, president of Decision Science, Inc., will feature authorities from many disciplines relating to this currently vital problem area. Smokers are advised not to.
- An **ART SHOW** will include works from overseas contributors experimenting with the role of the computer as artist and medium. In addition, there will be a half-day **ART FORUM** with invited speakers and featuring a number of films demonstrating computer-generated art. *Non Gustibus . . .*
- A **SCIENCE THEATER** located off the main exhibit floor will show films dealing with computer-oriented subjects. Parental permission is not required.

EXHIBITS

Between 160 and 175 organizations are expected to exhibit in approximately 700 booth areas. Access to the exhibits will be more convenient than at previous Atlantic City conventions because the newly-enlarged Convention Hall permits placing all the exhibits on one level and separating them by wider aisles. Exhibit areas will be open from 9:00 a.m. (10:30 a.m. on Tuesday) until 7:00 p.m. (5:00 p.m. on Thursday).

REGISTRATION FEES

AFIPS MEMBERS . . . . . $20 (pre-registration); $30 (registration at SJCC)

NON–MEMBERS . . . . . $50 (pre-registration); $60 (registration at SJCC)

NOTES: *Registration fees (except for a $5 fee for students and uniformed military personnel, and a **$10** "exhibits-only" fee) include one copy of the Proceedings. $15 of the non-member registration may be applied to membership in any AFIPS member society.*

CONFERENCE RECEPTION (May 18, 6–8 p.m., Grenada Room of the Howard Johnson Motor Lodge) . . . $8

CONFERENCE LUNCHEON (May 20, noon, Traymore Hotel) $7

PRE–REGISTRATIONS, including reception and conference reservations, will be accepted by mail until April 30. Checks must be made payable to **"1971 SJCC"** and mailed to:

1971 SJCC Registration
c/o AFIPS
210 Summit Avenue
Montvale, New Jersey 07645

CONFERENCE REGISTRATIONS will be taken at Convention Hall Monday through Thursday during the following hours, respectively: **4 p.m. – 10 p.m.; 8 a.m. – 7 p.m.; 8 a.m. – 9 p.m.; 8 a.m. – 5 p.m.** On May 18, **only**, off-site registration desks will be open from **8 a.m. to noon** in the lobbies of the following five hotels: **Shelbourne, Dennis, Holiday Inn, Traymore, Sheraton-Deauville.**

PROGRAM SESSIONS

TUESDAY, MAY 18 — P.M.

Session 1 . . . *Computing Machines—Menace or Messiah?*
Session 2 . . . . . *Image of the Industry*
Session 3 . . . . . *Hardware Design & Evaluation*
Session 4 . *Law Enforcement and Judicial Administration*
Session 5 . . . . . *Applications Requiring Multiprocessors Computer-Aided*
Session 6 . . . . . *Management of Earth Resources*
Session 7 . . . . . *Responsive Government*
Session 8 . . . . . *Computers in Transport*
Session 9 . . . . . *Present and Future Data Networks*
Session 10 . . . . . *Terminal-Oriented Displays*
Session 11 . *Competitive Evaluation of Interactive Systems*

WEDNESDAY, MAY 19 — A.M.

Session 12 . . . . . *Computers in the Electoral Process*
Session 13 . . . . . *Microprogramming and Emulation*
Session 14 . . . . . *Interactive Applications and Systems*
Session 15 . . . . . *Computational Complexity*
Session 16 . . . . . *The Evolution of Computer Animation*

WEDNESDAY, MAY 19 — P.M.

Session 17 . . . . . *From the User's Viewpoint*
Session 18 . . . . . *Information and Data Management*
Session 19 . . . . . *Computer-Assisted Instruction*
Session 20 . . . . . *Storage Computer*
Session 21 . . . . . *Arithmetic and Artificial Intelligence*
Session 22 . . . . . *Venture Capital*
Session 23 . . . . . *To Be Announced*
Session 24 . . . . . *Peripheral Processing*
Session 25 . . . . . *Computer "Pictorics" Computation,*
Session 26 . . . . . *Decision Making, & the Environment*

THURSDAY, MAY 20 — A.M.

Session 27 . . . . . *An International View*
Session 28 . . . . . *Simulation of Computer Systems*
Session 29 . . . . . *Application of Computers to Training*
Session 30 . . . . . *Diagnostics and Recovery*
Session 31 . . . . . *Systems Software*

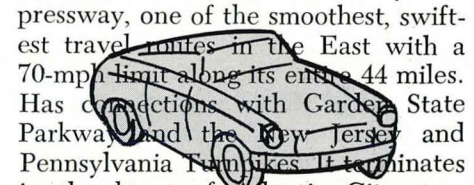
THURSDAY, MAY 20 — P.M.

Session 32 . . . . . *The Computer Professional Job Market*
Session 33 . . . . . *File Organization*
Session 34 . . . . . *Computer Architecture Educational*
Session 35 . . . . . *Requirements for Systems Analysts*
Session 36 . . . . *Computer Acquisition: Purchase or Lease*

GETTING THERE

Atlantic City, N.J., is an island, seven driving miles off the New Jersey coast, 120 miles south of New York City, and 55 miles southeast of Philadelphia. Since one-third of the nation's population — 60 million people — lives within 500 miles and 40 million people are within 300 miles, there are many ways of getting to and from the city:

By plane — Scheduled daily flights by Allegheny Airlines into Atlantic City Airport and connecting flights by other major transcontinental airlines at Phila., Washington, D.C., New York City. Bader Field, which is five minutes away from the center of Atlantic City, accommodates private planes. More than 350 flights arrive and depart daily at International Airport, Phila., which is served by the Allegheny Airlines' Conventionaire Service, only 25 minutes from Atlantic City. The trip is 60 minutes by non-stop express bus or airport limousine.



By car — Via the Atlantic City Expressway, one of the smoothest, swiftest travel routes in the East with a 70-mph limit along its entire 44 miles. Has connections with Garden State Parkway and the New Jersey and Pennsylvania Turnpikes. It terminates in the heart of Atlantic City, two minutes from Convention Hall.

By bus — Express busses daily from New York and Philadelphia, regular service from Washington and Baltimore, and charter service.

By train — Pennsylvania-Reading Seashore Lines from Phila., which is served by the Pennsylvania Railroad.

By boat — Complete facilities at Atlantic City State Marina which includes nine piers with 317 berths.

SJCC PRODUCT INDEX

INFORMATION INTERCHANGE BETWEEN DISSIMILAR SYSTEMS

HERBERT S. MELTZER and **HUBERT F. ICKES** • IBM Systems Dev. Labs., San Jose, Cal. and Poughkeepsie, N.Y.

An ASCII Task Group has developed valuable insights which will help those involved with several systems having dissimilar architecture — an increasingly common situation.

The explosive proliferation of computer communications is probably the most important recent development in the data processing industry. However, just as the expansion of verbal communications among nations has reinforced our awareness of linguistic barriers, our experience with computer communications has exposed the incompatibilities of various coding schemes.

Past efforts at reconciling these differences culminated in the American National Standard Code for Information Interchange (ASCII). However, ASCII has its limitations, particularly in that the character code which ASCII offers requires translation when data is stored in another code form, such as binary. Thus the problem remains of how best to apply ASCII when interchanging data between dissimilar computer systems.

This article analyzes data interchange, first examining codes and then looking at the interchange mechanism. Subsequently, three problems are addressed. First, the problem of transferring data files from one system to another. Second, the problem of converting a single system's files to ASCII. Finally, the problem of transferring a high-level language application program between systems.

Hubert F. Ickes is an advisory planner at IBM's Systems Development Div. Laboratory in Poughkeepsie where he is a member of the Systems Standards department. Mr. Ickes received a BSEE degree from Carnegie Institute of Technology in 1950 and joined IBM that same year as a customer engineer in Canton, Ohio. He is a member of the Association for Computing Machinery and also the American National Standards Institute subcommittee on codes.

ANALYSIS OF CODES

A *code* is a bit pattern representing some concept significant to an application. It can represent a character, a hardware task such as "backspace" or a numerical value. A *code set* is a collection of codes of similar format (e.g., ASCII, 32-bit floating-point hexadecimal). Some code sets include essentially the same concepts, but with different bit patterns, such as Hollerith and ASCII. A *family of code sets* (including "invisible" code sets generated by appending parity bits) is a collection of code sets, each of which a system requires to perform all its specified functions. For example, the IBM 1401 has a family of essentially four code sets: the graphic characters, the algebraic digits, the address numbers, and the operation codes. These are all expressed in BCD characters. Typically, a system has a family of code sets in which code sets are not redundant (e.g., both 36-bit floating-point binary and 32-bit floating-point binary codes would not be available). An intricate and comprehensive set of interrelationships (algorithms for translation) operate between any two code sets for which conversion is meaningful. Such algorithms range from (1) a simple "PACK" or "UNPACK" instruction converting between signed overpunched decimal digit characters and packed decimal numbers, to (2) a Fortran algorithm for translating a floating-point decimal character string to a floating-point hexadecimal number, to (3) an assembler system translating from mnemonic operation codes expressed in alphabetic and digital characters to machine operation codes. Each relationship is expressed in the context of the application, and translations between code sets in the family of codes are invoked, when necessary, by the problem programs.

Code sets are presumed to be unambiguous, i.e., for a particular code identification a specific bit pattern represents one and only one meaning.

Conversely, a meaning is represented by one and only one bit pattern. However, in all existing implementations, some exceptions in the form of dualing have been introduced. The purpose of dualing is to accommodate a greater number of meanings than can be provided by the unique bit combinations of one code set. For example, in BCD the ampersand and the plus sign occupy the same bit pattern. And in EBCDIC, zoned decimal bit patterns overlap with alpha bit patterns. Such exceptions complicate automatic translation between two code sets in which the same pairings do not exist since the translator cannot determine which of the alternative target bit patterns to substitute by simply examining the source bit pattern. Furthermore, in some pairs of code sets the identical meanings may not exist, e.g., in EBCDIC there is a bit pattern representing "¢" that does not exist in ASCII. Fortunately, this problem is relatively minor since the ambiguities generally affect data which is of minor significance to an application (e.g., "¢").

More important is an ambiguity problem which arises in the following manner. As a rule, a programmer explicitly identifies the data code of a field with a source program data description. The value of a field consistent with this data description is its token. In addition, the programmer may implicitly identify a code by loading a particular register or performing a particular operation, thereby giving the field an identity different from his prior explicit data description identification. Alternatively, a programmer may explicitly "redefine" the data code of a field. In either case, he endows the bit pattern with a further value of meaning which actually differs from its token. As a result, the system does not unambiguously know the contents, or the code of the contents, of any field in any record. This obviously leads to a problem in program interchange.

ANALYSIS OF THE INTERCHANGE MECHANISM

Interchange can be undertaken in many environments. Among them are: (1) **Widespread interchange of data** — dissemination of data to many recipients with different systems, as in the exchange of well-logging data among oil companies. (2) **Reporting of data** — the collection of data from numerous dissimilar originators. (3) **Communication between two systems** — two systems interchanging with each knowing the characteristics and capabilities of the other. (4) **Unconstrained interchange of programs and data** — routine, efficient, daily exchange of jobs among two or more systems for such purposes as load-sharing or staged processing. (Here interchange is anticipated and preparations are made.) (5) **Unanticipated interchange of programs and data** (e.g., with a backup system in case of system failure) — identical to the preceding, except that interchange is not anticipated and no preparation is made to facilitate it. (6) **Replacement of an installed system** — with time to plan an orderly, one-time conversion.

In all these environments data is broken into units of fixed length determined by the CPU. These units are then fetched in parallel from main storage by a channel. The channel transfers the data through control unit, drive, and recording mechanism to the medium. In the process, the system may also insert control information or modify the data. For example, the hardware may append parity bits, or the software may set record lengths.

A flow diagram for these kinds of conversions, translations, and transformations is shown in Fig. 1. A bit dump from any medium would be unrecognizable to a program or to the programmer. But on input the exact inverse of output changes are performed at fixed intervals identically to every unit, independent of the content or the code of the data. Thus the record is restored in memory, independent of the code of any field.

Data interchange between similar independent systems (that is, systems whose architecture, register lengths, and data formats are essentially the same) is affected in much the same way as data is stored and retrieved in one system. Both systems map with the same alogrithm, applied non-selectively to the data (see Fig. 2). The sending system modifies the data mapping unit by unit (e.g. byte, word), and records the modified data on the medium. The receiving system performs the inverse, and the data — even in mixed code form — is once again identical to its bit pattern before it was interchanged.

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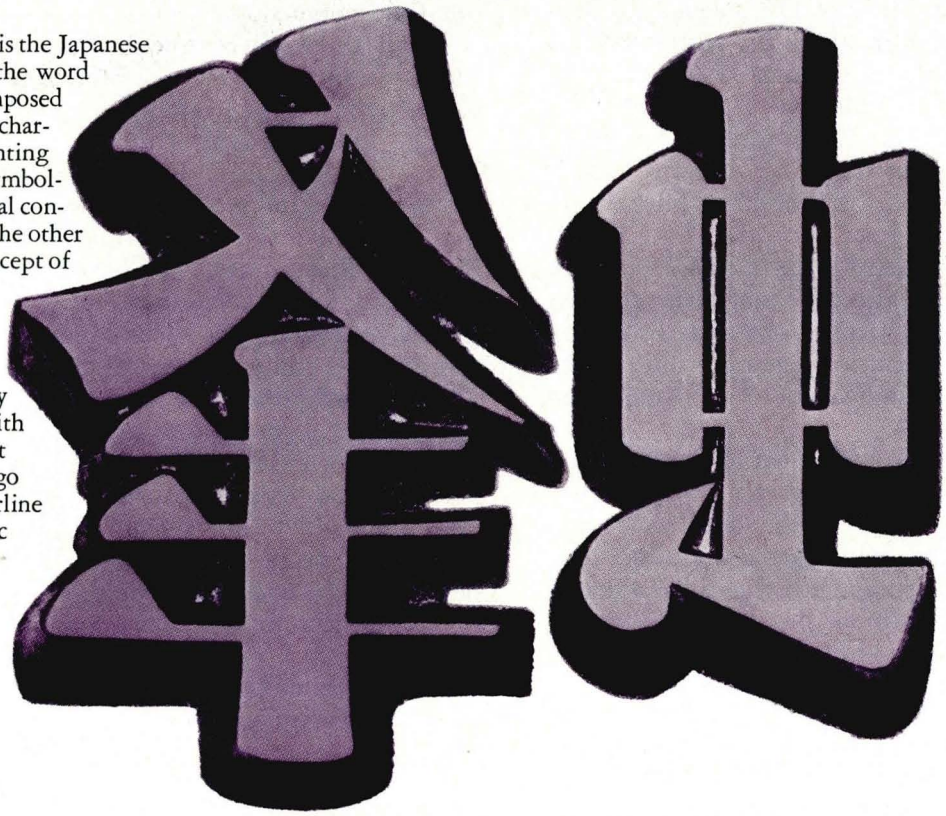

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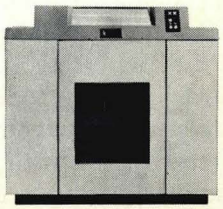

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On the other hand, systems with different architecture present barriers to automatic interchange of data because of the various incongruities of code and architecture. For example, a number represented in the first system by 36-bit floating-point binary must be represented in the second system as 32-bit floating-point hexadecimal. The following 36 bits may be six characters in the first system, mapping to 48 bits in the second. To translate these a selective mapping matrix is required as shown in Fig. 3. The mapping matrix of the sending system maps the data, unit by unit, from its main storage to some pattern on the interchange medium. The receiving system might not use units of the same length or algorithm for each unit. If the codes on the source system's files are mixed, the system must be able to identify codes as they are encountered in order to use the proper conversion algorithm. However, with current technology there is no way for a mapping matrix to be aware of an application program's explicit and implicit code designations. Therefore, data in mixed codes can not be interchanged between systems of different architecture.

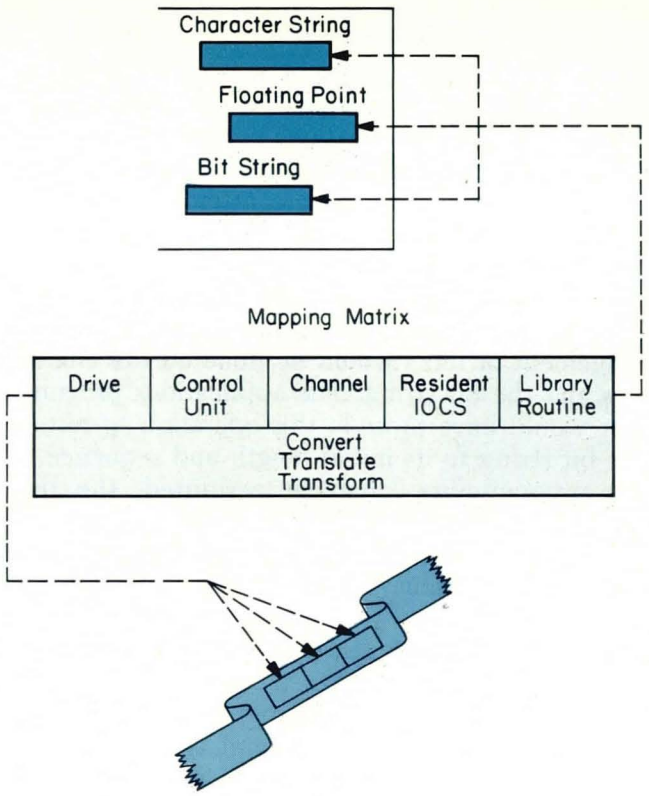

Fig. 1— Data storage in a single system

PROBLEM 1: ***Data Interchange between Dissimilar Systems.*** The preceding section has shown the manner in which data interchange becomes difficult if the systems involved are dissimilar and the coding structure of the files is complex. The following subsections discuss approaches to meeting this problem.

EMULATION

Emulation is the most effective way of avoiding a conversion. It consists of the processing of data in a system operating as though it were another system. The receiving applications program and the data formats are written as though they were operating in the sending system. This reduces the problem to interchange between similar systems. However, if the receiving system is operating in its native mode for some applications and emulating another system for other applications, interchange between these two sets of applications remains a problem.

CONTEXTUAL PROCESSING OF ALIEN CODES

In some cases, application programs can be written to operate upon alien codes. This is problem program emulation. Either the sending application is modified to record the data in the native mode of the receiving system, or the receiving application is modified to process the data in the native mode of the sending system.

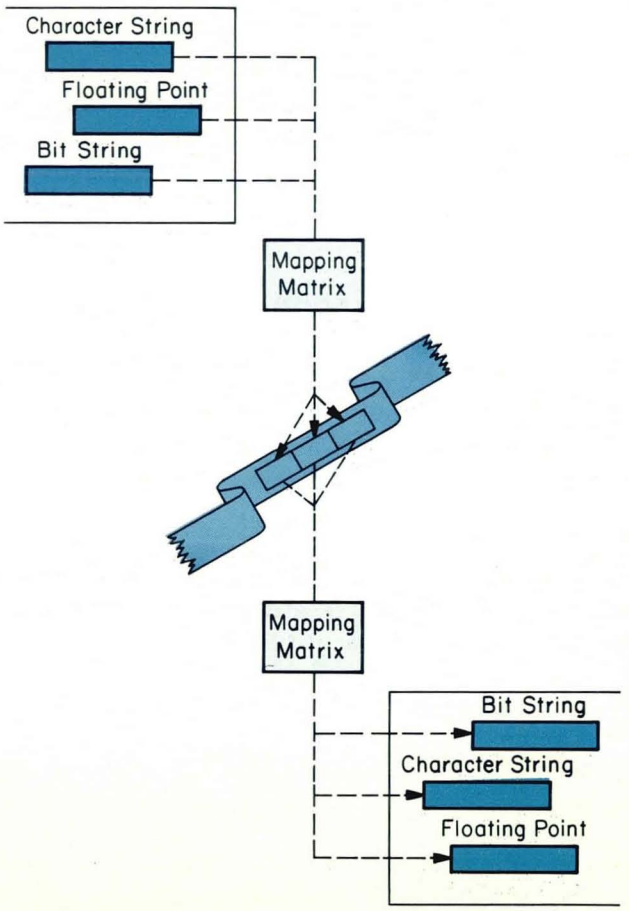

Fig. 2— Code interchange between similar systems

This once again reduces the problem to interchange between similar systems by placing the burden upon the applications programs. However, the technique would be complicated if any automatic code conversions were attempted. For example, if a six-character field followed by a ten-bit string were to be interchanged, any automatic operation upon the character codes in either system (e.g., translation of 6 to 8 bits per character, rearrangement of bits) would be done on the characters and the bit string. The applications programmer would have to undo this operation to restore the bit string to its initial length and sequence. If the programming language permitted, the programmer would convert his source program by inserting field descriptors reflecting the alien system's computation codes. This would alter the field equivalences ("redefines") and record length controls. (It would also fail if the program explicitly or implicitly assigned more than one code to a field.) The resulting program is bound to a particular set of alien codes and is not generally useful. Labor can be reduced by emulating a file at a time, if the compiler can assign the field descriptors. Even then, however, the user must ensure the correct code at subroutine and system software interfaces, and the program is trapped into more complex code mixes. Moreover, alien number formats degrade performance, increase costs of program testing and maintenance, and reduce usefulness of library subroutines and system functions. Finally, no standard programming language offers facilities for field descriptor insertion. Considering the number of codes in current use, future availability of such facilities seems unlikely.

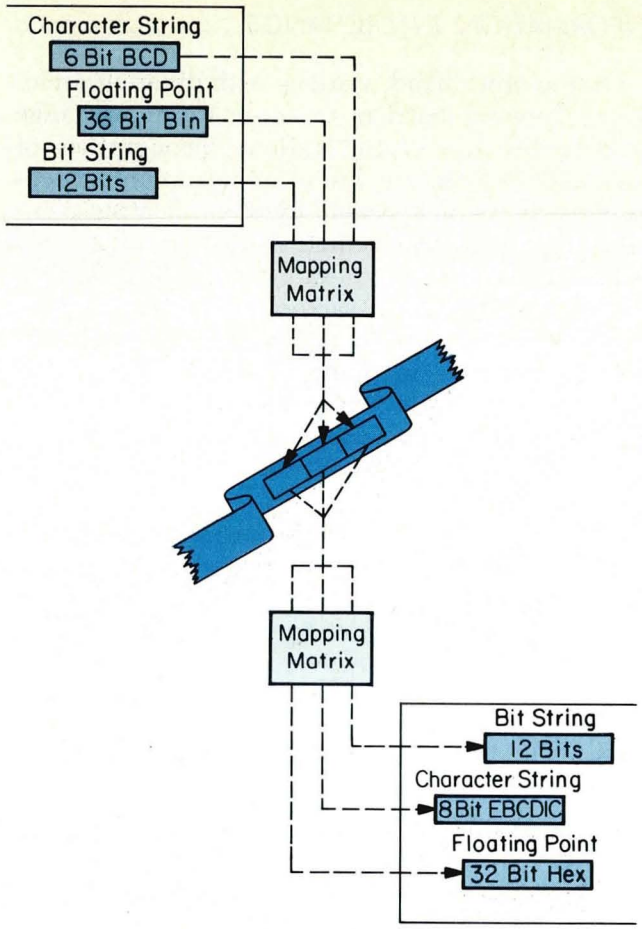

Fig. 3 — Hypothetical code interchange for dissimilar systems

CONTEXTUAL TRANSLATION WITH DESCRIPTORS

This technique would enable automatic selective translation of mixed code sets. Each code would be identified as it is encountered in the data stream, and the proper translation algorithm could be selected. There are essentially two methods of automatic identification: (1) one or more record descriptors could define the code of each of the fields in each of the record types in the file, and each record could identify its descriptor; or (2) each field may have a field descriptor adjacent to it in the record. Both methods might be used in the same file. This technique requires standardization of all the possible source and target data formats, a descriptor for each, and a method for associating a record with its descriptor. The descriptors may be placed onto the records manually or automatically, although manual placement is laborious and prone to error. Automatic placement requires the same types of constraints as before — no explicit or implicit redefinition of fields, loss of equivalences and record length controls, and potential loss of subroutine library functions. Such selective mapping is not likely to be supported in hardware. Selective mapping impacts program performance. The inclusion of descriptors in a record impacts main storage, channel, and media utilization. The expense of implementation, maintenance, and especially testing, is so high that this method would only be used in anticipation of interchange. Applicability and feasibility in small systems is doubtful. There has been no demonstration of feasibility at the current state-of-the-art, and efforts to standardize data descriptive language have been terminated here and in Europe.

CONTEXT-FREE TRANSLATION

With this technique one code set is used in interchange, reducing the problem to one mapping algorithm between the interchange medium code set (i.e., ASCII) and the corresponding system code set. Character code sets should be used because they represent the greatest range of values.

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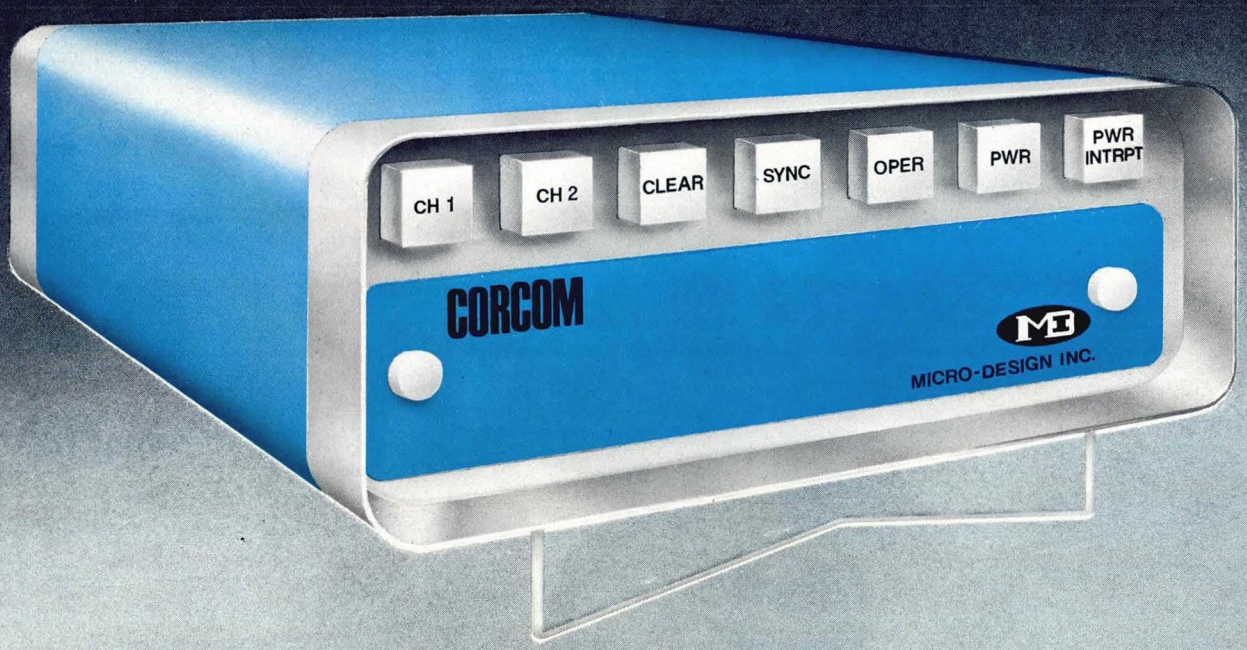

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(It is, for example, hard to represent a person's name in floating-point binary.) Also, if the code set is characters, the problem programs can use standard high-level language functions to convert between bit strings or dense numerics and character strings. Admittedly, this technique has disadvantages. Machine, device, and control codes cannot be interchanged. The conversion and expansion of dense numerics has a deleterious effect on main storage performance and space utilization. Character strings utilize channel and storage medium less efficiently than the binary numbers they replace. Dualing may present a minor obstacle. Finally, there may be a loss of accuracy due to radix change on conversion. However, the advantages seem far more noteworthy.

- Characters are a proper subset of every system. Pre-existing files or programs will not be affected by later developments.

- Unlike emulation, conversion can be done in an orderly, incremental manner. The changeover from computational forms to character strings can be programmed one file at a time. At a convenient time, the files can then be cut over to the new character code set, ASCII.

- Support is centralized, easily developed, tested, maintained, and extended to other character code sets.

- The technique is already known to programmers as it is currently in use to capture raw data and prepare reports.

- Typically in "formatted," "edited," and "display" character strings, only 64 or fewer symbols are used, retaining capability to interchange among 6-, 7-, or 8-bit systems without special provisions.

Thus, it seems clear that context-free translation of character strings from/to native to/from ASCII is the most promising technique for interchange of information between dissimilar systems in the interchange environments (1), (2), and (6) discussed previously. Interchange case (3) is a communications problem, not of significance to this discussion; cases (4) and (5) require that the systems be similar in architecture.

IMPLEMENTATION

All interchangeable data files should adhere to the American National Standards for media, labelling, and data organization. The American National Standard Code for Information Interchange (ASCII) provides a standard for the character code. The bit-patterns and their characters meanings must correspond precisely and only to those specified in ANSI X3.4-1968.

Users should ensure that dense numerics, overpunched or oversigned numerics, binary bit strings, binary or discontinuous binary address numbers or relative addresses, machine or device control codes, or any other noncharacter representations do not appear in the data. Reprogramming to eliminate usage of these forms is necessary. Common programming languages have automatic functions to convert dense numerics and binary bit strings to/from character strings. In Fortran, use FORMATed I/O. In Cobol, use ACCEPT and DISPLAY. Programming to move an overpunched sign to a separate position is trivial, if you use a compiler which has not yet implemented the new CODASYL separate sign facility.

PROBLEM 2: ***Conversion of a single system's files to ASCII.*** The problem of converting a single system's files to ASCII is largely equivalent to the problem of data interchange between dissimilar systems. For reasons apparent from the above discussion, context-free translation is the best approach to conversion to ASCII. That is, all character files should be converted to the source family's character code and thence to ASCII.

PROBLEM 3: ***Program Interchange.*** It is sometimes desirable for a source program to be recompiled and to operate in a computing system possessing a different family of codes from the one for which the program was originally written. Two primary considerations in doing this are, first, whether there are fields with multiple code identifications, and second, the program's requirements for collating sequence.

MULTIPLE CODE IDENTIFICATIONS

It has been explained that a programmer may attach explicit or implicit code identifications to a field in addition to its explicit data description code identification. Thus, two or more meanings are extracted from a common bit pattern. However, with contextual or context-free translation, only one of these meanings will be retained when that bit pattern is translated to the appropriate bit pattern in a second system. Therefore, such multiple code identification is inimical to program interchange unless the second system actually emulates the first. Reprogramming to eliminate dependence on such ambiguities is required.

SORTING AND COLLATING CONSIDERATIONS

It is convenient to think of three cases of sorting and collating, each having its own implication with respect to the problem of program interchange. Two of these cases are trivial. In the first,

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the record sequence is identical in all common codes, as when all characters in the key are numbers or all characters are lower-case letters. In the second, the sorting sequence need not be the same for both systems when it does not affect processing. For example, the sorting sequence may merely determine the arrangement of records in directly addressable storage. In either of these cases, no difficulty will be caused by interchange. A simple translation may be sufficient; at worst, a resorting of the file may be required as well.

In the third case, the sequencing must conform to application requirements and will generally not correspond to any hardware "compare" operation. If the source programming language offers a facility to specify any character sequence, then program interchange may present no difficulty. However, no programming language can automatically support a dependency upon complex sequencing rules, such as are used to construct a telephone directory. Therefore, in these cases of application-oriented sequencing, the programmer may have to rewrite these special procedures.

SUMMARY

If two programs operate on different code sets, it is convenient to translate codes from those used by the sender to those used by the receiver as

The following American National Standards should be followed for interchange of recorded information:

X3.4-1968 USA Standard Code for Information Interchange;

X3.6-1965 USA Standard Perforated Tape Code for Information Interchange;

X3.11-1966 USA Standard Specifications for General-Purpose Paper Cards for Information Interchange;

X3.14-1969 USA Standard Recorded Magnetic Tape for Information Interchange (200 CPI, NRZI);

X3.18-1967 USA Standard One-Inch Perforated Paper Tape for Information Interchange;

X3.21-1967 USA Standard Rectangular Holes in Twelve-Row Punched Cards;

X3.22-1967 USA Standard Recorded Magnetic Tape for Information Interchange (800 CPI, NRZI);

X3.26-1969 USA Standard Hollerith Punched Card Code;

X3.27-1969 USA Standard Magnetic Tape Labels for Information Interchange;

American National Standards Task Group X3L5 is working on a standard to establish compatibility for representation of arithmetic values in character strings interchanged between programs.

information is transmitted from one program to another. This translation can be accomplished automatically by hardware, by a generalized routine, or by both. It can also be accomplished by an application-oriented program, but this is neither automatic nor generalized.

To translate between two code sets, the translation mechanism must be informed of the source and target code sets, the target code set must contain at least those meanings in the source code set that the application has used, and the pairings must be unambiguous to the translator. This would have to be accomplished byte by byte, word by word, field by field; either uniformly or, in case of mixed codes, using different algorithms as the data stream is traversed.

Upon examination of the mechanisms for translation from code set to code set, it becomes obvious that in interchange or conversion of information between systems whose families of code sets are not identical, automatic processes are possible between only one code set of the source and one code set of the target. Thus, interchange of mixed codes cannot be accomplished. For generalized data interchange, the most applicable code set is the character code set. The standard interchange code set is ASCII.

Attempting to translate two or more codes sets between dissimilar systems is not a step function of increasing difficulty; it is a "cliff function." In order to accommodate more than one code set in interchange between them, no translation can be required and the systems must be similar. There would then be no constraint on the number of code sets shared by the two similar systems.

The problems of transition to ASCII are similar to the problems of interchange between an existing system and an ASCII system. When an installation has determined that it has requirements to interchange data among dissimilar systems or to convert to an ASCII system, it must make certain preparations in anticipation of interchange or conversion. There are constraints, side effects, and other considerations implied by context-free translation of data represented entirely by character strings to ASCII. Programming techniques are available in most programming languages to obtain character-string-only files. If a user ensures that the data files anticipated for interchange have these properties, unhindered and widespread interchange can be accomplished.

These rules are necessary to achieve interchange among dissimilar systems, but they are not sufficient. The user must ensure that the information in the file is useful to the receiving application, that the application can locate and understand the information it receives, and that the receiving system has no constraints (e.g., program dependencies, data incompatibilities) beyond those discussed here. ▲

PLANNING A DATA COMMUNICATIONS SYSTEM

Part 4: Quantifying Data Communications System Performance

SAUL STIMLER • Stimler Associates, Moorestown, N.Y.

This fourth part of a 5-part series of articles describes a method for estimating the performance of a data communications system and illustrates the results obtainable using this method. Part 1 (April 1970) provided a broad overview to the subject of data communications systems. Part 2 (May, June 1970) discussed the types and costs of various common carrier facilities. Part 3 (Sept. 1970) considered the selection of data terminals.

Consider the following "real-world" situation. The management of a multidivisional corporation is considering the feasibility of centralizing their corporate data processing facility. The batch processing needs of the remote locations would be served by a proper combination of mail and courier service, and the use of remote job entry terminals. Management has charged the corporate data processing staff to perform a feasibility study on the remote job entry terminal system. One approach the staff might follow would be to:

STEP 1. *Study the requirements of each remote location to be served;*

STEP 2. *Prepare a functional specification, including such requirements as the traffic volumes, turn-around time requirements, and the reliability needed;*

STEP 3. *Propose a system to meet the requirements of the functional specification;*

STEP 4. *Estimate the cost of the proposed system;*

STEP 5. *Estimate the performance of the proposed system;*

STEP 6. *Modify the design of the proposed system to reduce the cost within the functional requirements;*

STEP 7. *Iterate* **Steps 4, 5,** *and* **6** *until a satisfactory design is achieved.*

This article addresses **Step 5** – the estimation of performance of a proposed design. The objectives are to (1) illustrate the usefulness of estimating the performance of a specific data communications system; and (2) to illustrate the general type of results obtainable using a method we shall propose.

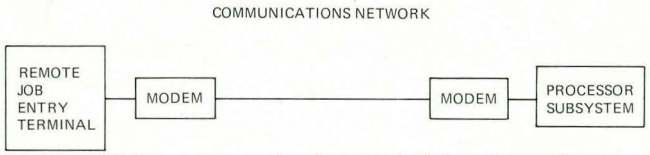

Fig. 1 — Major components of a remote job entry system.

THE PROBLEM TO BE ANALYZED

Considering the specific problem to be analyzed, assume that an important functional requirement is the daily transmission of 100,000 records, each 100 characters in length. The system proposed is illustrated in Fig. 1. In operation, a magnetic tape containing the 100,000 records to be transmitted is prepared off-line at the remote location. When the data is to be transmitted to the central processor, the magnetic tape is mounted on the reader of the remote terminal. The necessary connection procedures between the remote terminal and the central processor are completed and transmission is initiated. Assume that a half-duplex line is used and the transmission of data is accomplished in the following sequence of steps:

STEP 1. *The next block of data to be transmitted is read from the tape into a terminal buffer;*

STEP 2. *The proper control signals are transmitted between the remote terminal and the processor, and the block is transmitted from the terminal buffer, through the communications network, to the processor;*

STEP 3. *The received data is checked for line-introduced errors at the processor;*

STEP 4. *If no errors are detected, the processor generates an acknowledge message, transmits it to the terminal, and* **Steps 1** *through* **4** *are repeated. If an error is detected, a negative acknowledge is transmitted to the terminal, and the block in the buffer is retransmitted to the processor;*

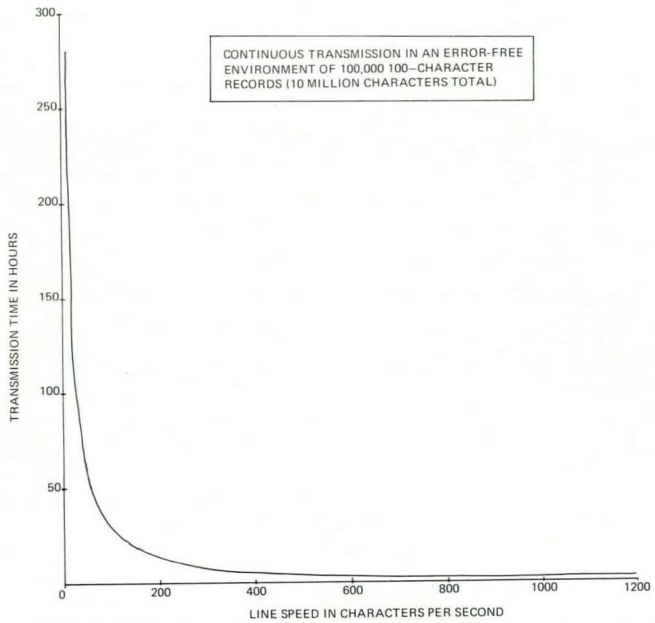

Fig. 2 — Minimum transmission time versus line speed.

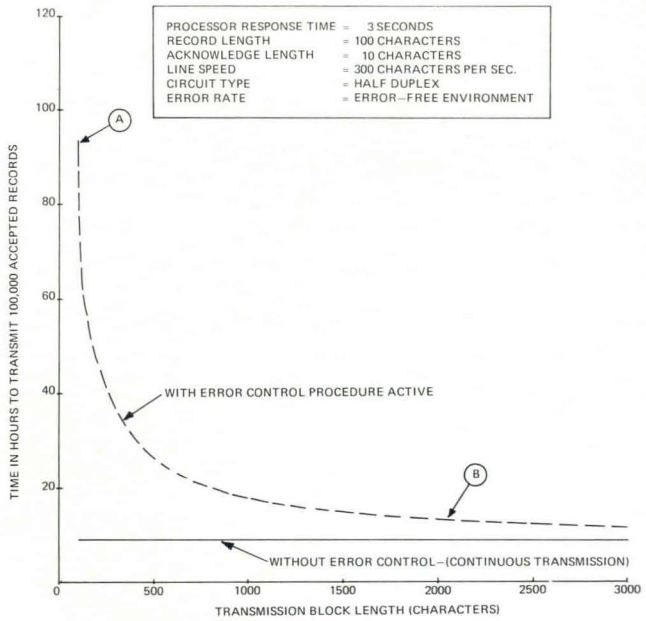

Fig. 3 — Effects of error control procedure.

STEP 5. Steps 1 *through* **4** *are repeated until all the data on the tape is successfully transmitted to the processor.*

THE PERFORMANCE ESTIMATE RESULTS

Simple arithmetic yields maximum performance of the system under ideal conditions, and directs the designer to first approximation values. For example, we know that a 10-character-per-second transmission rate at 100% throughput will require almost 12 days to transmit 100,000 records. Similarly, at 300 characters per second, our minimum transmission time is about 9 hours. These simple calculations are graphed in Fig. 2. To carry the estimate beyond the ideal level it is necessary to analyze the process in detail. The results of this analysis are shown in Fig. 3. The solid line is the 9.3 hour minimum achievable transmission time for a line speed of 300 cps. The dashed line is the calculated time to transmit 100,000 records when an error control procedure is in operation, still assuming, however, that no errors are introduced by the communications network. (This curve is calculated using equations which we shall not elaborate on here.) Point A indicates that approximately 94 hours would be required to transmit the 100,000 records when the records are read from the tape one-at-a-time, each 100-character record is transmitted to the processor, and the system waits to receive an acknowledge from the processor before the next block is read from the tape. It requires 10 times longer to transmit the 100,000 blocks when the error control procedure is active and data is

Before founding his own consulting company, **Saul Stimler** was employed by RCA for 8 years, during which time he was variously Manager of Advanced Systems Analysis in Product Planning, and manager of a time-sharing project having an annual project expenditure rate of $1.6 million. In connection with these tasks, Mr. Stimler developed numerous tests and criteria applicable to time-sharing systems. Since forming Stimler Associates, Mr. Stimler has used that experience to build his company its present reputation as an authoritative source of evaluation data on the performance and cost/performance of all types of EDP systems. He is the author of *Real-Time Data Processing Systems* (McGraw-Hill, 1969), and is presently completing a second book, *Data Processing Systems — A Practical Approach to Their Evaluation and Measurement*, from which this article has been drawn.

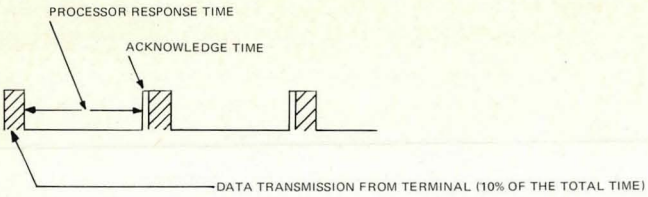

Fig. 4 — Transmission percentage for 100-character blocks.

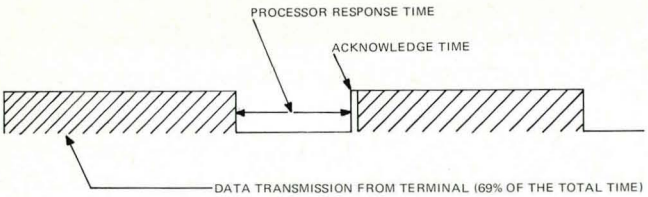

Fig. 5 — Transmission percentage for 2000-character blocks.

transmitted 100 characters at a time than when the data was transmitted as **one continuous block** (the solid line). This suggests using larger block lengths for transmitting the data. Point B indicates that about 13.5 hours are needed to transmit the 100,000 records when 20 records are read from the tape and transmitted as one block of 2000 characters. Thus, increasing the transmission block from 100 to 2000 characters decreases the transmission time from 94 to 13.5 hours. Note that we are still assuming an error-free environment.

Figs. 4 and 5 illustrate why it requires so much longer to transmit the 100,000 records when 100-character transmission blocks are used rather than 2000-character transmission blocks. (Only the response time and acknowledge time components of non-transmission overhead are considered in this example to help concentrate on the method. In practice, other overhead factors, such as line turnaround time, propagation time, and coordination time are also considered.) Fig. 4 indicates that when 100-character blocks are transmitted, the actual time spent in data transmission is only 10% of the total time; 89% of the time is spent waiting for the processor to acknowledge the receipt of the transmission block. Fig. 5 illustrates that when a 2000-character transmission block is used, 69% of the total time is used for transmission of data from the terminal to the processor. Thus, the 2000-character transmission yields about seven times the transmission efficiency as that achieved when the 100-character transmission block was used.

In the real world, however, data transmission is **not** error-free, and Fig. 6 illustrates the effect of communications line errors. The figure again illustrates the relationship between the time to transmit 100,000 blocks and the transmission block length. The dashed curve is for the error-free environment and is identical to the dashed curve in Fig. 3. The lower solid curve graphs the situation when the average error rate is one character in error for every 10,000 characters transmitted. The time to transmit 100,000 records for all practical purposes is the same as in the error-free environment. The upper solid curve graphs the estimated performance when the line error rate is one error in 1000 characters transmitted. The time drops from 106 hours when a 100-character-per-transmission block is used to about 42 hours for the 100,000 records at the minimum transmission time when a 600-character transmission block is used. However, the time does not continue to decrease as in the error-free environment. This is because as block length increases, the time required to retransmit blocks received with errors increases.

The effects of transmission block length, computer response time, and line-introduced errors on the remote job entry system performance have been briefly considered. Line speed is another parameter which may be expected to have a great effect on system performance. For example, we would expect a tripling of line speed to reduce transmission time by two-thirds. However, will we, in fact, triple the transmission efficiency? Fig. 7 illustrates the ratios of times to transmit the 100,000 records when 300 and 900 cps lines are used. The same line error rate is assumed for the two line speeds. The dashed line indicates the theoretical maximum ratio of 3. Using a 100-character block length, the achievable ratio is 1.07 – an increase of only 7% in transmission efficiency – though the line speed is tripled. This is due to the relatively long period of time the system has to wait for the computer to respond relative to the data transmission time. Even for 3000-character transmission blocks, the graph shows the improvement is still considerably below the theoretical 3. (As illustrated in Fig. 4 and 5, the computer response time must be reduced to increase appreciably the transmission efficiencies for transmission block lengths below 3000 characters.)

CLASSIFYING DATA COMMUNICATIONS SYSTEMS

Data communications systems can be classified into three types. The first, illustrated in Fig. 8-a, consists of two bulk data transmission terminal subsystems. The terminal devices may typically be magnetic tape devices, card readers, and/or printers. During actual transmission of data the human operator need not be considered in the estimation of performance. This is the easiest type of data communications system to quantify. Fig. 8-b illustrates a system which consists of a bulk data transmission terminal subsystem transferring data to and receiving data from a processor subsystem. Again, during data transfer, the human is not directly involved. However, the processor subsystem may be servicing other terminal subsystems as well as performing internal processing functions simultaneously with data transfers to the terminal

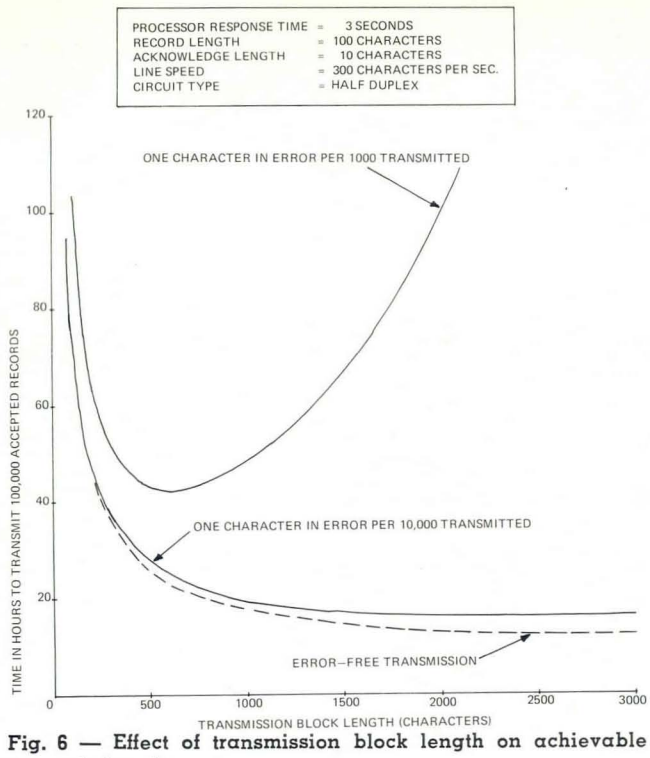

Fig. 6 — Effect of transmission block length on achievable transmission time.

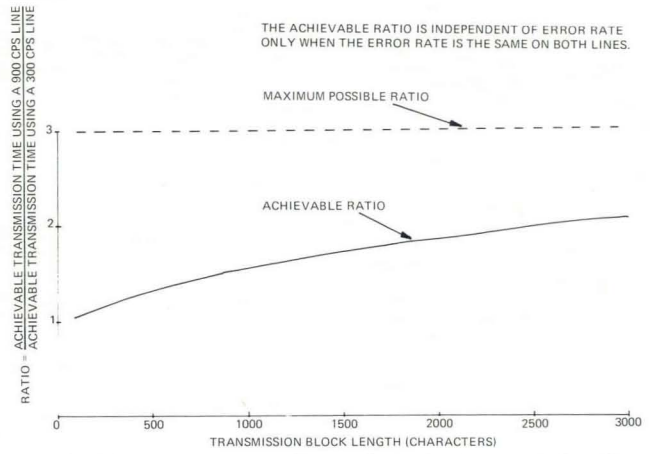

Fig. 7 — Effect of line speed on achievable transmission time.

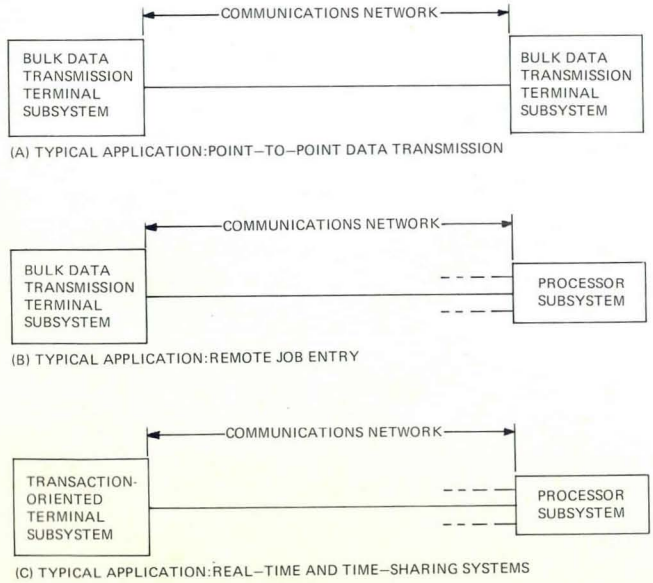

Fig. 8 — Classification of data communications systems for performance estimation purposes.

being analyzed. This is the type of system analyzed in this article. The importance of response time was illustrated in the calculated results described. In a reasonably complex system of this type, the calculation of response time may be non-trivial.

Fig. 8-c illustrates the most difficult class of system, where the data transfer is between a transaction-oriented terminal subsystem and a processor subsystem. A teletypewriter and video data terminal are examples of transaction-oriented terminal devices. With these devices, a human enters a single transaction, usually through a keyboard, and awaits a reply from the processor subsystem before entering the next transaction. The man-machine interface and the functioning of the human may be the critical factors limiting the performance of this type of data communications system.

MEASURES AND METHOD

Two quantitative measures for performance are suggested: The **THROUGHPUT RATE CAPABILITY** of the system, which is the maximum number of records or transactions the system can successfully transfer per hour in an error-free environment and without regard to response time requirements.

The **ACHIEVABLE THROUGHPUT RATE** of the system, which is the maximum number of records or transactions the system can successfully transfer in the expected environment when response time requirements must be met. The effects of errors and failures are included in this measure.

In brief, the performance estimation process requires the analyst to:

1. **Obtain the information needed as input to the analysis.** Generally a functional specification for the system, a hardware (and software, where appropriate) configuration, and a description of the operation usually suffice as input for a performance estimate.
2. **Choose appropriate parameters.** In the example described, the choice of transmission block length as an important parameter may not be nearly as obvious as line speed. Examining the relative effects of performance of the components, as was done in Figs. 4 and 5, is an important way of identifying significant parameters.
3. **Develop a mathematical relationship or simulation model for the system.**
4. **Perform the needed calculations.**
5. **Present the calculated results in a form readily useful to the recipient.**

A NOTE ON RELIABILITY

The words "estimate" rather than "calculate" has been used in this article to indicate that for complex systems, development of numerical values for performance is at best approximate. For systems such as that illustrated in Fig. 8-a, a well-considered estimate with reasonably good input data should give results within 15% of measurable values. Real-time systems of the type illustrated in Fig. 8-c, agreements within 30% may be expected. ▲

ELECTROSTATIC PRINTER\PLOTTERS FOR SMALL SYSTEMS

RONALD LEE, Systems Analyst • Versatec, Inc., Cupertino, Cal.

EDITOR'S NOTE: If you're a small system user happy with your present low-speed teleprinter, higher-speed impact printer, or pen plotter, you can get by without reading this article. But if you're not, or if you're using a combination of these output devices, you owe it to yourself to consider the arguments for an alternative output device that "puts it all together."

The rapid acceptance of the minicomputer in the scientific, process control, and engineering environment has brought with it accompanying problems in the area of systems design. The problems have arisen because – until recently – peripherals were not specifically related to the minicomputer, but were instead adaptations of large-scale system peripherals.

A minimum minicomputer system usually costs in the range of $10,000 to $12,000. However, as the system user begins adding peripherals to enhance performance, a medium-speed system soon results that can end up costing three to four times the original cost of the minicomputer. In addition to the computer, the user usually requires a teleprinter for about $2,000, and, often, a paper tape punch and reader system for another $7,500. Where ordinary teleprinter speeds are unacceptable, a medium-speed impact printer is purchased for $10,000 to $12,000. Then, to provide graphics capability, a small plotter is added for $5,000 to $6,000. As a result, the user's expenditure rises from around $12,000 to approximately $35,000.

Today, new, silent electrostatic printers, plotters, and combination printer/plotters can reduce that cost by approximately $10,000. But even more importantly, they eliminate the system's major bottleneck – the output mode.

BENEFITS

Typically, teleprinters are slow devices which print at rates from 10 to 30 characters per second, or approximately 8 lines per minute. A listing of 300 statements, for example, would require roughly 40 minutes on the average teleprinter. The newer electrostatic printers, capable of printing at 600 lpm, can handle the same task in less than one minute at approximately one-half the cost of impact printers with comparable performance.

There are additional benefits to using non-impact printers in minicomputer systems. One is that, except for the paper transports, they have no moving parts and are therefore three to four times more reliable and less expensive to maintain than the electromechanical devices they replace. Another benefit is that electrostatic devices can provide both character and graphic capability. Previously, a system user had only two choices: he could use his printer to plot low-resolution charts with asterisks or other characters, or he could purchase a high-resolution, fairly fast pen plotter at a cost upwards of $5,000.

Pen plotter speeds are usually referred to in increments per unit time, such as 300 increments per second. If the increment is 10 mils in length, the pen plotter must use considerable on-line CPU time. Similarly, because higher resolution requires

The author of this article, Versatec systems analyst RONALD LEE, is shown here instructing a Hewlett-Packard mini to print-out Teletype-generated data on the Versatec printer/plotter combination at left. In his present position, Lee is responsible for programming and hardware/software interfacing Versatec's complete line of six different hard-copy output devices as well as analyzing customers' system requirements.

shorter increments, speed cannot be increased without sacrificing resolution. Electrostatic printer/plotters, on the other hand, plot with the same degree of accuracy regardless of speed. With these devices, the user usually refers to inches per second of vertical paper speed instead of increments per second, typically producing 560 points across 7¾ inches (72.5 points per inch) or 1,000 points across 10 inches (100 points per inch).

In addition to high resolution, electrostatic devices can provide shading in plots and graphs. This capability can be very important in, for example, a chart describing new product performance, where the use of shaded areas can instantly call attention to performance deviations from plan. Pen plotters can shade charts just as electrostatic devices can, but they take considerably more time. A complex 8½ x 11-inch shaded chart on a conventional pen plotter takes two to four hours typically. The same chart can be produced on an electrostatic plotter in about 8 seconds . . . a considerable time and money savings.

THE PRINCIPLE

One of the reasons for the increased speed and reliability of electrostatic devices is that the electrostatic writing nibs are stationary in the writing head. The paper passes over the writing head; and, on command, the nibs print their individual dots. Writing is accomplished by programming the voltage applied to the nibs, which are addressed in a digital manner according to the output of a computer or other digital device. The conducting nibs produce a charge directly on the surface of a dielectrically coated paper which is subsequently developed by a liquid toner to produce a visible image. Each writing nib, therefore, becomes a specialist in a specific area as dictated by the program, rather than attempting to accomplish the entire task.

SUMMARY

Although combination electrostatic printer/plotters cost more initially than teleprinters, their considerably higher speeds increase system efficiency and lower overall system operating costs. In addition, they offer graphic capabilities which are equal to or superior to those of high-speed pen plotters; decrease system down-time by eliminating the mechanical components and hammers of the impact printer; and are quiet in operation. Summarizing, they provide the small computer system user with a fast, high-quality output device that can eliminate output bottlenecks. ▲

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57	166	**LaConcha** (1, 2, 3, 4, 5)	14—24	14—26	35—52	66—78
37	410	**Marlborough-Blenheim** 1, 2, 3, 4)	14—18	18—30	44—60	
1	93	**St. Charles** (1, 2, 3, 4, 5)	10—16	16—20		
40	325	**Shelburne-Empress** (1, 2, 3, 4)	15—27	18—36	47—72	67—100
52	119	**Sheraton-Deauville** (1, 2, 3, 4, 5)	14—30	16—32	50—100	80—135
3	160	**Sheraton-Seaside** (1, 2, 3, 4, 5)	18—22	22—30	65	95
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25	168	**Jefferson** (1, 2, 5)	12—14	16—18		
21	100	**Richfield-Boscobel** (1, 5)	10—16	14—20		
24	60	**Sterling** (5)	12	14		
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58	60	**Caribe** (4, 5)	16—18	18—24		
17	26	**Carolina Crest** (5)		16—22		
55	38	**Castle Roc** (4, 5)	12	14—20		
14	56	**Catalina** (4, 5)	16—20	20—28		
30	275	**Colony** (1, 2, 3, 4, 5)	14—24	16—28	45—65	75—90
7	50	**Colton Manor** (1, 2, 4, 5)	22—30	24—32		
27	64	**Continental** (4, 5)	10—18	14—24		100
9	34	**Crown** (5)	14—16	16—20		
39	96	**Dennis** (1, 2, 3, 4, 5)		18—36		
49	61	**Diplomat** (4, 5)	14—16	16—22	42—46	
51	35	**Dunes** (4, 5)	14—18	16—22		
33	57	**Eastbourne** (4, 5)	16—18	20—22		
48	25	**Eldorado** (5)		16—20		
20	45	**Envoy** (5)	18	20—22		
19	72	**Fiesta** (1,4,5,)	20	22	50	
44	115	**Four Seasons** (3, 4, 5)	16—20	18—28		
50	64	**Galaxie** (4, 5)	12—16	14—18		
42	333	**Howard Johnson's** (1, 2, 3, 4, 5)	18—22	22—38	52—76	114
13	225	**LaFayette** (1, 2, 3, 4, 5)	12—22	14—30	40—85	90—120
64	38	**Lincoln Roosevelt Beach** (4, 5)	18	22—24		
23	247	**Lombardy** (1, 3, 4, 5)	12—24	15—33		
60	72	**Malibu** (4, 5)	9—21	12—24		
56	27	**Mardi Gras** (4, 5)	14	16—20	30	
36	88	**Marlborough-Blenheim** (1, 2, 3, 4)	27—29	56		
45	120	**Pageant** (1, 2, 3, 4, 5)	14—24	16—28		
63	137	**President** (1, 2, 3, 4, 5)	14—24	18—36		
35	152	**Quality Motel-Mt. Royal** (1, 3, 4, 5)	12—24	15—33		
11	250	**Ramada** (1, 2, 4, 5)	14—28	16—38	85—125	150
2	44	**St. Moritz** (5)		18—20		
41	266	**Shelburne-Empress** (1, 2, 3, 4, 5)	15—27	18—36	47—72	67—100
53	241	**Sheraton-Deauville & Sheraton Deauville West** (1, 2, 3, 4, 5)	16—32	18—34	100	135
4	140	**Sheraton-Seaside** (1, 2, 3, 4, 5)	20—24	22—30	65	95
26	78	**Sorrento** (4, 5)	12—14	12—18		
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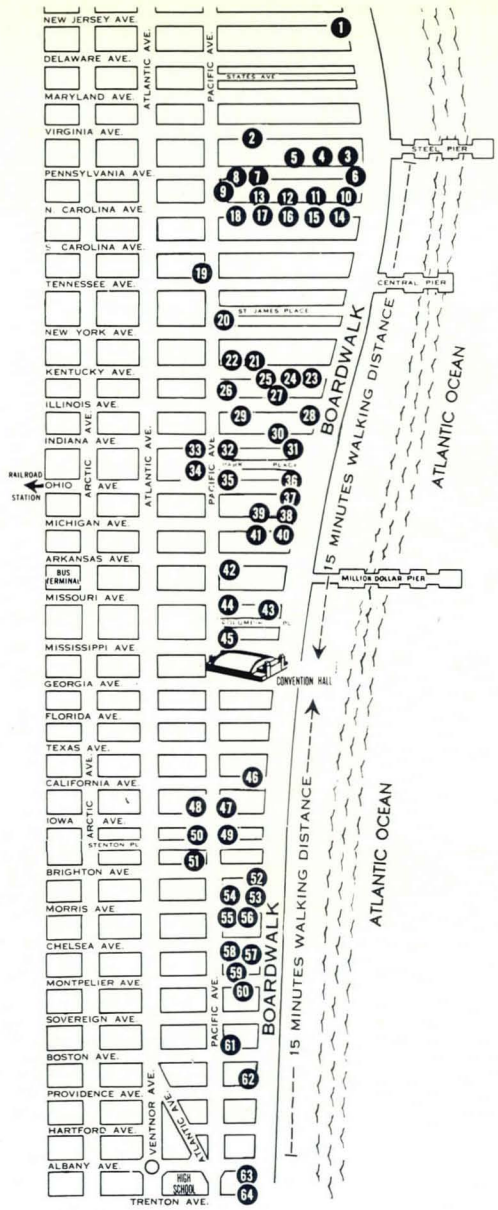

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THE COOKBOOK APPROACH TO CORE MEMORY EXPANSION

EUGENE S. TIMLIN, Core Memory Product Mgr. • Ampex Corp., Culver City, Cal.

A whole grocery store of extended core storage equipment is presently available from independent system suppliers. By selectively combining such ingredients as capacities, cycle times, bandwidths, and prices, the user can put together a recipe that best meets his system's requirements and his own tastes.

The EDP manager who wishes to expand his installation to accommodate more business generally has three alternatives:

Alternative 1 — Install an additional computer to assist his present system;

Alternative 2 — Replace his system with a newer, more powerful computer;

Alternative 3 — Add more on-line peripheral storage to his present system.

These alternatives have generally been too rigid to meet the needs of many installations, particularly those involved in time-sharing or multi-programming operations. An additional computer may provide the desired throughput, but at sharply increased overhead. Replacing the computer with a more powerful system will certainly increase processing capability, but again at sharply increased cost. Added periphral storage, such as disks or drums, brings more capacity but seldom higher speed, and rarely economy.

What should be a time of new promise becomes a time of new problems. These limited alternatives were a fact of life that the user had to accept. Now, however, there is a fourth alternative, that of uniquely specified extended core storage.

Extended core storage equipment, produced by independent memory system suppliers and plug-to-plug compatible with many major computer systems, has become so versatile in capacities, cycle times, memory bandwidths, modularity, and pricing that the user now has at his disposal a virtual "cookbook" for expanding his core storage and perhaps optimizing his overall system. For the first time the user can configure his core storage exactly as he wishes it to be — without compromises. In addition, extended core storage equipment is generally available below the purchase or lease price of corresponding memory systems from the original mainframe supplier.

With the cookbook approach, a user can combine hardware features to achieve the optimum combination of cost, speed, capacity, and word length best suited to his overall system's application. Blending the various ingredients, the user can make additional core storage totally consistent with the mainframe memory of his computer (if desired) or, if better suited to his application, he can buy slower, more economical core storage.

WHAT IS AVAILABLE?

Many of the independent memory system suppliers are specialists in core memory and have been producing systems for many years.

Memory cycle speeds offered range from 500 nsec to 3 usec. The most popular systems at the moment are in the 1-2 usec area.

Memory capacities range from very small buffers of 1024 words to 2 megabyte mass memories. Here the most popular are in the 32K to 128K words range.

Features available are generally customized to fit the particular mainfrane, and system requirements of the user. Among these are multi-port access, switchable block addressing, two- or four-way interleaving, multiple banks of memory with common multi-port access, field expandability, and various maintenance aids.

NEW OPTIONS, NEW PATHS

For the EDP manager, problems no longer need be cut-and-dried. With new options available, new paths are being taken, as the following case studies illustrate.

• An EDP manager has a processor with an addressing capability of 256K words and which operates asynchronously with its memory bus. To expand his system, he buys a new processor from the mainframe supplier (he now has a multi-processor system) and decides upon memories with two-port access (shared by both processors). He selects 16K words of fast memory (0.65 usec) and two 32K blocks of slower, more economical (1.50 usec) memory with two-way interleaving. He specifies that the systems be expandable and have switchable block addressing.

He has now upgraded to a multi-processor installation with 96K of shared memory which operates effectively at mainframe speed. By specifying the switchable block addressing, he may in future expand any of the systems as his budget permits and his need increases, and relocate the banks of memory.

In this case, the EDP manager needed additional memory capacity and was willing to allow a slight reduction in speed to gain a substantial reduction (50%) in cost. Had he not wished to allow any reduction in speed (or even wished to gain speed), he could have specified a 1.0 usec system (or a 750 nsec system) from an independent supplier and still achieved his goal of inireased capacity with economy.

• A user has a 1-microsecond mainframe system that accepts only 36-bit words. He wants to expand the present system to handle more terminals. His original mainframe supplier recommends adding a 1-microsecond core storage unit with a word length of 36 bits (the extended memory that "goes with" the system). This means greater capacity, but with the added price of a large 1-microsecond core memory.

Let us say the user instead specifies his unique memory system from a range of characteristics offered by independently-produced core storage units. The unit he obtains is a custom blend of parameters. Its word length is 72 bits, twice that of his mainframe. Also, it has a slower cycle time — 2 microseconds.

Every 2 microseconds, a 72-bit word is transferred from the added memory to the 36-bit central processor. Because of the flexibility of the hardware components, the system is organized so that half of the 72-bit word is accepted by the processor every microsecond. The processor is still on a 36-bit, 1-microsecond routine.

Thus, the user receives, in effect, 1-microsecond performance from a 2-microsecond core memory. Yet he realizes monthly savings by having a 2-microsecond memory rather than a 1-microsecond unit.

INTERLEAVING

Another path open to the EDP manager who seeks to increase effective speed is interleaving. Consider the following examples.

• The user has a mainframe memory with a cycle time of 750 nanoseconds. It is an 8-byte-word memory. Instead of specifying a fast (and expensive) memory for his secondary on-line stor-

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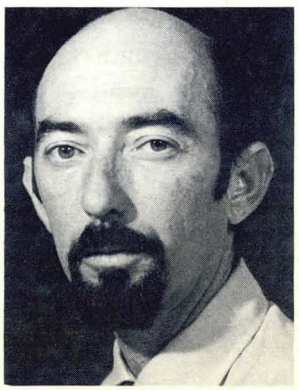
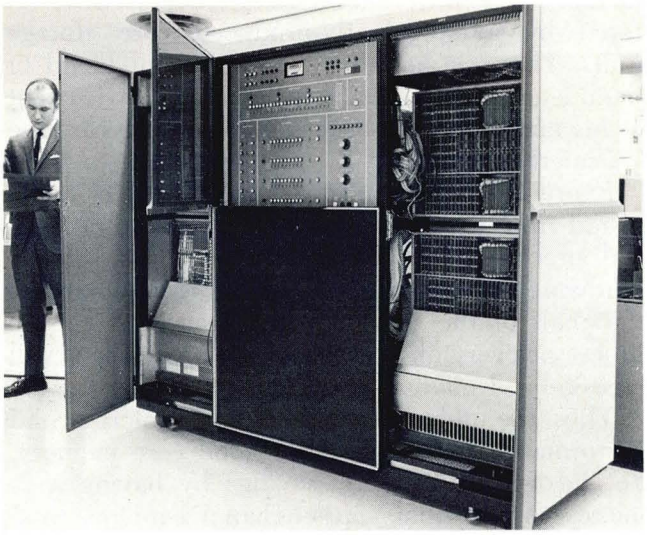


age, he configures his own system independently.

The result is four relatively slow core memories. From each of the core memories, an 8-byte word is fed at one time to the mainframe memory, which accepts it in two steps. Thus, 32 bytes are being transferred from the secondary core memories to the fast mainframe memory in each operation. Because these slow bulks are interleaved, the central processor sees the entire core memory capacity as being mainframe memory – at the speed of the mainframe memory. Similarly, by proper interleaving, two 4-microsecond memories can be made to produce the effect of one large 2-microsecond memory.



An Ampex extended core memory (ECM) is checked out by Dialog Computing, Inc., Fairfield, Conn. Dialog, a major time-sharing company, uses this and similar Ampex units with IBM System 360/50 and 65 processors. Cycle times of Ampex ECMs, numbered for the 360 models they serve, are 4.0 microseconds (ECM-50) and from 2.8 to 2.0 ms (ECM-65 and 75). ECM lease rates are approximately $6,700 (replacing IBM 2361-1) and $11,400 (replacing IBM 2361-2). One of the first companies to add independent core memory to 360s, Dialog installed its first Ampex ECM in late 1969.

The possibilities of interleaving are not trade secrets. EDP managers are generally aware of the efficiencies – and economies – which slow bulk core storage with interleaving can bring to the sequential operations of a time-sharing system. But until now, most EDP managers have been unable to configure their own memory systems to provide for the exact type of interleaving they want. Now they can rescue their central processors from nearly full-time page-swapping chores and free them to do the job for which the user is paying: processing data.

• An EDP manager in a time-sharing installation had reached system saturation. He had fully expanded his system's core up to the 128K of high-speed core which was the maximum his processor could address. His system was bogged down by page-swapping chores. He knew of the advantages to be gained by using bulk core as the swapping device instead of a drum, but his mainframe manufacturer did not supply bulk core. By going to an independent that had economical bulk core available and by specifying an interface that was compatible with his system I/O processor, he replaced the drum with core at a very small increase in system cost (about 10%), and bettered his system response time and performance by an estimated three times.

Few mainframe manufacturers offer such core memory interleaving capability with standard computer systems. However, they can now be purchased through the independents.

To the user who considers going to one of these newer systems primarily to achieve a faster throughput, there are often more economical avenues open.

• A user has a 360/50 and wants to put in more terminals. From some quarters he may hear that what he really needs is a new installation – another 50 or a more powerful processor (perhaps a 65). Other advice may be to expand the present CPU (50) with an additional million-byte 2361 large core store unit.

"Going independent" is a third option. By doing so, the user may expand the 50 with an extended core memory that equals the 8-microsecond 2361 in capacity, but which operates at a cycle time of 4 microseconds. With such an addition, he is in effect obtaining two increments of expansion for the (reduced) price of one more memory. With the 2361, he would have added a million bytes of throughput; with the independent memory, he is adding 2 million bytes of throughput in the same time period because it operates at twice the speed. More terminals can now be added, busy signals will decrease due to faster throughput, and the time-sharing service can be expanded without the costly step of installing another computer.

The number of subscribers that may be added as a result of the right configurations of independent memory units can be rather dramatic. A computer system that is limited to seven terminals, for example, can be expanded to accommodate 16 or more terminals with the proper alignment of additional on-line core storage. In view of present and near-future branching capabilities using teleprinters and data-phone lines, the additional terminals might mean one or two hundred new subscribers.

CONSIDERATIONS

To the EDP manager, it might be said: In exercising the new freedom of configuring your ideal memory system, remember the prime considerations that will determine your success.

Cost—Independently produced memory systems, as mentioned earlier, are available at purchase and lease prices below those of original mainframe computer suppliers. But this may not be true with **all** independent suppliers. Know what the costs are and what they include.

Size—Choose hardware that is modular-expandable. In this way, you pay for only that added capacity you need now, yet will be able to add capacity to the memory as your need increases.

Speed—Evaluate speed/size tradeoffs thoroughly. Where greater speed is recommended as providing advantages, make sure those advantages are clear-cut (as in examples cited earlier). Also, remember that core memories of relatively slow speed may be used effectively and economically with interleaving. The key is the variety of tradeoffs which the independent memory supplier has available. Inspect them all.

Reliability—Providing extended core memories for successful plug-to-plug, on-line operation with such computers as the IBM 360, DEC PDP-10, Sigma 7, Univac 1108, and others is not an easy game that anyone can play. Be sure the supplier has demonstrated capability in designing and producing plug-to-plug compatible memory systems. Insist on customer references. In addition, seek memory systems of modular design. If a 256,000-word wired-together memory has one failure, all 256,000 words of memory capacity are unusable until the failure is corrected. If a 32,000-word memory module has a failure, it is simply removed and switched out so the central processor can relocate addresses elsewhere; the remaining memory is still "up."

Service—Consider the reputation and resources of the supplier company carefully. Talk to people at the supplier's prior installations. Investigate warranty, service facilities, and maintenance contracts.

Hardware flexibility in expanding core storage means the time-sharing manager is no longer bound to the recommendations of his mainframe computer supplier. Given a sufficient range of ingredients by the independent memory supplier, he can use the cookbook approach to formulate much of his operation's future productivity and profit. ▲

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SOURCE DATA AUTOMATION IN MANUFACTURING—PROSPECTS FOR PROFIT

Your data collection system should be as up-to-date as your third-generation computer.

In the executive's own words, he "may not know much about computers, but he knows what he wants." As EDP manager, it's your responsibility to:

1. listen to his needs;

2. educate him generally as to what the EDP system does, or can be made to do, and finally;

3. try to make your system responsive to management's information requirements.

An increasing number of companies have decided that, in order to get more effective EDP use, they must apply the power of these systems to their manufacturing environment. Here is probably the greatest area of potential profit improvement. In fact, it seems to me that within a few years almost every large- and medium-sized firm will control its inventories and run its factories using computer-generated reports with data automatically collected from the operating areas.

Source data acquisition promises better utilization of your data processing power than traditional manual key-punching and data preparation. Instead of having to report that the computer center is "busy," some EDP managers are now walking into the front office with accurate, timely printouts of information upon which basic business decisions can be made. When you can tell the general manager what yesterday's payroll, inventory, production, true accounting cost, and scrap figures were the next morning, he may ask you to stay for coffee and your merit review!

Obviously, automating data collection at the source is not simple or necessarily feasible. Even feasibility does not equal justification. The first thing to consider is whether automatic data collection can be accomplished without overburdening or creating a major unheaval in your present system. It is imperative, for instance, that a working manual system for collecting data be in use now in your production operations. If none exists, you'll wind up a dead hero trying both to methodize and mechanize such a system. Instead, you must ask that your general manager set his own standards, develop methods of operation, and put them into use. Then you will add automated data collection to what he has already created. Along the way, you both should agree that (**1**) **you** won't tell him what data to collect, and (**2**) **he** won't tell you how to do it. It's an honest, intelligent, and justified division of responsibility.

KEY TO SUCCESS

The key to successful use of any computer – your third-generation model or someone else's time-sharing job – is to distinguish between the tasks that computers do best and the tasks that people

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do best. One manager suggests the acronym, TAPE, to recall the necessary ingredients for any successful computer project:

Technically sound

Administratively convenient

Politically defensible

Economically justified.

All right, let's apply TAPE to your proposal to automate data collection at the source in your plant.

TECHNICALLY SOUND — A data collection system should enable the user to exploit fully the capability of the latest third-generation computers by combining simple basic modules with a discipline that insures the most timely, accurate, reliable, error-free entry transmission and accumulation of data. This can be accomplished by collecting data at its source and eliminating the manual handling of the data.

ADMINISTRATIVELY CONVENIENT — The system should minimize the manual handling of data by reducing the number of timekeepers and handwritten forms, and by simplifying or eliminating the processes of form distribution and collection, keypunching, and verifying. And the results — the final printed-out reports from data collection — should be so programmed that they flag management's attention for action, rather than producing the usual reams of information.

POLITICALLY DEFENSIBLE — Any information system that permits management to report faster, more economically, and more accurately in real-time should benefit the user and give force to his judgements. On-line, such a system would permit management to improve production and, subsequently, corporate profits. How can management — and therefore you — lose under this system?

ECONOMICALLY JUSTIFIED — Improved profitability should be the main justification for installing any data collection system. This project should be evaluated in terms of its own economic impact. The argument that benefits will not be derived until a large group of interacting projects has been completed is hazardous. If an individual project cannot be justified by itself, there is a good chance that the project is premature or that it should be redefined in some other way . . . or that it should not be attempted at all.

ORGANIZATION

How can you organize and run a study for data collection successfully? The following steps seem most logical to me.

1. Organize a task force and be sure to include all affected parties. Ask for and let them contribute their own ideas. Make sure that the task force is headed by a P.M., meaning **P**rime **M**over, possibly even the president of the company.

2. Hold short but frequent meetings. Listen to what the people attending have to say because "a need is but a coarse, justifiable want." Suggestions should be analyzed for their profit potential.

3. Pick out a specific area for your data collection system and guarantee its success.

The purpose of installing modern data collection systems is to assure that the system inputs are both timely and accurate. Recognizing that computers will only operate on data supplied, it is necessary that usable manufacturing input data be fed regularly into the computer system. In most cases, the computer EDP center can be utilized to supply daily action reports for production supervisors on the priority items requiring their attention. This information alone should significantly improve the quality of their performance and the flow of material through the production area.

BENEFITS

One of the unique fringe benefits from the installation of a data collection system in a manufacturing environment is its ability to instill a discipline of operation. Now this does not mean to say that it can mechanize something that does not already exist. Every company has some sort of information system. Some are good, some are bad, and some involve nothing more than communication between foreman and supervisors. The best data collection system that can be installed is

one that allows a successful company to continue its internal *modus operandi* and will not force the company to conform to a piece of hardware. Many computer equipment manufacturers design generalized systems which require the customer to modify his operational procedures. It would be far better to have a system customized for his particular needs.

Any factory data collection system must provide sufficient information so that the EDP system can report desired cost analysis, payroll, quality control, manpower loading, machine loading, inventory status, and other production facts. The idea is to minimize the amount of manual effort required by the people operating the input data collection equipment.

The design of an advanced automatic data collection system must emphasize accuracy, simplicity, modularity, flexibility, and reliability. Maximum use should be made of integrated circuitry; not only in implementing digital logic, but in communications circuits as well. Newer design approaches to data collection use a general-purpose minicomputer in the central station, communication with internal modems over telephone lines or their equivalent, and numeric keyboards for variable data with operator visual verification. Fixed data inputs are obtained from a Hollerith card reader, and each terminal should be provided with a printer such that a terminal operator has a hard copy of the variable and other data that the central station may choose to send to that location.

COST PARAMETERS

Some of the cost parameters of a data collection system are:

• **Equipment Costs** – Besides the cost of purchasing or leasing the equipment, you should include the total cost of all the hardware necessary, such as whatever peripheral output requirements are needed to input to your existing system. For example, if your system were a 360/30 with only disk file and card inputs, and the data collection system offered did not have a card output or a means of providing a disk file, you must include the cost of modifying your equipment or obtaining additional peripherals. In trying to develop a comparison for the cost of the hardware involved, it would be wise to list all the direct and indirect equipment necessary for the implementation of a data collection system and then to divide by the number of anticipated stations to get a cost-per-input station for the total system.

• **Communication Costs** – These costs comprise the cost of leasing telephone lines, data sets, modems, etc., or possibly even the personnel time involved in physically transferring data reports from one point to another. Communication costs become quite significant when private lines are leased for individual terminals at remote locations.

• **Installation Costs** – Consider them carefully. In most cases it will be more economical to have your plant engineering department or telephone service personnel install the necessary wiring. It is a very efficient work filler for the plant engineering department because usually the installation time can be spread over several months. Also consider the mobility and weight of the equipment for immediate and future use. How easily can it be carried by a single person? Does it require forklift trucks in moving? What is involved in moving the equipment to a different physical location? Can it be done without the supplier aiding?

• **Maintenance Costs** – Look at the total maintenance cost for all the remote terminals and central station equipment involved. You also must consider the manpower necessary for repacking and shipping equipment to be returned to vendor.

• **Cost of Expansion** – This is one of the most critical factors and one of the hardest to quantify. Do you expect your company to expand? Do you expect your data base to expand? How can you be assured that your system will not be made obsolete by the company's growth? It is important that the system you are planning to purchase or lease have built-in expandability, not only in the number of terminals and input stations, but in its terminal configuration. Will you or the vendor perform the expansion – and at what cost?

• **Training Costs** – How many people are going to use the terminals? Does it take ten hours or ten minutes to become proficient in their use? What cost does this represent?

• **Programming Costs** – Suppose a terminal is to be relocated into a different factory area. How much time would it take to reprogram the central computer? Two hours or twenty? These costs must be taken into account.

A WORD OF ADVICE

Beware of the fallacy committed by many EDP managers. They are proud of the fact that they have third-generation computing systems, but they are still using prehistoric data collection systems. ***It is important that your data collection system be at least as up-to-date in design and operational concept as your third-generation computer.*** ▲

To pick the right data modem, pick the right modem company.

If finding the right data modem were as simple as flipping through a Sears catalog, you'd have little cause for concern.

Frankly, it isn't.

All kinds of people make data modems, so you have quite a variety of modems from which to choose. And all kinds of problems come up if your choice happens to be the wrong one. But not necessarily because of the data modem.

The moment of truth isn't at hand until a data modem is hooked-up to the telephone line. Even then, just because it operates, there's no guarantee you will get optimum throughput, making the most efficient use of the telephone line.

And when it comes to money, you can spend too much for modems—or sometimes—not enough.

So with all this in mind, how do you go about picking the right data modem?

You have to choose a combination of cost, performance and supplier capability that adds up to the best overall value.

Which bring us, United Business Communications, into the picture.

Whether you're an OEM or an end-user, UBC can help you determine your data transmission needs. Then we'll show you how to meet them with a degree of value, performance and support capability that, we believe, sets us apart in the data modem field.

UBC, with our wholly-owned subsidiary company, Rixon Electronics, is a stable, continuous source of thoroughly tested, low maintenance, quality data modems ranging from 1800 to 9600 bps. Modems with features such as built-in diagnostics that enable even non-technical people to isolate and correct a transmission problem in a matter of minutes.

Data modems that you can purchase, lease or rent depending on your needs.

The expertise and experience of UBC data engineers insure the best possible applications of UBC data products to your most demanding requirements.

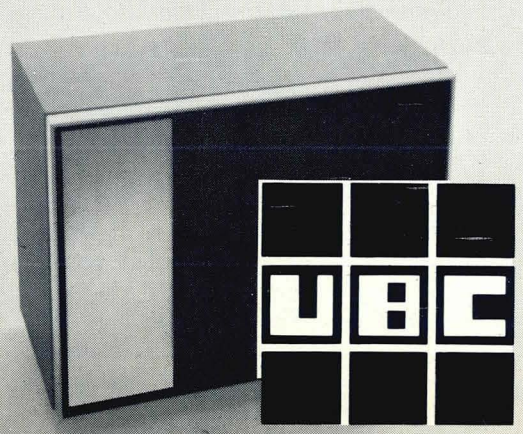
Another important fact. Our support capability is enhanced by strategically located sales and service offices staffed with knowledgeable, factory-trained, full-time people. People who provide timely assistance in the application, installation, testing and maintenance of UBC data modems. There is no subcontracting of this important work.

Consider, too, UBC's communications background.

Most of our people have high-level communications expertise. And, our parent, United Utilities, Incorporated, operates the nation's third largest telephone system. So, we do know quite a bit about telephone lines.

If all this doesn't convince you that UBC is a logical choice to supply your data modem needs, write us and we'll tell you more. We'll also send you our *free telephone line conditioning guide,* a handy tool whether you buy from us or not.

Write: General Sales Manager, United Business Communications, Inc., Dept. MD-7-4, 6405 Metcalf Ave., Shawnee Mission, Ks. 66202. Telephone (913) 362-5300.



United Business Communications, Inc.

Subsidiary of United Utilities, Incorporated

Sales and service offices in: Atlanta / Burlington, Mass. (Boston) / Chicago / Dallas / Kansas City / Los Angeles / New Haven, Conn. (New York) / Pittsburgh / Silver Spring, Md.

NEW PRODUCTS

REMOTE BATCH SYSTEMS

The UT-1000 remote batch communications terminal is capable of providing tabulations and special print-outs as a remote off-line system, and of acting as a programmable data communications terminal for a larger computer system. The basic configuration is comprised of a processor, card reader and printer; expansion offers CRTs, disk storage, key-to-tape, and store-and-forward message switching equipment. All systems are supported by software, maintenance, and leasing services. *Computer Terminals of Minn., Minneapolis, Minn.*

Circle No. 326 on Inquiry Card.

POINT-OF-SALE SYSTEM

Transaction Systems has introduced a retail register system that may operate in both on- and off-line environments. The Transaction Register System employs a magnetic data wand sensor to read sales tags, credit cards, ID badges, and transaction procedure labels to effect data verification and entry. The register performs all computations, checks the data, instructs and controls clerks, prints sales-checks, sends data to a processor. *Transaction Systems, Palo Alto, Cal.*

Circle No. 337 on Inquiry Card.

IBM-COMPATIBLE MAG TAPE SYSTEMS

TI has introduced a family of IBM S/360 & S/370 plug-to-plug compatible magnetic tape drives and controllers. The 934/9803 Magnetic Tape Subsystem is designed for high reliability and operator convenience, and offers lease savings as much as 20% over comparable subsystems. *Texas Instruments, Houston, Texas*

Circle No. 354 on Inquiry Card.

MODEM

IXI has introduced a bit pattern insensitive 4800 bps modem, the 248A. The modem offers manual loopback for fast fault isolation, and manual equalization that may be performed by non-technical personnel. *Information Exchange Systems, Minneapolis, Minn.*

Circle No. 340 on Inquiry Card.

PRINTOUT STORAGE

National Blank Book has introduced a line of six compatible, modular storage racks for computer printout filing and storage. *National Blank Book Inc., Holyoke, Mass.*

Circle No. 339 on Inquiry Card.

BUSINESS SYSTEMS

The Commander 500 and 1000 systems are equipment configurations which may be tailored to retail, hotel, health, legal, or light industrial applications by means of a proprietary software technique. The systems can be operated by unskilled workers, all communications being in English and machine-directed. *Mobydata, Utica, New York.*

Circle No. 338 on Inquiry Card.

PORTABLE DATA TERMINAL

The PD-1001 system consists of a portable, battery operated digital data recorder, a data transmitter, and a receiver interface for a printer or off-line computer compatible tape transport. Alphanumeric data is entered via a 16-key keyboard, and recorded on a tape cassette for future transmission (via transmitter and telephone hook-up) to a computer central office. *Digital Technology, Halesite, New York.*

Circle No. 330 on Inquiry Card.

NAKED-MINI

The Naked-Mini is a complete, tested minicomputer stripped of its power supply, console, and metal chassis. This lowers cost and gives the OEM engineer more freedom in product design. The $1700 price includes a 4K core memory and a fully parallel computer, assembled into 15x15-inch modules bolted together into one integral functional unit. Operationally, the Naked-Mini computers are identical to CA's existing Models 116, 216, 108, 208, and 808, which contain such standard features as hardware multiply/divide, direct memory channels, automatic memory scan, block load and dump, and vectored hardware priority interrupts. I/O structure, instruction sets, software, options, and peripheral controllers are the same, and the Naked-Mini carries the same one year factory warranty. *Computer Automation, Newport Beach, Cal.*

Circle No. 320 on Inquiry Card.

MINI INPUT/OUTPUT KEYPUNCH

Model 403 Vari-Punch punches standard tab cards or sets from signals generated by cable-connected equipment, such as badge/card readers, time clocks, I/O typewriters, scales, voltmeters, testing equipment, medical instrumentation, etc., and from its integral keyboard. It can also control other devices, such as adding machines, through self-generated output signals. All control functions including tab (skip), space, hold, and return may be actuated from remote signals. Alpha and numeric data in up to four hole combinations are punched at twelve characters per second. *Varifab, Inc., Old Greenwich, Conn.*

Circle No. 323 on Inquiry Card.

NEW PRODUCTS

TV VISUAL DISPLAY

The TeleComputer converts, by simple clip lead attachment to the antenna terminals, any standard TV set into a full service I/O visual display terminal. The unit can generate a 64 alphanumeric character set on a 32-character by 8-line field. The built-in acoustic coupler and keyboard fit into any briefcase, and assure operation anywhere a telephone and TV receiver are available. OEM price is $650. *Digi-Log Systems, Conshohocken, Pa.*

Circle No. 335 on Inquiry Card.

DATA ENTRY TERMINALS

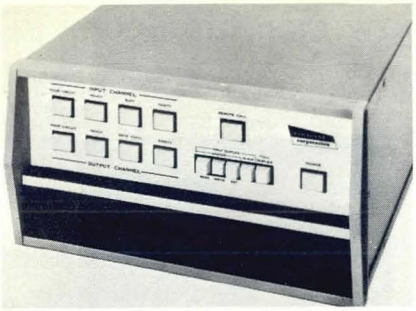
Data Pathing has introduced new additions to the 1300 series of source data entry input/output terminals used with its MIS systems. The terminals utilize alphanumeric keyboards and ID badge readers to input data, have a 16-digit alphanumeric display, and use a blacklighted 18-position procedure mask to instruct and control the operator. The terminals may operate up to 12,000 feet from the processor, with long-line options of up to 100 miles. *Data Pathing, Sunnyvale, Cal.*

Circle No. 341 on Inquiry Card.

CRT-TO-DISK

The 480 is a CRT-to-disk data entry and verification system, capable of controlling up to 64 CRT keystations and of providing computer-compatible magnetic tape output. Data is inputed by the operator via a job format shown on the 480-character display; verification may be visual or keyed. The 480 checks format, batch totals, and upper and lower limits automatically as each field is entered. Rentals range from $2,749/mo for a 16-station system, to $4,998/mo for a 32-station operation. *Entrex, Lexington, Mass.*

Circle No. 342 on Inquiry Card.



PARALLEL INTERFACE EXTENDER SYSTEM

Paradyne has introduced a 600 byte/sec, parallel interface extender system to aid the CPU in communications tasks. Designated the PIX-600, the system combines a modem, an error control system, and an I/O channel interface to eliminate the need for high-speed modems, data set adaptors, communications controllers, remote terminal processors, and special communications software from the CPU communications environment. The PIX-600 guarantees that the user will be freed from the need to interact with or control communications functions. Error control and sync logic within the PIX provide for automatic communications error detection and data retransmission; the CPU does not have to manage communications functions, error control protocol, and retransmission overhead. *Paradyne Corp., Clearwater, Fla.*

Circle No. 343 on Inquiry Card.

CRT TERMINAL SYSTEM

The Entelekon CRT terminal is designed for high-reliability, 24-hour supervisory control system operation. The terminal is a direct replacement for the IBM 2848/2260 and 2845/2265 CRT systems, and may directly operate at 250,000 characters/sec or over communications lines at 110 to 4800 baud. An internal random access IC memory allows the computer to randomly position the cursor just by transmitting screen coordinates, and, conversely, to read the cursor position—a feature of special interest in control and multi-screening applications. Prices start at $4.295, with quantity discounts available. *Texas Scientific, Houston, Texas*

Circle No. 325 on Inquiry Card.

COMPUTER CHANNEL SIMULATOR

A line of computer I/O channel simulators for testing plug-to-plug compatible devices has been released by Sierra Data Systems. The computer-controlled system exercises an I/O channel, in a manner identical to the system being matched, by the use of hardware interfaces and software packages. Present configurations simulate IBM S/360 and 370 MPX and SEL channels, the 1108 I/O channel, 2- or 4-wire phone line IBM 2701/2703 communications channels, and the Univac CTM protocol. Simulator system prices start at $18,100. *Sierra Data Systems, South Pasadena, Cal.*

Circle No. 327 on Inquiry Card.

CDC 700 SERIES TERMINALS

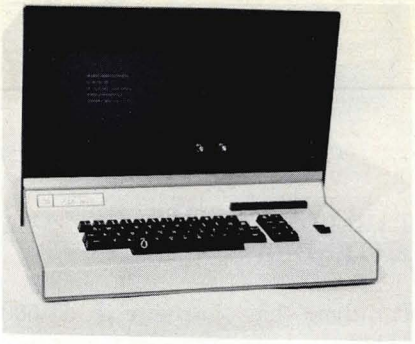
CDC has announced the first three products in its 700 Series—the 711 single-station CRT; the 712 terminal printer; and the 713 time-sharing terminal. The CRT displays eight 80-character lines on a 15-inch screen, and can transmit up to 4800 bps in half-duplex synchronous mode. The 712 prints a 64-character ANSI alphanumeric set on a 132 column carriage at a rate of 30 cps. The time-sharing CRT terminal displays a 96 ANSI character set on a 15-inch display, and has asynchronous data rates of 75, 110, 150, and 300 bps. *Control Data, Terminal Equipment Div., St. Paul, Minn.*

Circle No. 324 on Inquiry Card.

CORE MEGAMEMORY

The Megamemory 1000 is a flexible, 2-wire, 2-1/2D core memory system that has an access time of 850 nanosec and storage capacities ranging from 33K words (32 to 160 bits/word) to 524K words (8 to 14 bits/word). Other features include a 1.5 microsec cycle time, power failure and over temperature protective circuitry, pluggable power supply module, and nonvolatile start-up. *Electronic Memories, Hawthorne, Cal.*

Circle No. 328 on Inquiry Card.



TTY-REPLACEABLE VIDEO TERMINAL

The Elite 2000 is an interactive, alphanumeric CRT display terminal capable of displaying 12, 18, or 24 80-character lines per frame. Operator modes include page mode, roll mode, and transmit line mode. Speed of operation is preset to an 1800 bps maximum with operator selection of half- or full-duplex operation. In its minimum configuration, the 2000 is plug-to-plug compatible with a TTY, and sells for less than $2,000 in quantities of 25. *Datamedia, Blackwood, N.J.*

Circle No. 329 on Inquiry Card.

PAPER-TO-MAG TAPE CONVERTER

The VertaTape converter allows for off-line conversion of 5, 6, 7, or 8 channel paper tape to 64-character, 7- or 9-track mag tape. Tape input is 500 cps and output density may be 200, 556, or 800 bpi for 7-track tape, or 800 bpi for 9-track tape. *Datascan, Clifton, N.J.*

Circle No. 334 on Inquiry Card.

24-BIT MINICOMPUTER

The 6024/5 is a 24-bit, planar core minicomputer having a cycle time of 1.2 microsec and a basic 4K memory, expandable in 4K increments of 32K. The 6024/5 is software and peripheral compatible with the 6024/1 and 6024/3 minicomputers. *Datacraft, Ft. Lauderdale, Fla.*

Circle No. 322 on Inquiry Card.

TIME-SHARING COMPUTER

The Tenet 210 is a medium-scale, interactive time-sharing computer designed to handle from 32 to 128 simultaneous, on-line users. The ultimate system, which can handle 500 users, comprises multiple CPUs, a million-byte core memory and 8 million-byte semiconductor memory, and has a billion-byte disk memory capacity. Software is available, written in Basic and/or Fortran-IV, with Editor, MetaAssembler, Loader, Debug, Mathematical Library, and Test Diagnostics offered. *Tenet Inc., Sunnyvale, Cal.*

Circle No. 336 on Inquiry Card.

S/360 SIMULATOR

The Model 531107 S/360 Simulator allows manufacturers of S/360 compatible peripherals to decrease their costs of testing. The simulator is programmable, and is capable of providing responses, timing, and control for bi-directional communications in the same manner as an IBM S/360 Selector or Multiplex Channel. Slight, in-the-field, modifications can provide responses comparable to the IBM 2700 series. Cost is $22,500 with a 60 day delivery. *Datawest, Scottsdale, Ariz.*

Circle No. 331 on Inquiry Card.

SDA TERMINAL

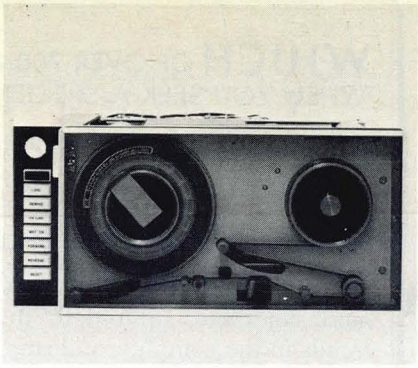
The Sorcerer source data collection terminal may be used in point-of-sale, inventory, accounting, or fast-food environments. The terminal consists of a keyboard, listing printer, processor, cassette drive and modem, and is contained in a portable package. Prices range from $2,000 to $7,500, depending on options. *Tranti Systems, Tewksbury, Mass.*

Circle No. 321 on Inquiry Card.

SPECTRUM ANALYZER

The H-P Model 8580A Automatic Spectrum Analyzer is a minicomputer-controlled, frequency-programmable system which can scan and analyze any desired spectrum. The 8580A can perform tests for gain, bandwidth, attenuation, isolation, VSWR, noise figure, distortion, linearity, stability, spectrual purity, conversion loss, frequency response, etc., on devices such as amplifiers, oscillators, frequency converters, detectors, multipliers, switches, limiters, attenuators, couplers, isolators, circulators, and whole receivers or transmitters. A minimum configuration analyzer, for spectrum monitoring only, costs $70,000; other systems range upwards of $90,000. *Hewlett-Packard, Palo Alto, Cal.*

Circle No. 344 on Inquiry Card.



MAG TAPE DRIVES

The Series 7/9 magnetic tape drives are IBM-compatible, 7-inch reel tape units. The transports are available in 7- or 9-track models, have a basic forward speed of 12½ ips, and are available with recording densities of 200, 556, 800, or 1600 bpi. Recording modes available are NRZI on 7-track models (IBM compatible), and NRZI and Phase Encoding on 9-track models; rewind speed is 125 ips. Prices start at $2,150 for OEM quantities. *Willard Labs, Los Angeles, Cal.*

Circle No. 351 on Inquiry Card.

BIT ERROR RATE ANALYZER

The MX-270 Bit Error Rate Analyzer can test modems and channels for error rates at up to 10 megabits per second transmission. Mark, space, square wave, or short or long pseudo-random sequences may be compared bit-by-bit with a generated sequence, and error rates between $1x10^{-2}$ and $1x10^{-9}$ may be directly indicated. *Magnavox Research Labs, Torrance, Cal.*

Circle No. 352 on Inquiry Card.

PDP-11 ADD-ON MEMORY

The CorPac II provides PDP-11 users with up to 24K words of additional core memory. The add-on memory is available in 4Kx16 bit increments, and comes furnished with plug-in interface and power supply. Price for the full 24K system is $18,500, with delivery from stock. *Information Control, Los Angeles, Cal.*

Circle No. 353 on Inquiry Card.

MAG TAPE CONTROLLER

The Model SDI-3010 magnetic tape controller is designed for use with synchronous recorders for off-line data recording. The unit features bit-by-bit error checking after recording to ensure completely accurate data entry, eliminating the need for back-up systems. The 3010 is compatible with DTL or TTL inputs, may be used with 7- or 9-track recorders, and has a memory of 511 to 4095 bytes for error checking and verification. Speeds may range from 10 to 45 ips, with recording densities of 200, 556, 800, or 1600 bpi. *Systems Development, Dallas, Texas*

Circle No. 346 on Inquiry Card.

PDP WRITING TABLET

A writing tablet input device for digitizing graphic data has been made available by DEC for the display devices offered with the PDP-8 and PDP-12 small computers and PDP-15 medium-scale machine. The device, the VW01, digitizes any kind of graphic material, from intricate designs to simple written statements, as it is produced. One controller can operate up to four tablets, in effect making the computer's graphics display a sharable peripheral. First deliveries are set for April, with the price of a single tablet, $4,500. *Digital Equipment Corp., Maynard, Mass.*

Circle No. 348 on Inquiry Card.

AUDIO RESPONSE SYSTEM

The audio (voice) response system offers a vocabulary of up to 256 words for spoken output, with three different ASCII responses for visual display or printed output. The system, with 64 input lines, can handle up to 256 remote terminals using concentrator/receiver units for line switching. A typical application, with 4000 persons having access to the system, involves keeping track of parts, labor, and tooling required to process thousands of jobs in an industrial environment. *Wavetek Data Communications, San Diego, Cal.*

Circle No. 350 on Inquiry Card.

DATA SIMULATOR

The Model TTS 130 Data Simulator is designed to locate data transmission problems and determine if they are caused by the transmission line or the terminal data sets. The 130 can generate 511 bit pseudo-random signals to observe "eye" patterns or to detect errors at the far end. A direct reading level meter also provides means for measuring incoming signal levels. *Northeast Electr., Concord, N.H.*

Circle No. 355 on Inquiry Card.

1800 BPS MODEM

The Bell-compatible data modem, the UDS-202, which can operate at speeds up to 1800 bps, is offered in desk top, rack, or OEM card configurations. The desk top modem is priced at $450, with the OEM card at $250, both in unit quantities. *Universal Data Sys., Huntsville, Ala.*

Circle No. 357 on Inquiry Card.

ACOUSTIC COUPLER

The DD 103 AC is a coupler capable of converting EIA or TTY signals to FSK signals for transmission over standard telephone lines. The unit is compatible to the WE 103A, and may operate in half/full duplex modes. Delivery is from stock, with quantity prices – $97. *Digi-Data, Bladensburg, Md.*

Circle No. 345 on Inquiry Card.

MAG TAPE CLEANER

The GKI Model 7000 features a continuously-moving cleaning blade to remove over 95% of the error-causing flaws from magnetic tape. This new cleaning device, together with automatically advancing tissue wipers, ensures that both adhered dirt particles and loose debris can be removed from the tape without affecting the recorded data. *General Kinetics, Reston, Va.*

Circle No. 349 on Inquiry Card.

NEW SOFTWARE AND SERVICES

BASIC TEST PACKAGE

The Basic Compiler Test Package consists of more than 85 individual programs which test the object coding and/or error conditions produced by the various statements and elements of the Basic Compiler. The Dartmouth Basic Language (excluding matrix statements) was used as the design criteria. The package is of modular design permitting independent testing of specific elements and statements. Whenever possible, results are checked automatically at execution time and manual checking is therefore kept to a minimum. The package sells for $1000 and includes a write-up and listing for each program. *J and R Raymond, Inc., Dover, Mass.*

Circle No. 379 on Inquiry Card.

ACCOUNTING SYSTEM

This system is designed to operate on the IBM System 360 Model 20 to produce the following reports: a transaction listing by type of input document; a general ledger; a budget status report; an equipment listing; and a listing of outstanding purchase orders. It conforms to the U.S. Office of Education format and is suitable for organizations using Federal Handbook 4 or related requirements. The system can be easily adapted to satisfy the accounting requirements of local, state, and federal government agencies such as the Department of Labor, OEO, and HEW. Purchase price is $2500 excluding installation. *Contract Computer Services, Atlanta, Ga.*

Circle No. 390 on Inquiry Card.

TESTDATA GENERATOR

Testdata creates records for testing business data processing programs. The user specifies tape, disk, or card output, and records of either fixed or variable length, blocked or unblocked. Testdata runs on CDC 3170, 3300, and 3500 computers with approximately 14K of core being required. A record generated may contain from 6 to 20,000 characters with a maximum of 1,000 fields per record. A maximum of 50 variable length fields per record is allowed. The type of data to be generated for each field is specified by the user through 18 field options. These options include numeric or alphabetic sequence; random selection of numeric, alphabetic, or alphanumeric characters; blank or zero fill; insertion of a specified set of characters; and either random or sequential selection of values from a list supplied by the user. The price of $750 includes documentation. *DataCreation Services, Beverly Hills, Cal.*

Circle No. 376 on Inquiry Card.

TIME ALLOCATION

TABS is a software system designed for the management of a computer installation in a multiprogramming environment. The system analyzes problems involved in job mixing, and provides data on the peripherals and core size required, the average run time, the percent compute bound, and the average efficiency of a computer operation. TABS is priced at $3,500 for the first computer, and $1,000 for each additional computer at the same location. *Datachron, New York, N.Y.*

Circle No. 387 on Inquiry Card.

CONVALESCENT HOME MIS

A software package that provides patient billing and accounting routines for nursing and convalescent homes is available. The system provides the statistics necessary for Medicare reimbursement, and management reports for the home administration. It is written in Cobol, runs under S/360 DOS or OS, and costs $10,000. *Computer Dynamics, Cherry Hill, N.J.*

Circle No. 388 on Inquiry Card.

MATRIX INVERTER

Sparse is a set of sub-routines for inverting matrices to conserve core by not saving zero elements in the matrix. Sparse takes in a description of the matrix list form where each element value and its row and column position in the matrix is contained in the list. By suitable type declarations, Sparse can handle real, complex, or double precision matrices. A modified GAUSS-JORDAN elimination scheme is used and the routines will work on non-symmetric matrices. Sparse is written in standard Fortran IV and will operate on any computer supporting this language. The matrix inversion package, which includes a source card deck, the program listing, and a descriptive manual, is priced at $2,000. *Environmental Computing, Lowell, Mass.*

Circle No. 391 on Inquiry Card.

ATS LOCATE PROGRAM

The ATS Keyword Locate program is designed to expand the data handling and information retrieval capabilities of ATS/360. The program allows the user to search a working storage document for any character or group of up to 48 characters. This capability allows working storage records to be selected based upon the occurrence of a keyword or upon the result of a comparison specified through the use of one of the relational operator reserved words. The user can choose from a variety of options in deciding how he wants to work with selected records. The lease price of this system including full term maintenance is $400 per month. *Systems 2000 Corp., Houston, Texas*

Circle No. 382 on Inquiry Card.

PAYROLL PACKAGE

PALD is a payroll and labor distribution system that is written in 3rd generation Cobol and can be implemented on any 3rd generation computer with 65K of core. PALD can produce reports on paychecks, check registers, employee status, overtime, unemployment, labor by project and category, and labor distribution. Base price is $2,500 with documentation and source decks included. *Info Dyne, Washington, D.C.*

Circle No. 380 on Inquiry Card.

DEBUGGING AID

The Chicago Bug Chaser is a source level, interactive debugging aid for Cobol. A programmer, using the Bug Chaser, can sit at his terminal and interact with his program, the computer, and the test data. If the program Abends, the Bug Chaser shows where, and allows the programmer to make corrections; if logic is incorrect, the Bug Chaser can show the actual program flow in source language at reading speed. The Bug Chaser is designed for IBM 360, with ANSI Cobol, and OS, and costs $25,000. *R. M. Hornaday, Chicago, Ill.*

Circle No. 381 on Inquiry Card.

NEW LITERATURE

DATA TERMINAL

The Novar 5-50 business data communications teleprinting terminal is described in a six-page foldout. *Novar, Mountain View, Cal.*

Circle No. 415 on Inquiry Card.

KEY-TO-DISK

The Key Entry System is outlined in a six-page bulletin. Major features covered include expanded tape processing, communications, printers, and multi-system supervisors. *Inforex, Burlington, Mass.*

Circle No. 417 on Inquiry Card.

MINICOMPUTERS

An 18-page product pamphlet on the Nova 1200 and 800, and the Supernova SC is available. *Data General, Southboro, Mass.*

Circle No. 416 on Inquiry Card.

DATA SAFES

An 8-page booklet describing the perils involved in storing magnetic media, and the specifications of data bank safes to protect such media, is now available. *Wright Line, Worcester, Mass.*

Circle No. 421 on Inquiry Card.

TOCS

A six-page brochure describes CDC's Terminal Operations Control System (TOCS), designed for IBM 360-based terminal networks. This hardware/software combination permits expanded multi-user applications of on-line, local, and remote entry/retrieval without adding intermediate communications equipment or changing software. *Control Data Corp., Minneapolis, Minn.*

Circle No. 419 on Inquiry Card.

CRT TERMINALS

Specification sheets on the TEC 5020 and 8024, high-speed, parallel I/O CRT terminals are available. *TEC, Eden Prairie, Minn.*

Circle No. 400 on Inquiry Card.

TELETYPE 37 TERMINALS

Model 37 data terminals and their components are described in a 28-page catalog available from Teletype. The terminals operate at 15 characters per second and have complete ASCII capabilities, as well as printing the 94 standard graphics. *Teletype Corp., Skokie, Ill.*

Circle No. 420 on Inquiry Card.

FACILITIES MANAGEMENT

Questions and answers on the why, what, and how of EDP facilities management services are presented in an 8-page letter. *Data Facilities Management, Stamford, Conn.*

Circle No. 405 on Inquiry Card.

REMOTE BATCH TERMINAL

The Model 70 Remote Batch Terminal, a plug compatible IBM 2780 system, is described in a 4-page brochure. *Data 100, Minneapolis, Minn.*

Circle No. 409 on Inquiry Card.

SYSTEMS HANDBOOKS

The folder describes 19 reference handbooks on systems management that serve as aids to effective EDP management. *Systemation, Colorado Springs, Colo.*

Circle No. 408 on Inquiry Card.

PDP-10 SOFTWARE

DEC has issued a revised bulletin of PDP-10 application programs that may be obtained from DECUS, the DEC Users Society. *Digital Equipment, Maynard, Mass.*

Circle No. 410 on Inquiry Card.

DUAL-DENSITY TAPE SYSTEM

800 cpi NRZI and 1600 cpi Phase-Encoded operations are fully explained in two brochures describing System 8000, a fully coordinated magnetic tape system capable of both modes of operation. *Kennedy Co., Pasadena, Cal.*

Circle No. 401 on Inquiry Card.

INFORMATION RETRIEVAL

Tymshare has published a 46-page manual describing Retrieve, a general-purpose information retrieval system designed to allow access and manipulation of a uniformly formatted data base. *Tymshare, Palo Alto, Cal.*

Circle No. 414 on Inquiry Card.

PRINTER RIBBONS

The 12-page brochure describes fabric and film ribbons available for IBM Selectrics and Composers, high-speed printers, and other printing equipment used in computer peripherals. *Columbia Ribbon & Carbon, Glen Cove, N.Y.*

Circle No. 404 on Inquiry Card.

MINICOMPUTERS

A pocket-size booklet describes and gives specifications for Computer Automation's minicomputer models 116, 216, 108, 208, and 808, and provides details on a logic module tester. *Computer Automation, Newport Bch, Cal.*

Circle No. 413 on Inquiry Card.

MULTIPLEXER/DIGITIZER

A 26-page brochure that describes the new XDS Model MD40 analog signal multiplexing and converting unit is available. The rack-mountable multiplexer/digitizer offers relative accuracy up to 0.025 percent of full scale with resolution of 8 to 13 bits and throughput up to 133,000 samples per second. *Xerox Data Systems, El Segundo, Cal.*

Circle No. 411 on Inquiry Card.

APL FORMATTING

The 11-page manual describes means for producing reports when using APL as the programming language. *Scientific Time Sharing, Wash., D.C.*

Circle No. 412 on Inquiry Card.

N/C TIME-SHARING

A 172-page guide for the use of GE's time-sharing service for preparing numerically controlled machine tool tapes is available. *General Electric, Bethesda, Md.*

Circle No. 407 on Inquiry Card.

TIME-SHARING SERVICES

A management-oriented 22-page report on commercial time-sharing companies is available at a price of $25.00 per copy. *Datapro Research, Philadelphia, Pa.*

Circle No. 406 on Inquiry Card.

DATA COMMUNICATIONS DEVICES

Prentice Electronics has issued a series of specification sheets describing its line of acoustic couplers, modems, and line adapters. *Prentice Electronics, Palo Alto, Cal.*

Circle No. 403 on Inquiry Card.

MEDICAL DATA SYSTEM

A ten-page booklet describes the computer analyzed ECG service offered by Telemed. *Telemed, Schiller Pk., Ill.*

Circle No. 418 on Inquiry Card.

COMPUTER SYSTEMS

A 100-page brochure is now available that enables users to configure and price Modcomp computer systems matched to almost any real-time measurement and control application. The Systems Design Handbook spans the nine members of the Modcomp computer family that feature on-site expandability from minis priced under $10,000 to multiprocessing systems priced over $300,000. *Modular Computer Systems, Ft. Lauderdale, Fla.*

Circle No. 402 on Inquiry Card.

INDEX TO ADVERTISERS

If you've been having problems finding, training and keeping keypunch operators, maybe we have a solution. The MDR Series Document Reader. It gets the job done when you want it, how you want it, and at a cost far lower than you are now paying.

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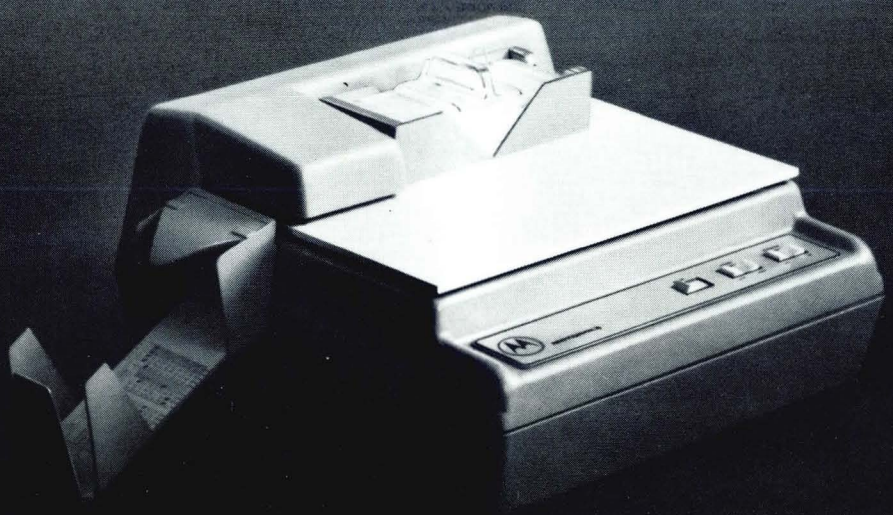

CIRCLE NO. 51 ON INQUIRY CARD

The Repco 120 Printer.
It's fast, quiet, reliable, compatible, compact.

The REPCO 120 is a low-cost, solid state impactless printer designed to interface with all CRT terminals, minicomputers or other remote data terminals. It operates asynchronously at speeds to 120 characters per second, 80 characters per line, 5 lines per inch vertically. It will handle serial or parallel data of 64 character standard ASCII code. When interfaced with a modem or accoustic coupler, it can be used as a terminal printer over telephone or private wire communications lines. By adding the keyboard option, REPCO 120 becomes an interactive terminal for your minicomputer. REPCO Incorporated, 1940 Lockwood Way, P. O. Box 7065, Orlando, Fla. 32804, telephone (305) 422-2451.

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