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71

May 15

minicomputer survey

SJCC product preview

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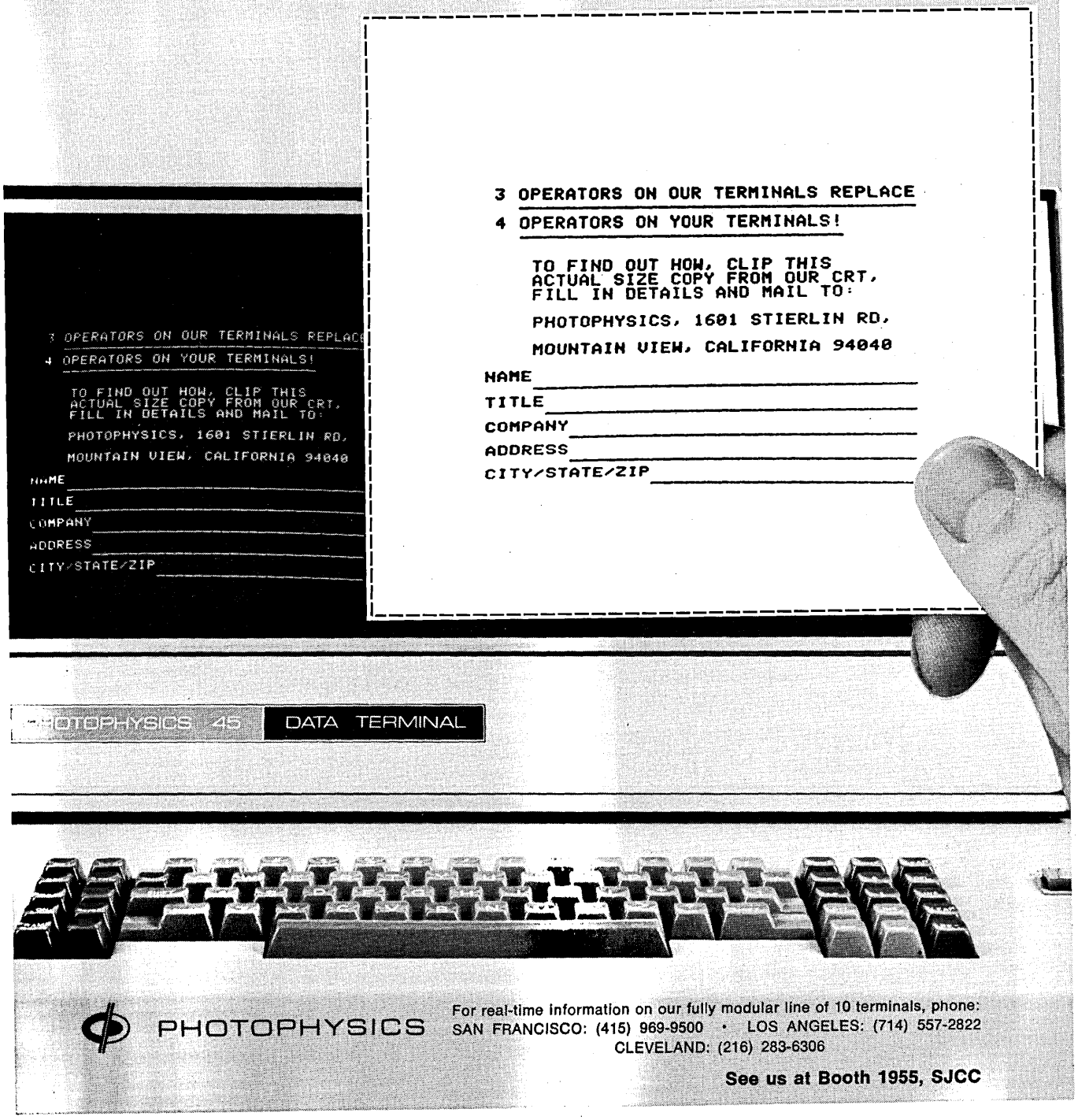

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Diablo

CIRCLE 17 ON READER CARD

DATAMATION®

MAY 15, 1971
volume 17 number 10

TECHNICAL

GENERAL

MANAGEMENT

COMMENTARY

About the Cover

As computers get smaller, applications grow wider. Our visually contracting and expanding design by Barbara Benson focuses on the direction things are taking, any way you want to look at it.

DATAMATION®

MAY 15, 1971
volume 17 number 10
This issue 116,910 copies

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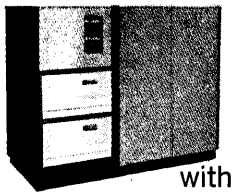

In the computer business, the first thing you've got to do is learn how to get along with others.

Nobody knows that better than we do. And nobody does it better than we do. Case in point: Our new 2200. A direct access storage facility that's instantly compatible with the IBM 2314 and 2319.

Just roll right up, ladies and gentlemen, and plug right in.

Our new 2200 and the IBM 360 system were just made for each other.

And the nice thing is, no matter how you want it, it'll change for you. If you want just plain big memory, you can get the 2200 system with a controller and a single drive unit. Or for really mind boggling memory you can get a controller with anywhere from one to four dual drive units, with a single drive unit as a spare.

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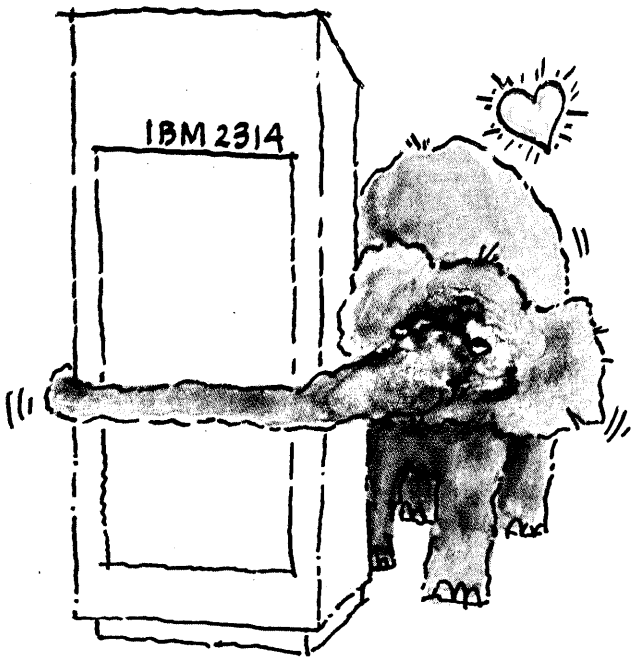
If you'd like to know more about the 2200 or its little brother, the 1100 (who's every bit as good, but just doesn't remember as much), remember to get in touch with your local Bryant representative. Or write to 850 Ladd Road, Walled Lake, Michigan 48088.

What he has to say should put a smile on your interface.

The new Bryant 2200. We never forget an interface.



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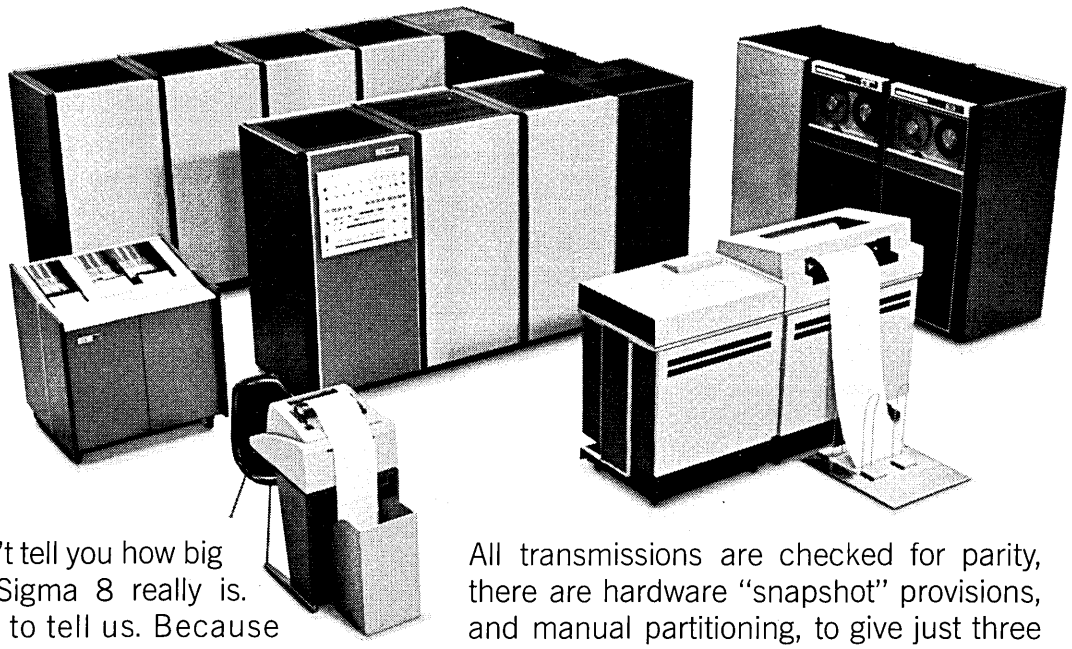
Here's one:



We can't tell you how big a Xerox Sigma 8 really is. You have to tell us. Because Sigma 8 has a flexible structure that allows you to configure the hardware exactly to suit your needs. Whether you need a scientific system with data management, a real-time system with batch, a batch system with time-sharing, a full-blown multiprocessor system or anything in between. What's more you can grow from one to all the others.

The secret is memory oriented architecture. Memory is expandable, from 64K bytes to 512K bytes in increments of 64K. We provide 12 access ports to which you can attach 12 processors in any practical combinations of CPU's and IOP's. (Four CPU's max., however.) There's a separate clock for each system element, so you can shuttle information in and out of memory, compute, and communicate with your peripherals, all at the same time, asynchronously.

We've included many features to make sure that Sigma 8 is available when you need it. Its availability is a combination of reliability features and easy maintenance. All transmissions are checked for parity, there are hardware "snapshot" provisions, and manual partitioning, to give just three examples.

We also have a set of on-line hardware diagnostics that allow our experts at headquarters to communicate with your system over long distance telephone lines and offer help with any necessary trouble shooting.

Of course we've included all the scientific and real-time performance features you've come to expect from Sigmas, and added a few more. Very high speed. Up to 224 levels of interrupt. 6 microsecond interrupt response. Interleaving and instruction look-ahead. Storable interrupt commands. A powerful machine language: context switching, for example, is one instruction.

Software? Since Sigma 8 is a more powerful, sophisticated, faster version of Sigma 5, it uses all the field-proven operating systems that handle real-time, time-sharing and batch, concurrently.

And if there's anything else you need in a Sigma 8 for a special application, call the people at our Systems operation.

They'll make it shape up in a hurry.

Xerox Data Systems

XEROX®

LETTERS

For Pete's sake

Sir:
I enjoyed reading Mr. Pete Lindley's informative "Field Application Note Identification of Right and Left Hand." However, I take exception to the format of the article (April 1, p. 35).

It is advisable to print a WARNING before, not after, the procedural step that poses the potential hazard.

It is my hope that this error can be corrected before you are deluged with complaints from readers with mangled wrists.

ROBERT K. ROTH
Albertson, Long Island

Etal oot.

Left on

Sir:
Pete Lindley's Application Note has proven helpful to us and we are instructing our field personnel in accordance with this standard. We find, however, that the terms Right and Left are not defined in the referenced Note. This is a distinct limitation to its usefulness, because:

(1) Programmers and systems people never go outside of buildings, thus the common Moss method and

the Natural Horizon Method cannot be employed.

(2) Magnetic compasses used around edp gear generate glitch phenomena.

The programmer's normal response to this problem is of course to interrogate the cpu, or the operator thereof (more frequently the latter). This approach would be unavailing in the present instance, though, because the requisite analog reference data—the positional orientation of the interrogator—is not resident in core storage.

Due to the symmetricality of the human anatomy, then, the basic referent required is left indeterminate in your instruction, a predictable condition under Corollary-22 of the Murphy-Phynnagel Theorems.

We would appreciate it, therefore, if you would publish a definitive technique for making this prerequisite determination of positional attitude.

C. SHERWOOD KIDDER
St. Paul, Minnesota

You have the right attitude now, Kidder.

Proffer toot

Sir:
In Letters (March 1, p. 11), Mr. Robert Mankin did grievous error in his proffering professions re professionals. Please note that even in the second oldest (nothing is first) profession, there are charlatans, knaves, and incompetents—surely filled occasionally at least. All this is, of course, extracurricular with respect to otherwise joyous encounters during which—in my innocence I assume—one also encounters knaves, etc. I think "rigorous body," "distribution," "ethics," and "scents" even may apply to "our" other proffering professionals.

D. BORETA
San Jose, California

Bonus, baby

Sir:
An idea for improvement of programmer performance occurred to me, which I would like to pass along to you (free of charge) in the hope you can think of something to do with it. I am a government employee, and unfortunately it isn't appropriate in government due to personnel and pay regulations. The idea came to me when, after 10 years in data processing, I found I now have need to rent computer time for a personal project, and found myself moving carefully since I'll be paying the bill.

I suggest that a bonus incentive system be established for programmers, on a per-program or per-system basis in which the "bonus" is a "charge account" of a stated amount of money based on the complexity of the program or system. The programmer's computer time would be chargeable (at a reduced rate) against this charge account. When this program or system is completed, debugged and in production, any unused money in his bonus charge account can be "cashed" as a dollar bonus to his paycheck.

In any conflicts on the use of computer time alleged to be due to operator or system error, the error would have to be proven by the programmer for a rebate of the charges. I think the programmer will improve his performance for profit, doing more desk-checking, better testing, careful label checking of input, and programming test points for a audit trail. If the bonus is on a per-program or per-system basis, when he has finished, a new charge account would be established for his next job as an incentive to keep moving on.

A company interested in trying the idea would determine the average cost of the computer per hour and the average testing time for acceptable performance in a job of a given complexity. A formula to compute the maximum bonus would be developed such that even if the programmer earned a large bonus, the company is ahead when compared to the expense of running extra runs for careless errors. The bonus could be calculated at, say, 10% of actual cost of running. If the programmer used up his charge account, the company will not have lost the bonus money, since the programmer will not have earned any. I do not believe a penalty is necessary, for although a bonus will not always be earned, I think programmers will try harder for the extra dollar incentive. Where he now humbly apologizes for a careless error, under this system the careless error is "money out of the programmers pocket" in future bonuses.

YVONNE G. TROUT
McLean, Virginia

Gomez is aware

Sir:
Regarding the letter that you published in your March 15 issue titled "Higher Him," I think that your editorial staff used extremely poor judgment in printing that letter. In these

(Continued on page 15)

TRACOR gets it all together in Booth 1219.

All for you at the SJCC: line printers, magnetic tape drives, disc storage systems, time-sharing computer systems, remote batch terminals, 10/15/30 CPS terminals, and special input terminals.

Ask about our quality, performance, competitive prices, unsurpassed reliability, availability and service.

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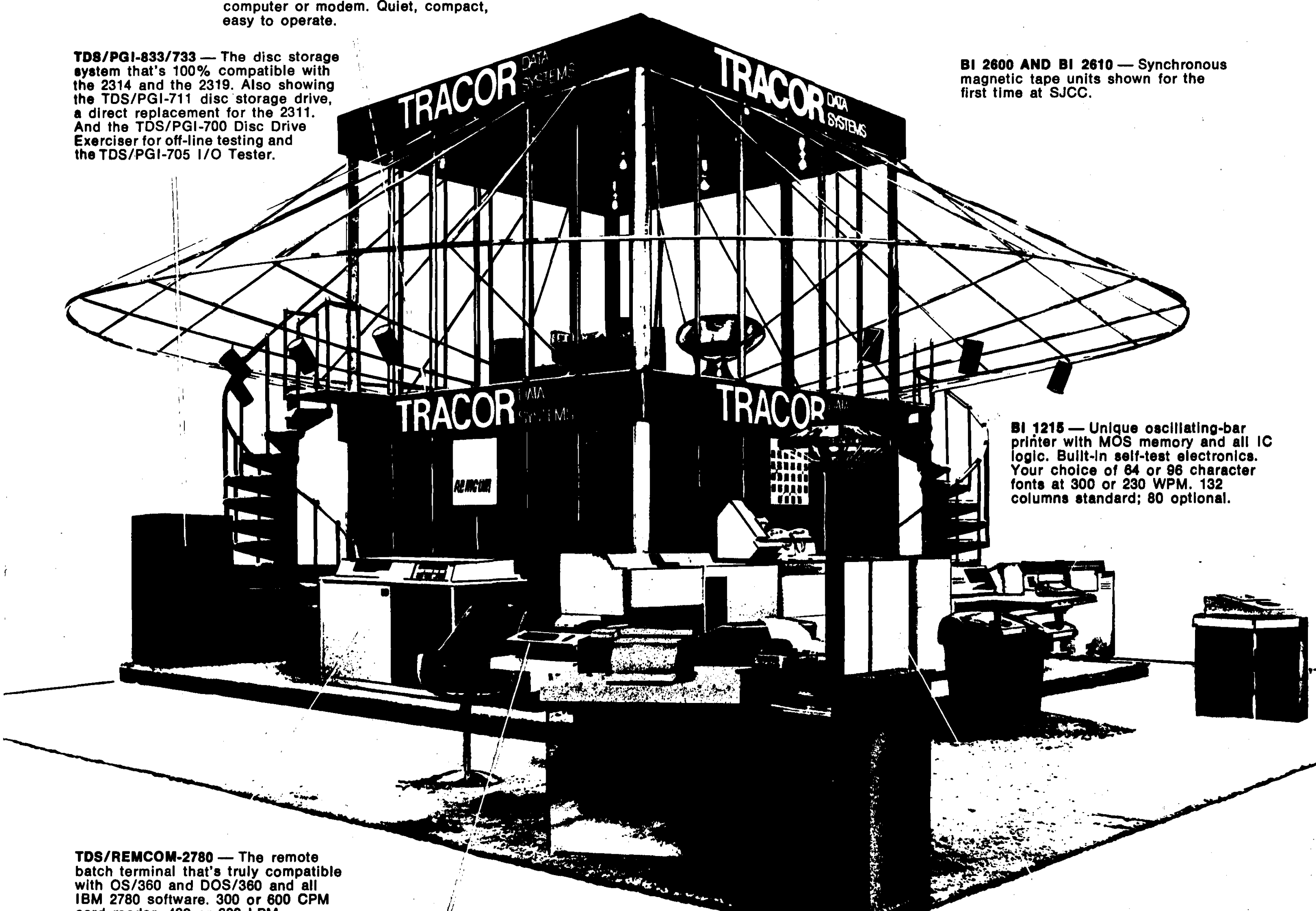

TDS/BSL TERMINALS — Special data input devices let you enter data by keyboard, see it in digital format for verification, then, by pushing the SEND key, transmit it to tape, disc, computer or modem. Quiet, compact, easy to operate.

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TDS-1600 — Introducing the 30 CPS model of the TDS-1600 impact conversational terminal series. A combination of high-speed performance and the simplicity and reliability of the 10/15 CPS TDS-1601.

TDS-1255 — The in-house time-sharing computer system that lets you write, debug and run big-system programs. 256K words big! Enhanced FORTRAN IV. Handles up to 16 terminals plus peripherals for concurrent batch processing.

TDS/Remcom-2780

$854 a month

You bet we're competitive. And then some.

On price, you get our remote batch terminal for as little as $854 a month . . . with a full 132 print-position printer. On a 12-month lease. Maintenance included.

In performance, you'll have the truly compatible terminal. With OS/360 and DOS/360 and all IBM 2780 software. More peripherals can be added without additional electronics. And repair and maintenance are easier.

For faster data transmission, our exclusive *advanced data compression/decompression* gives you the option of up to 80% increase in send-receive rate. In fact, ours are the only 2780s now running on 9600 bps lines.

On options choose: 300 or 600 CPM card reader, 400 or 600 LPM printer, and double buffering to 1200 bytes.

For service, we have ten regional centers complemented by the nationwide Honeywell offices that service TDS/Remcom-2780 Terminals.

Delivery? Still 60 days.

Contact Tracor Data Systems, 601 California St., San Francisco, Calif. 94108. Phone (415) 781-5455 or our regional office nearest you: Chicago — (312) 298-5090, Dallas—(214) 328-9991, San Francisco—(415) 781-5455, Washington, D.C. — (703) 525-3300.

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Yes, we set the pace for 2314 and 2319 compatible disc storage systems. Quality and price!

This can save you thousands of dollars on purchase or rental. Whether you need three, six or nine spindles. And of course you can save on single spindles as well.

What's more, we include 24-hour maintenance and unlimited use in our low rental prices.

And please note. Our TIDS/PCI-838 Controller and TIDS/PCI-738 Disc Drives are *100% compatible* with the 2314 and the 2319. Plug-to-plug and pack-to-pack! Can any other system actually use its controller with IBM drives? Or its drives with the IBM controller?

Ours can. And we're more than glad to demonstrate it.

You'll find our reliability unsurpassed. Advanced electronics, such as monolithic circuitry, assure you more equipment up-time. And several exclusive design features provide easier maintenance, also.

Fast, complete service for all TIDS/PCI disc systems is provided nationwide by Comma Corporation.

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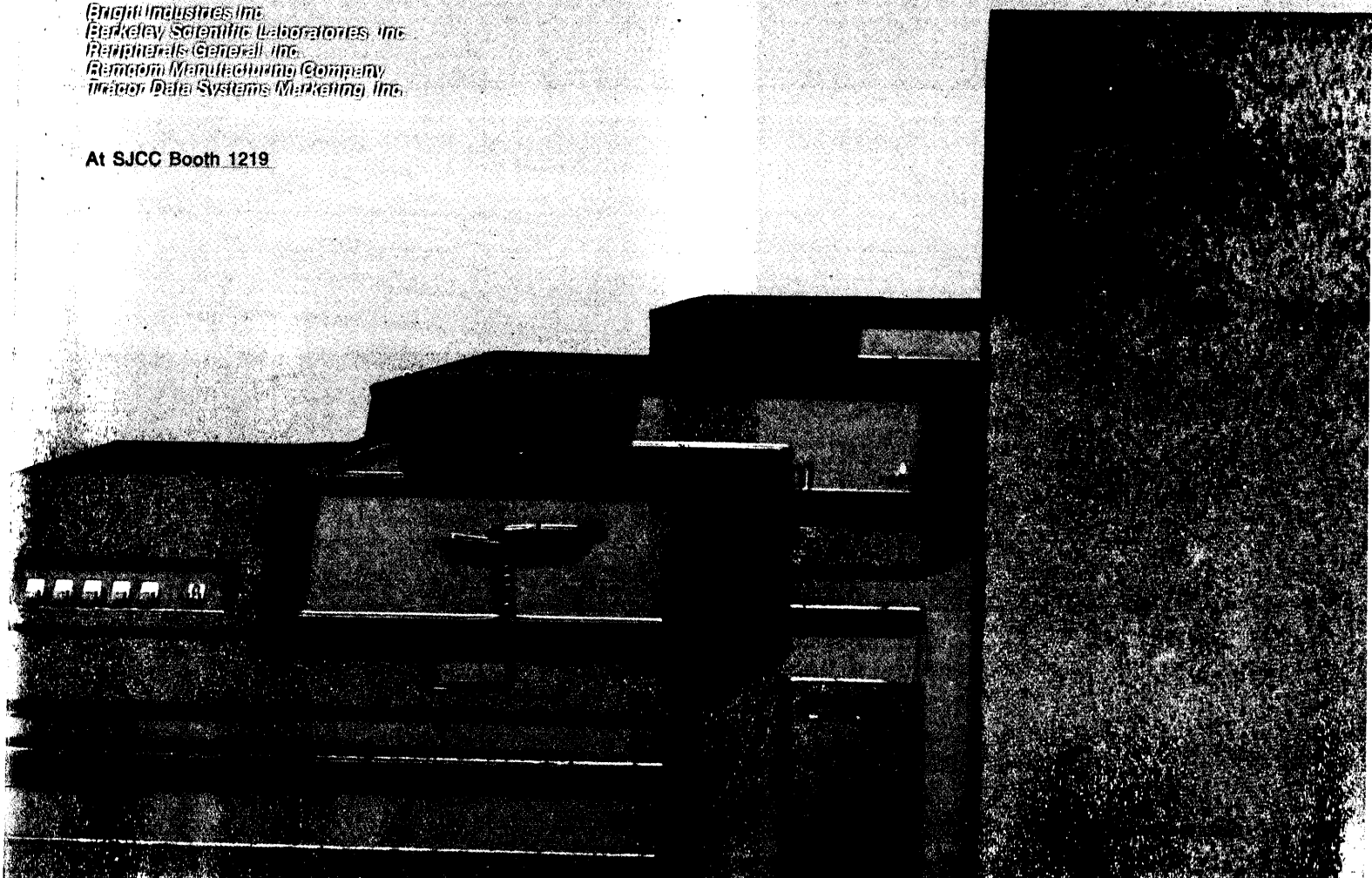

Lightweight printheads for heavyweight OEMs

If you can use quality printheads in quantities as large as one-hundred or more, our unique series of 30/15/10 CPS impact printheads is for you: The answer to your needs for hard copy and other communication or computer terminal applications.

It's simple. Highly reliable. Weighs as little as 6½ pounds. And makes multiple copies.

In your choice of three models.

The first offers a 64-character ASCII subset at 30 CPS. And prints 80 columns on standard 8½-inch roll or sprocket-fed continuous stock.

Our second model gives you the same features at 10/15 CPS (20 CPS in parallel mode).

And with our third, you get up to 20 CPS in a 156-column format.

Of course, we use these printheads in our own 10/15/30 CPS terminals, the TDS-1600s. We omitted hundreds of moving parts in their design; our printheads allowed us to use advanced electronics.

Which reduces the noise and repairs. Increases the up-time.

You really ought to have our printhead examined. It's a lightweight heavyweight.

Contact Tracor Data Systems, 4201 Ed Bluestein Blvd., Austin, Texas 78721. Or call (512) 926-7770.

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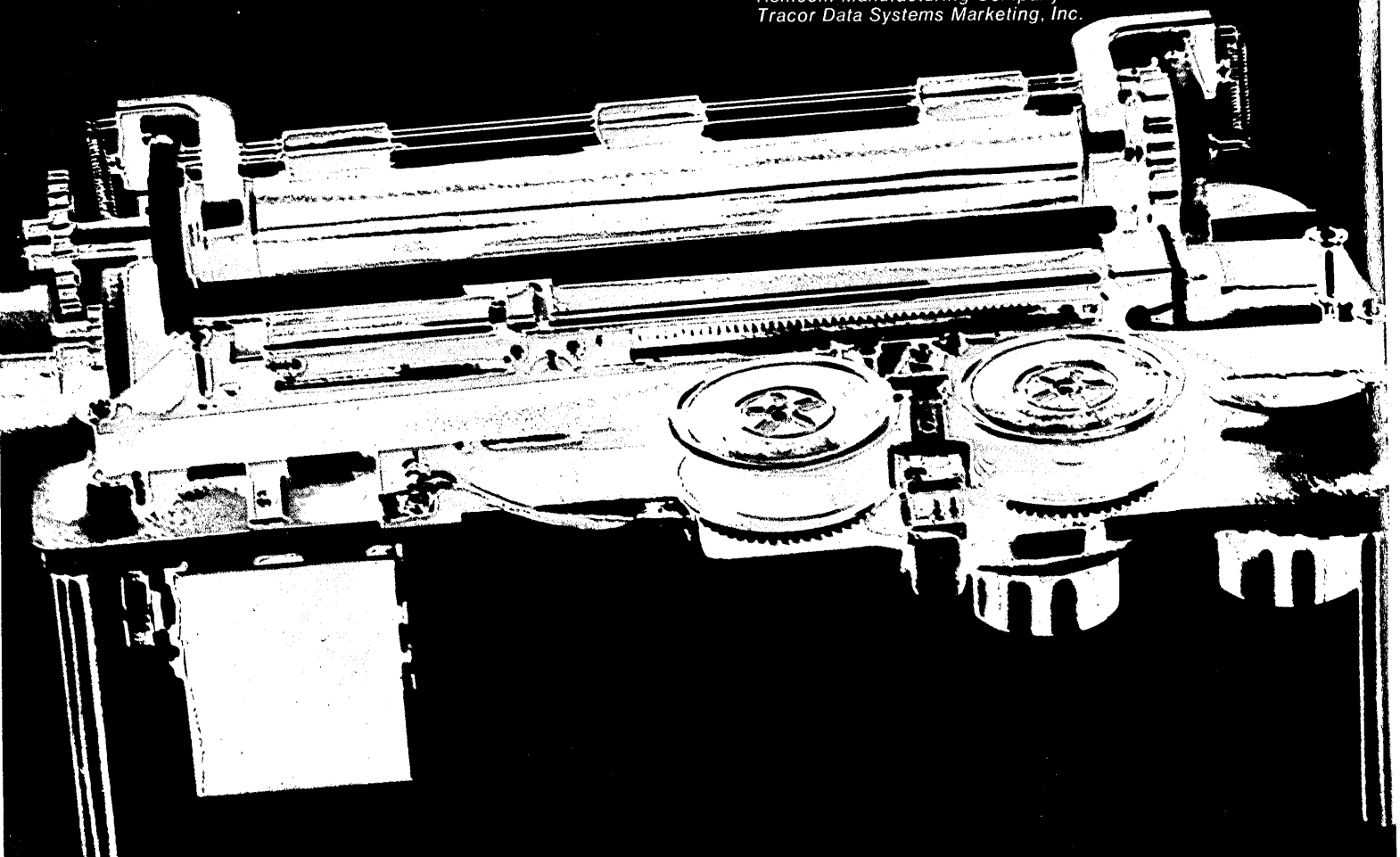

NOW, TRACOR gives you a 30 CPS terminal

Introducing the 30 CPS model of the TDS-1600 impact conversational terminal series.

It's ideal for your time-sharing and computer I/O requirements. And it provides the same simplicity, high reliability and performance of other TDS terminals.

It uses the same, simple impact printhead.

Hundreds of parts inherent in more complicated terminals have been designed out of TDS terminals in favor of advanced electronics.

This reduces the noise, downtime and repairs.

The new TDS model generates a 64-character ASCII subset, 80 columns wide, in full or half duplex mode.

It makes multiple copies, using standard 8½-inch paper, roll or sprocket driven.

Other options are available: built-in telephone acoustical coupler, magnetic tape cassette unit, Receive-Only model, and your choice of teletypewriter or parallel interface.

Of course, our lightweight printhead is available separately in OEM quantities.

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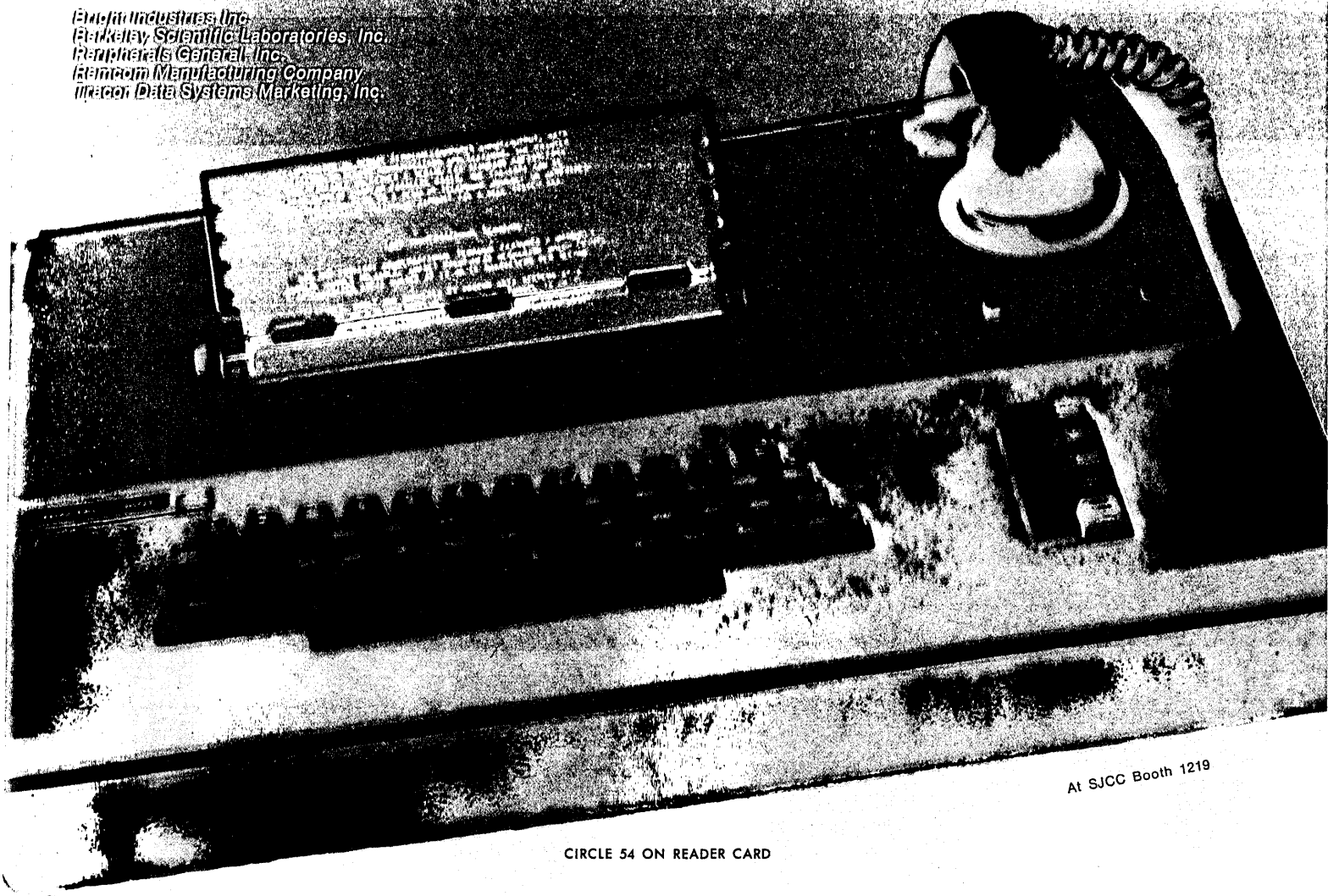

At SJCC Booth 1219

CIRCLE 54 ON READER CARD

If you're underwhelmed

. . . with outside computer time-sharing, consider the convenience of an in-house TDS-1255. It's the time-sharing system that lets you write, debug and run big-system programs. 256K words big. Then run them, if you wish, on big computers.

For example, with its enhanced FORTRAN IV, the TDS-1255 has processed programs written for the 1108 and the larger 360 systems with no changes.

TDS-1255 combines 512K words of virtual memory with access to 8-, 16- or 32-million characters of mass disc storage . . . directly addressable in FORTRAN. It handles up to 16 terminals simultaneously, local and remote. And it accommodates additional peripherals to facilitate batch processing concurrent with time-sharing.

Other important features include File Edit, MATH, built-in usage accounting, random and sequential file management processors, and extensive diagnostics that explain program mistakes in English.

We can deliver it in 90 days for as low as $2,700 a month, *including maintenance.* No extra shift charges. It's yours 24-hours-a-day.

We'd like to give you a live demonstration of the TDS-1255. You may find it overwhelming.

Contact Tracor Data Systems, 4201 Ed Bluestein Blvd., Austin, Texas 78721. Or call (512) 926-7770.

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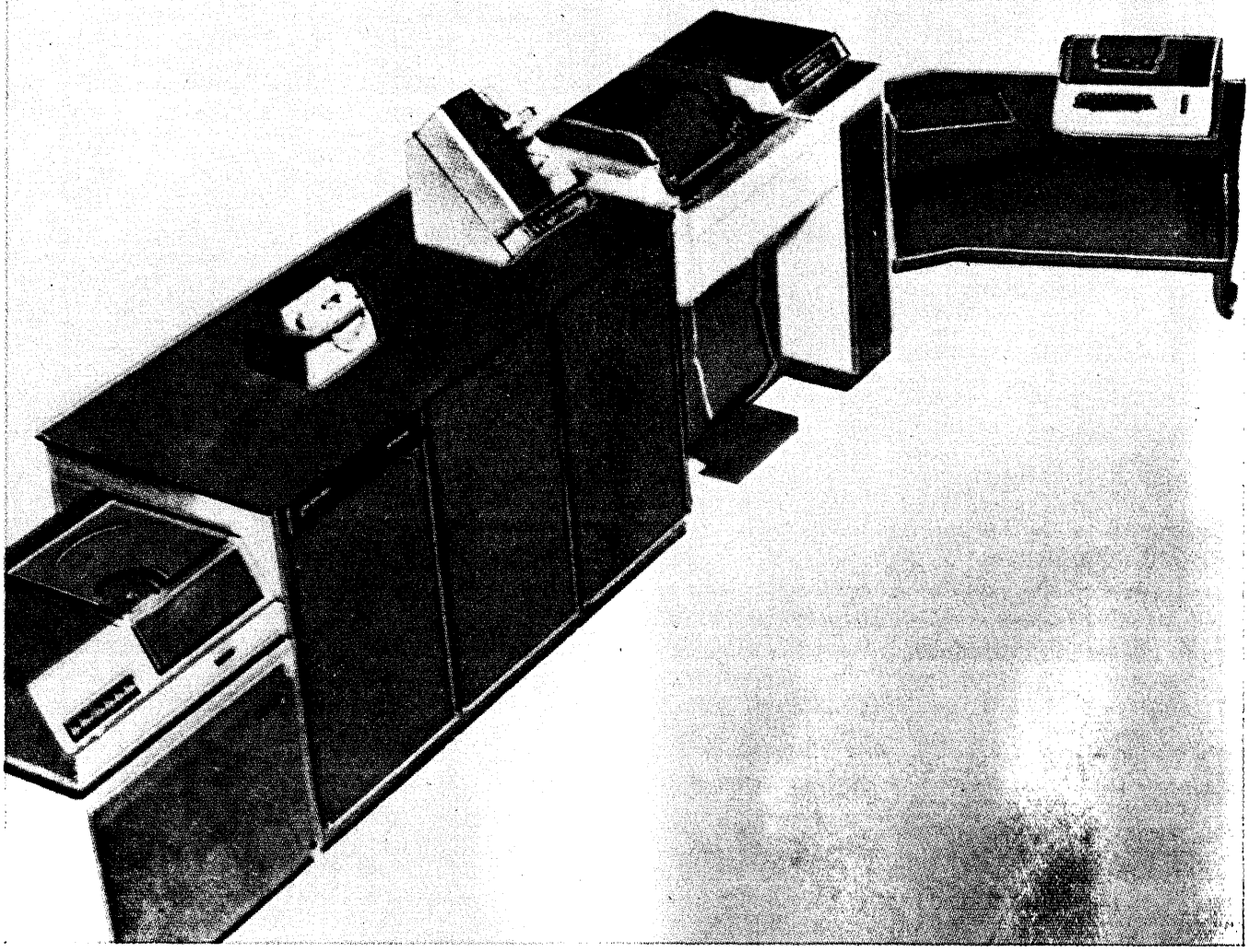

At SJCC Booth No. 1219

CIRCLE 55 ON READER CARD

troubled times when racial problems should be of concern to any intelligent person, publishing a letter with obvious racial overtones shows very little sensitivity towards minority problems. Just because DATAMATION is a technical magazine should not imply that the people involved in publishing the magazine should be socially naïve.

Is Mr. Gomez aware of the plight of the Spanish-surnamed people? Better education, better jobs, and a better life are the goals of millions of socially deprived Mexican-Americans. Your publishing such an obviously madeup letter can do nothing but hurt the efforts of concerned Mexican-Americans. The extreme bad humor sterotyping Spanish-surnamed people as illiterates shows the same bad taste as the "Frito-Bandito" or any other racial stereotypes. The Mexican-Americans have come a long way towards social equality in the last few years, but the publishing of sick letters can only hurt their cause.

RICHARD F. CHAMBERLIN
Pasadena, California

Dvorak's new world

Sir:
The standardized keyboard proposed after "years of effort" by ANSI committees neither provides for "ease of operation" nor "minimizes operator training and retraining." Most typing teachers are aware of the fact that the traditional (Universal) keyboard is merely a haphazard arrangement.

In contrast, Dvorak's DSK (Dvorak Simplified Keyboard) represents a scientific approach to keyboard design; people learn to type faster in less time on the DSK.

Ancona, Garland, and Tropsa (March 1, p. 32), in their acceptance of the argument that the traditional keyboard should be adopted because millions of people have been taught to use it, and because schools are still teaching it, seem "cowed" by the weight of numbers. What of the millions more who are to use keyboard terminals in future—what of the fact that the day is surely coming when each person will have his own personal electric typewriter or terminal—what of the millions of dollars that are surely to be lost through blind faithfulness to an inefficient device?

Dvorak has shown that retraining typists on the DSK is not a serious problem; further, in a few years (perhaps no more than it takes for a new car to wear out), Universal typists would have left the labor market and been replaced by DSK operators. And schools teach what they think industry likes.

Mr. Ancona, who is director of standards, IBM Office Products Div., of all people, should be willing to at least try the DSK; IBM, with its Selectric element, has it in its power to revolutionize typing instruction in American schools. By simply making the DSK element available to typing teachers (at the same price as the Universal), it would soon find out which keyboard is superior.

ENOCH HAGA
Society of Data Educators
Northfield, Vermont

On the bloc

Sir:
I would like to bring to your attention a major inaccuracy in the "World Roundup" item headlined "If It's IBM, It Must Be Belgium" (Feb. 1, p. 85).

It says: "Trade discrimination has been raised in another form with objections lodged, mainly via IBM, to get the NATO committee that places embargoes on sales to the Soviet block to restrict business being done in Russia by U.K.'s ICL." IBM had lodged no objections nor approached the U.S. government or any other agency in an effort to prevent the sale of ICL or any other manufacturer's computers to the U.S.S.R. IBM has exercised no influence whatsoever on the position taken by the U.S. government on this matter at COCOM meetings.

CHARLES FRANCIS
Director of Information
IBM World Trade Corporation
New York, New York

Fraudian clip

Sir:
Your articles on "Managing the Campus Computers" (March 1) were good, but they left out one very important aspect that many people are not aware of, and that is the use of university computing facilities by professors for their outside consulting work, which in many cases is neither billed nor accounted for as other than "research." While a professor's salary is nothing to write home about, the outside fees obtainable by their free access to university computing facilities can quite readily reach astronomical proportions. It has been only a short while ago that reputable professors and concerned graduate students have prodded the U.S. Joint Audit Agency to undertake investigations where merited and help eliminate both fraud and unfair competition.

SAMUEL SHIPKOVITZ
Pittsburgh, Pennsylvania

Deepest penetration

Sir:
After reading Lowell Amdahl's Forum article, "Realizing the Unrealized" (March 1, p. 79), I just wish to say I feel it to be one of the most penetrating and succinct editorials ever.

H. T. NISSLEY
Toronto, Canada

Cycle mates

Sir:
Out here in Palo Alto we've been hit by the ecology types. My wife and I, the kids, etc., all collect newspapers.

I've even found a way to recycle my tab cards. But no one can tell me anything about recycling all that paper and carbon paper that comes out of my printer.

Would you please ask your readers if any of them know anything about computer paper reclamation. I'd like to know the names and phone numbers of people to contact.

SAMUEL GORDON
Autologic, Inc.
San Francisco, California

Games play people

Sir:
Ethan I. Shedley ("Big System Games," April 1, p. 22) has succeeded, using humor(?) to expose the real culprit(s) behind big (or small) system failures; people! But, alas, there's the rub; that very humor shall become the rationale for people to ignore his sage insights. Perhaps Mr. Shedley could add this last trick to his list of games called . . . "The Game of Games" or "The Three Monkeys."

L. THOMAS HAMMOND
Denver, Colorado ■

Meet George Taylor, HP Systems Analyst.

He'll show you how to save a bundle with your own time-share system.

George is a systems analyst in our Englewood, Colorado, office. Like his fellow HP analysts throughout the country, he was specially selected and trained as a time-share expert.

His role is a simple one: to help you realize the full potential of in-house time-sharing, made possible by HP's Series 2000 Systems. How? By working with your engineering, manufacturing, marketing and accounting people—so they'll know how to get the most out of the system. And George won't take forever to train them either. His objective is to make your people self-sufficient. Usually it takes just about a month.

But George and company are just one part of our great new deal for in-house time-sharing. For instance, we've just added a unique new rental plan that lets you try before you buy. Another nice thing—when you do purchase you'll be happy to know that over 60 percent of your rental payments come right back to you as additional equity.

Low cost is another part of our deal you'll like. For just $69,900 you can start with our 16-terminal 2000A System. And expand it to a 32-terminal system at any time. They'll all provide you with totally unattended operation, matrix, string and random-access file capability. And our 2000C model gives you all the bells and whistles—like program chaining, 3-levels of libraries and up to 8 moving-head disc files.

Add it all up—the systems analyst, the new rental plan, the low cost. You'll arrive at the only reasonable solution to spiraling time-share costs—an HP Series 2000 System. So why not give George Taylor (or any of our time-share analysts) a call and talk it over? Or write for complete information to Hewlett-Packard, Palo Alto, California 94304; Europe: 1217 Meyrin-Geneva, Switzerland.

22019B

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DIGITAL COMPUTERS

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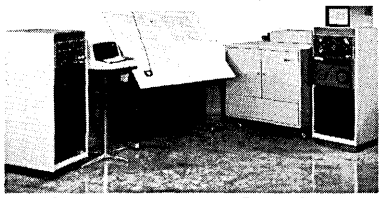

Our new Microfilm Plotter lets you do some other impressive tricks, too. A single-data input command can produce a circle, arc, line or vector in solid, dashed or broken lines.

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For details, contact The Bendix Corporation, Computer Graphics, 23850 Freeway Park Drive, Farmington, Michigan 48024. (313) 477-3700.

Bendix Computer Graphics

360/22: CAN A 26 BE FAR BEHIND?

Used computer dealers feel IBM's 360/22, to get rid of its growing 360/30 inventory, has damaged their market for used 30s, particularly 32K systems that have been going for $65-70K, vs the 22 at $44K. But lessors say they don't fear loss of their mod 30 customers since the 22 has a 32K core limit and no 1400 series emulation.

There's a rumor of a 360/26, which would be a stripped down mod 40 or a bigger stripped 30, not competitive with the 135. Also, watch for continued price cuts on a host of IBM peripherals. A cut on the 2314 control unit would drive the independents even tighter against the wall.

TELETYPE'S MOD 38: LAST OF THE IMPACTS?

Look for a nonimpact terminal from Teletype Corp. We hear the device won't be called a CRT terminal but a CDT (Communications Display Terminal), though the firm won't comment. It will say its new mod 38 unit with built-in modem, to be introduced at the SJCC, is probably the last highly mechanical device from Teletype, which turns its attention to electronic units. This doesn't signal an end to the popular impact terminals, a spokesman says. For example, a design team is still assigned to the mod 33 introduced nine years ago. For the next four years, production plans for the 33 will stay the same as today's rate. And that, according to industry sources, is about 5K a month.

HUGHES PUTS PRO AT DP HELM

Under new management is Hughes Aircraft's computer centers, which are undergoing a lengthy process of reorganization. With the hairy job of centralizing three facilities and cutting costs is Carl Reynolds, one-time president of Computer Usage Development Corp. Plans to centralize in Fullerton, Calif., are afoot, demoralizing many, and some top jobs reportedly have gone to Reynolds' cadre of execs. We hear a 165 will replace a 65, with possibly a second 165 taking the place of another 65 and a GE 635. It may all take 2½ years, inevitably will burn a few.

THOSE COMPUTERS OURS? NO, SAYS RCA

RCA is having tax problems in California, $1 million worth. That's the amount of property tax levied by Sacramento county over the past three years on some $8 million (assessed value) of RCA dp equipment used by the state. And there's more at stake, for the value of state-used RCA gear should go up by at least $1 million in the next fiscal year as a result of a decision to sole-source computers for the California Justice Info System, which will mean the addition of two Spectra 60s if an expected federal grant comes through. It's a question of title. RCA contends its agreements with the state are conditional sales contracts and transfer title. The county says no, they're leases, and RCA retains title and taxable interest. In a similar dispute in Orange county, RCA

lost out and paid $80K in taxes on gear leased to the county. But the case is a little different, for a county is prohibited by state law from entering into a conditional sales contract where payments extend beyond a fiscal year. The state is not. Both RCA and the county have taken their cases to superior court. Deputy county counsel Monte Fuller, handling the county's case, expects any decision to be appealed, so resolution of the issues appears a long way off. Whatever the result, it should interest Honeywell and Burroughs who have lease-purchase agreements with the state similar to RCA's and have paid their taxes quietly.

IS OCR NEXT AT INFOREX?

We hear there will be more bells'n whistles coming for Inforex's data entry equipment. OCR capability maybe? The firm won't comment, but we think so. Our educated estimate is that the Burlington, Mass., company has shipped more than 350 data entry systems, making it far and away the leader in shipments, perhaps more than double that of runner-up Computer Machinery. Moreover, we hear Inforex is shooting to multiply that figure by four by year's end.

CODASYL BROUHAHA NO LAUGH TO IBM

The brouhaha over why IBM, followed by RCA, voted "no" on the Codasyl Data Base Task Group report (see April 1, p. 19) has propelled that report into the public attention it apparently deserves. "The work to establish specifications for data base languages will have as much impact on the industry in the next 10 years as programming language efforts have had in the last 15," said one large computer user. At this writing, the report has not been widely distributed and both IBM and RCA are this month submitting their qualifying statements to the Codasyl programming language committee, which will decide the next step. Thus, specific arguments aren't yet clear.

IBM objected to implications in this column that its 71 proposals for the report were a delaying tactic. In fact, 70 were implemented and IBM's work is praised, which is why many wondered about the "no." But IBM's objections center on the lack of fundamental architectural considerations in the deliberations.

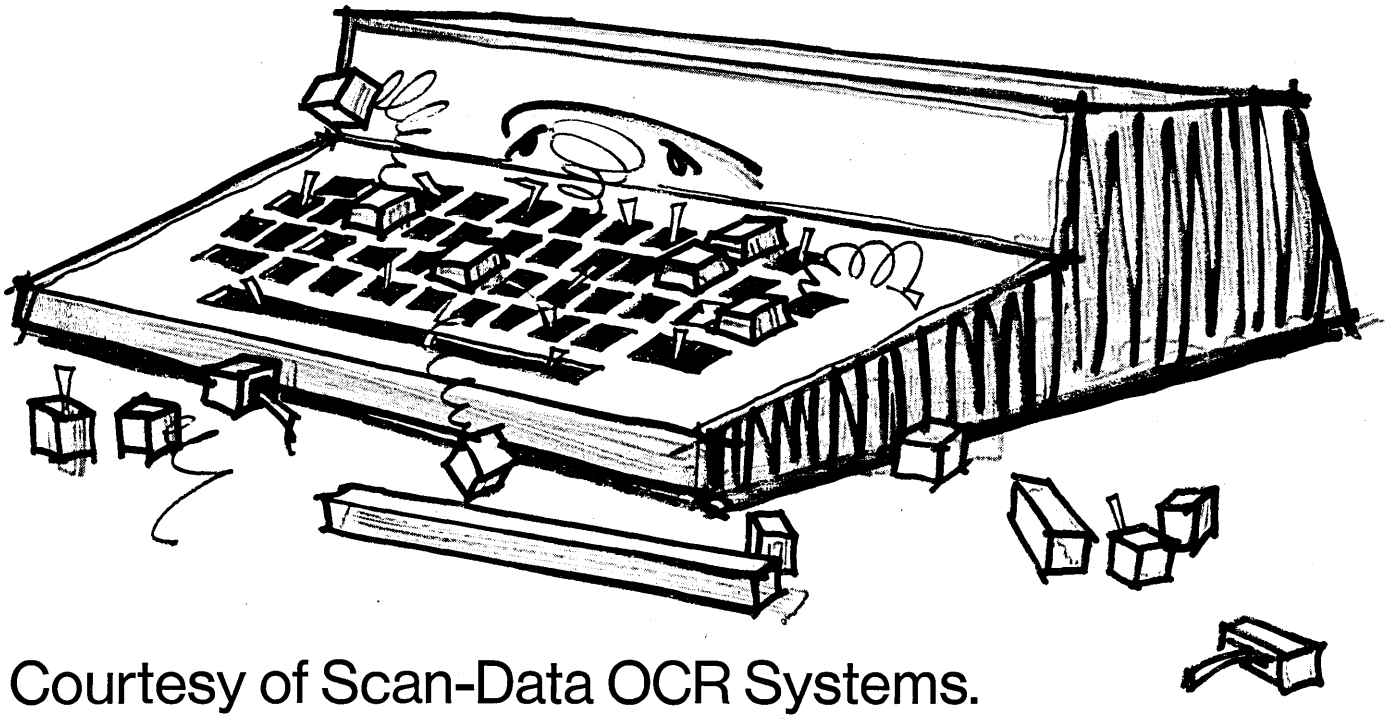
MOORE FORMING COMPUTER PLAN

Moore Business Forms has entered the computer biz. It purchased 50 of Documentor Science's self-contained, typewriter-sized computers, which read sales slips and other transaction records, and will use them as demonstrators in an initial sales effort in the L.A. and San Francisco areas. First concentration will be in the foods industry, and if all goes well will be expanded nationally and to other applications. A side benefit for Moore, as the firm's Tom Steiner says: "Those machines use lots of forms."

RUMORS AND RAW RANDOM DATA

Service bureau moguls, attending a recent industry meeting, talked about handling their budgets on the computer. Half of those queried did, but one said: "I can do it much faster manually."

the NON-KEY to success



Courtesy of Scan-Data OCR Systems.

The systems that do what you've been hoping OCR equipment would do someday—eliminate the need for re-creation of source documents.

Which means no more of the costly and time-consuming re-keying that has made OCR equipment nothing more than a promise unfulfilled.

Until we introduced SWAMI, Software-Aided Multifont Input. The world's first, and only self-teaching OCR system. That reads virtually any consistent font, even degraded characters—directly from source documents. Combined with our superior handprint capabilities, SWAMI makes document re-creation a thing of the past.

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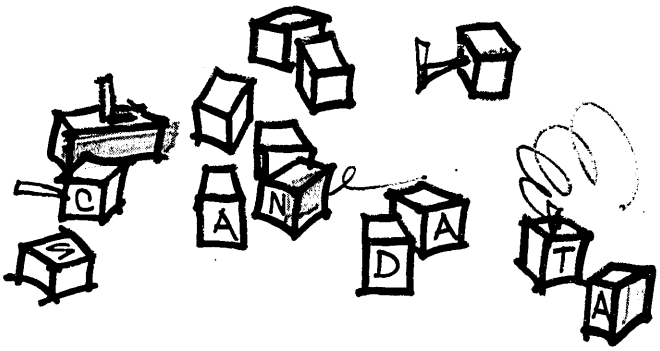

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As portable data recorders go, the three you see below leave all the others behind.

Surprisingly versatile for their size, they're yours for the taking whenever and wherever there's a need to record or reproduce analog signals.

Part of the broad line of TEAC instrumentation products, which have come a long way in worldwide business and industry over the past ten years, these portable systems are now set to go places in this country.

The smallest of our get-up-and-go trio is the low-priced R-70 Series using Philips-type instrumentation cassettes.

You can select direct or FM on any one of its four channels with a flip of a switch, or add any spoken data needed. And a light goes on to tell you when you've come to the end of your tape.

Rugged and reliable, the R-70 will operate on self-contained batteries, or on external AC or DC.

The R-200 Series Direct/FM recorder is another fine idea that you can never carry too far. In the field or laboratory, it gives you four independent record/reproduce channels, built-in calibration source, input/output level meters and a direct-drive closed-loop capstan. It performs well under mobile conditions on AC or DC and takes voice messages on one channel when desired.

It'll even follow your directions via a remote control unit. Which guarantees your always having everything well in hand.

The mightiest of our lightweights, (only 67 pounds), the R-250 Series, is made to IRIG standards. Using an FM system, it will record and reproduce analog signals from DC to 5kHz, on its ½" tape.

You can take your choice of using one or more of its seven independent channels plus one edge-track voice channel.

While a bit heftier than the R-70 and R-200, it's worth its weight in dependability, whether you're on the move or not.

For additional details on these portable recorders and other TEAC systems, write or call Ken Williamson, Director of Marketing, Technical Products, TEAC Corporation of America, 2000 Colorado Ave., Santa Monica, CA 90404. Telephone: (213) 394-0240.

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CIRCLE 22 ON READER CARD

DID AT LAST

The headaches started last June, and at first I thought it was just that awful relentless booming coming from the Northridge Noisies assembled in a yard next to that of the Wizard of Ego, the famed one-man-band nonpareil, Robert L. Patrick Hisself Esquire.

We were there to lay down preliminary plans for a new Directory that some nincompoop thought we ought to put out. Since the nincompoop had the power to enforce his whims, we thought so too.

Of course, since Patrick was involved, the Directory couldn't be just another directory. That was probably when the *real* headaches began.

We decided that this Directory ought to have some useful but easily digestible information in it about products and the companies that make them more or less available. We didn't want it to get a review like the one delivered once by a sixth grader: "This book tells me more than I want to know about rats."

And we didn't want it to tell us merely such drivel as only the names/addresses of all the companies making Glitch Removers, either.

We decided that to manipulate the information we got—to organize it and present it in the most usable fashion—we should use a computer.

That's when the headaches got bad.

This is not the place to catalog the oversights, undersights, dropped balls, misplays, miscues, mistakes, errors, and uglies that we and the friendly fellers down at the information factory pulled on each other over several months.

But it does seem the place to point out an irony: that the Editor of *Datamation*—a magazine that has almost worshipped the computer—should (after years of avoiding any connection with the beasts whatsoever) become one of its victims.

I now have a new and startlingly deep empathy with the user, a new and surprisingly deep distrust of keypunchers, programmers, analysts, computer center managers, and Big Deal computer consultants. I am also beginning to suspect that the user with a system design that is slightly less than completely clear and complete—and a design that he chooses to change whimsically midstream—may be (however small) a *part* of some of the problems facing our industry as it tries to do what it thought it could do with speed, laughter, and No Hands. No Way.

Well, the main point of all this running on is that we did survive, we did triumph, we did make our deadlines, even if there are some guys still trying to recover from lack of sleep, overdoses of chocolate donuts, and the third-shift Whydintitworkthistime Blearies. Like Directory Editor Dick McLaughlin.

The result—the 1971 Datamation Industry Directory—is now available. We've sent a bunch of free copies out to qualified *Datamation* installations, and we've got a few left over for sale to those of you who didn't qualify or who want one of your very own to play with.

The ads we're running in *Datamation* and in other publications will tell you more about why DID is really a swell thing that you will like immensely and use a lot. Some of you will see it at the Spring Joint.

In the meantime, we just wanted to let you know three things:

1. We at *Datamation* are always thinking about you. The latest proof is the 1971 DID. Designed by Bob Patrick, put together by Dick McLaughlin and a crew of computer specialists, it should be a real help to you in tracking and narrowing down the companies and products most likely to help you solve your information processing problems.

2. After all these years of talking about computers, we finally got did by one. We hope it will make us wiser and humbler than before.

3. We've already started to learn from our mistakes. First of all, there are just a few minor systems modifications we'd like to make . . .

But the *big* change will be the site of first planning meeting for the 1972 DID. Got to get away from those drums. I *still* think that's why we had so much trouble.

—R.B.F.

A fresh look at the one segment of the industry that continued to grow last year

The Minicomputers

Many significant changes have occurred in the minicomputer industry since the previous survey article by the authors in the March 1969 issue of DATAMATION. The most notable changes and trends are in lower costs, architecture, faster memories, and new technologies.

Table 1 summarizes recent minicomputer characteristics and prices for machines believed to be in production at present. The data has been updated to include the many price reductions and changes in characteristics announced by manufacturers. Because of the rapid change in the minicomputer industry and the frequent announcements of new machines, it is important to note that the computers, prices, and characteristics in Table 1 (P. 26) were current as of early January 1971. There will undoubtedly be a number of additions to the minicomputer family by the time this article reaches print. Ten of the minicomputer models included in the March 1969 survey have been discontinued, but 20 new ones have been added in this survey. Hence, 49 production minicomputer models are included in Table 1. The data on the characteristics and prices of the different minicomputers presented in Table 1 are based on information supplied by the manufacturers in response to a detailed questionnaire and updated by telephone discussions. Considerable time has been spent validating this information and trying to achieve consistency of interpretation. However, the authors cannot guarantee the accuracy of every figure and prices are subject to change without notice.

The reader is referred to the discussions of minicomputer applications and features in the March 1969 article which are not repeated here. The remainder of this article will discuss the more important changes and trends cited above with particular consideration of the future developments that can be anticipated.

With the advent of MSI/LSI logic and new memory technologies, minicomputer prices are expected to continue to drop in the next three to five years at a rate in the order of 20% per year as they have for the last five years. Table 2 shows the historical sales price trend for a basic 4K (16-bit) word memory machine. Applying this same rate of price decrease for the next five years gives the projection shown in Table 3.

The lower cost of the 8-bit word length computer, which evolved in 1968, opened many new application areas where cost had previously precluded consideration of the use of computers. The price trend projection for the 4K (8-bit) word machine over the same time period is shown in Table 4.

Architecture

Several new minicomputer organizations emphasize general purpose registers (à la the IBM System/360). New and unusual architectures are anticipated using variations of the general register theme. As register and logic costs go down, more and more effort is expended in taking advantage of this technique; hence, many new cpu features will be incorporated that have not been found in minicomputers previously.

A few of the newly announced minicomputers offer a bus structure wherein the registers, the arithmetic unit, and the memory are directly linked to external peripheral devices. With this technique each device on the bus is addressed in the same way as main memory. This tends to minimize data transfer overhead and housekeeping operations.

One important change in architecture that can be anticipated in the future as a result of wider use of semiconductor memories is in the distribution of memory among different parts of the machine. Centralization of main memory has been forced in the past by the characteristic of core memories that the

Revisited

by D. J. Theis and L. C. Hobbs

cost per bit decreases rapidly as module capacity increases. This is not true for semiconductor memories above some minimum size dictated by the basic capacity of a single silicon chip. Hence, semiconductor memories can be distributed about the machine without a cost penalty. The architectural implications of this have yet to be fully explored.

The characteristics of semiconductor memories permit different design approaches and higher speeds. For example, with nondestructive read-out, overlapped fetch and execution of instructions, and a 100 nsec LSI memory speed, 2-3 million instructions per second (in terms of internal speed, not necessarily throughput) could be achieved.

The fact that conventional control circuit logic does not lend itself to the advantages of LSI has given great impetus to the use of microprogram control. The more regular or systematic organization in a microprogrammed control structure is amenable to implementation by LSI. In addition, this approach offers much greater flexibility, including trading time for cost in implementing features such as: floating point operations, multiprecision operations, push-down stacks, sophisticated I/O routines, and specialized instructions.

Microprogram capability is very powerful in certain applications, such as communications processors, remote-batch terminals, smart terminals, and other specialized configurations, where advantages are gained by tailoring some instructions to the unique requirements of the applications.

Memory

In the past, main memory was implemented with magnetic core; however, a few manufacturers now offer semiconductor memories. MOS memory arrays are available with a 400 to 600 nsec cycle time with a potential of 150 to 250 nsec by 1975. This is in contrast to bipolar LSI memory arrays with cycle times of 150 to 250 nsec. Main memories with less than 100 nsec are expected by 1975. Faster memories are available now in small buffer sizes at higher costs. A cost differential of approximately two-to-one is anticipated between these two types of semiconductor

(The Tables of Characteristics follow on pages 26-33, text continues on p. 34.)

1965	1966	1967	1968	1969	1970
$25K	$20K	$16K	$12.8K	$10.2K	$8K

Table 2. Basic 4K (16-bit) word machine—price history trend.

1971	1972	1973	1974	1975
$6.4K	$5.1K	$4.1K	$3.3K	$2.6K

Table 3. Basic 4K (16-bit) word machine—price projection trend.

1971	1972	1973	1974	1975
$4K	$3.2K	$2.6K	$2.1K	$1.7K

Table 4. Basic 4K (8-bit) word machine—price projection trend.

Table I

The machines in this survey are listed in descending order of word length, from 18 to 8 bits.

MANUFACTURER AND MODEL NUMBER	Digital Equipment PDP-15	Computer Automation 216/116	Control Data 1700	Data General Nova 1200
MEMORY				
Memory Cycle Time, μs	0.8	2.6/1.6	1.1	1.2
Memory Word Length, Bits	18	16	16	16
Minimum Memory Size, Words	4K	4K	4K	1K
Memory Increment Size, Words	4K	4K	4K	1K, 2K, 4K
Maximum Memory Size, Words	128K	16K	32K	32K
Parity Check	Optional	None	Standard	None
Memory Protect	Optional	None	Standard	Optional
READ ONLY MEMORY	None	Optional	None	Optional
CPU FEATURES				
Instruction Word Length(s), Bits	18	16	16	16
Number of Accumulators or General-Purpose Registers That Can Be Used as Accumulators	1	1	2	4
Number of Hardware Registers Not Including Index Registers	9	6	8	10
Number of Index Registers (Hardware, Memory, or Other Technique)	1 Hardware	1 Hardware	1 Hardware 1 Memory	2 Hardware 16 Memory
Indirect Addressing (Multilevel, Single Level, or None)	Single Level	Multilevel	Multilevel	Multilevel
ARITHMETIC OPERATION CAPABILITY				
Add Time for Full Word, μs	1.6	5.3/3.2	2.2	1.35
Fixed-Point Hardware Multiply/Divide	Optional	Standard	Standard	Optional
Multiply, μs	7.4	12.6/13.6	7	8.8
Divide, μs	7.6	13.1/14.4	9	8.8
INPUT/OUTPUT CAPABILITY				
Data-Path Width, Bits	18	8/16	16	16
Direct Memory Access (DMA) Channel	Standard	Optional	Optional	Standard
Maximum DMA Word-Transfer Rate	1 MHz	625 KHz	900 KHz	833 KHz
Number of External Priority Interrupt Levels in Basic System	8	3	16	16
Maximum Number of External Interrupts	36	256	16	62
OTHER FEATURES				
Power Failure and Automatic Restart	Optional	Optional	Standard	Standard
Real-Time Clock or Internal Timer	Optional	Optional	Optional	Optional
SOFTWARE				
Assembler (1 Pass, 2 Pass, Both)	2 Pass	2 Pass	2 Pass	2 Pass
Relocatable Assembler	Yes	Yes	Yes	Yes
Minimum Core Size Necessary to Use Relocatable Assembler	8K	4K	4K	4K
Macro Assembler Capability	Yes	No	Yes	No
Real-Time Executive Monitor Available	Yes	No	Yes	Yes
Disc Operating System Available	Yes	No	Yes	Yes
BASIC MAINFRAME COSTS				
Basic System Price with 4K Words Including Power Supplies	$16,500	$7,900/ $8,490	$29,000	$5,100
Total System Price Including ASR-33 Teletype and CPU	$16,500	$10,000/ $10,500	$35,000 (ASR-35)	$6,700
Basic System Price with 8K Words Including Adequate Power Supplies, Enclosure, and Control Panel	$22,500	$12,840/ $12,290	$37,000	$7,665
Total System Price Including ASR-33 Teletype and CPU	$22,500	$14,850/ $14,300	$43,000 (ASR-35)	$9,265
PERIPHERALS AVAILABLE				
Magnetic Tape	Yes	Yes	Yes	Yes
Approximate Price for Operational Unit Including Controller and Necessary Options	$22,000	$5,700/ $10,000	$22,500	$9,900
Mass Storage Device	Yes	Yes	Yes	Yes
Approximate Price for Operational Unit Including Controller and Necessary Options	$9,750	$6,500/ $9,950	$27,500	$7,250/ $9,750
High-Speed Paper Tape Reader	Yes	Yes	Yes	Yes
Speed, Characters per Second	300	300	350	300
Approximate Price of Operational Unit	Comb. $4,800	$2,200	$4,500	$2,650
High-Speed Paper Tape Punch	Yes	Yes	Yes	Yes
Speed, Characters per Second	50	60	120	63.3
Approximate Price of Operational Unit	Comb. $4,800	$3,300	$5,100	$2,200

Data General Supernova	Data Mate Computer Systems 16	Digital Equipment PDP-11/20	Electronic Associates 640	EMR 6130	General Automation SPC-16	General Automation 18/30	GRI Computer 909
0.8	1.0	1.2	1.65	0.775	0.960	1.2	1.76
16	16	16	16	16	16	16	16
1K	4K	4K	4K	8K	4K	4K	1K
4K	4K	4K	4K	8K	4K	4K	1K, 4K
32K	32K	64K	32K	32K	32K	32K	32K
None	Optional	Optional	None	Standard	None	Standard	None
Optional	Standard	Optional	Standard	Standard	Optional	Standard	None
Optional	None	Optional	None	None	Optional	Optional	Optional
16	16	16	16/32	16/32	16/32	16	16
4	2	8	2	2	16	16	1
10	6	12	9	4	22	20	4
2 Hardware 16 Memory	1 Hardware	8 Hardware	1 Hardware	3 Hardware	8 Hardware	3 Hardware	1
Multilevel	Multilevel	Multilevel	Multilevel	Multilevel	Multilevel	Single Level	Single Level
0.8	2.0	2.3	3.3	1.9	0.96	2.4	1.76
Optional	Standard	Optional	Standard	Standard	Optional	Standard	Optional
3.8	6	4.3	18.15	6.4	9.6	12.0	10.0
6.9	7	4.8	18.975	9.6	17.8	13.2	11.7
16	16	16	16	16	16	16	16
Standard	Optional	Standard	Optional	Standard	Optional	Optional	Standard
434 KHz	1 MHz	833 MHz	600 KHz	1.26 MHz	1.0 MHz	833 KHz	570 KHz
1	8	4	7	None	3	6	16
62	64	64	64	126	64	59	64
Standard	Standard	Standard	Standard	Standard	Standard	Standard	Standard
Optional	Optional	Optional	Optional	Optional	Optional	Standard	Optional
2 Pass	2 Pass	2 Pass	2 Pass	Both	2 Pass	2 Pass	No
Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
4K	4K	8K	8K	8K	8K	4K	—
No	Yes	Yes	No	Yes	No	Yes	No
Yes	No	No	No	Yes	Yes	No	No
Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
$9,250	$13,900	$10,800	$26,500	N/A	$10,000	$18,000	$8,290
$10,850	$15,900	$10,800	$27,700	—	$11,200	$19,500	$9,900
$12,718	$20,400	$14,300	$35,500	$39,500	$14,200	$25,000	$11,530
$14,318	$22,400	$14,300	$36,700	$41,000	$15,000	$26,500	$13,140
Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
$9,900	$19,500	$22,000	$30,000/ $32,000	$35,000/ $67,200	$11,000	$14,000/ $25,000	—
Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
$7,250/ $9,750	$18,000/ $45,000	$9,750	$24,500	$20,200/ $54,700	$9,000/ $15,000	$14,000/ $30,000	—
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
300	300	300	300	300	300	300	300
$2,650	$2,000	$2,000	Comb. $8,400	Comb. $10,000	$3,000	$2,500	$2,090
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
63.3	120	50	120	60	120	60	50
$2,200	$4,000	$2,000	Comb. $8,400	Comb. $10,000	$4,000	$3,000	$1,750

MANUFACTURER AND MODEL NUMBER	Hewlett-Packard 2114B/2114C	Hewlett-Packard 2116B/2116C	Honeywell H-316	Honeywell 516
MEMORY				
Memory Cycle Time, μs	2.0	1.6	1.6	0.96
Memory Word Length, Bits	16	16	16	16
Minimum Memory Size, Words	4K	8K	4K	4K
Memory Increment Size, Words	4K	8K	4K	4K
Maximum Memory Size, Words	8K/16K	32K	16K	32K
Parity Check	Optional	Optional	None	Optional
Memory Protect	None	Optional	None	Optional
READ ONLY MEMORY	None	None	None	None
CPU FEATURES				
Instruction Word Length(s), Bits	16	16	16	16/32
Number of Accumulators or General-Purpose Registers That Can Be Used as Accumulators	2	2	2	2
Number of Hardware Registers Not Including Index Registers	7	7	4	5
Number of Index Registers (Hardware, Memory, or Other Technique)	None	None	1 Hardware	1 Hardware
Indirect Addressing (Multilevel, Single Level, or None)	Multilevel	Multilevel	Multilevel	Multilevel
ARITHMETIC OPERATION CAPABILITY				
Add Time for Full Word, μs	4.0	3.2	3.2	1.92
Fixed-Point Hardware Multiply/Divide	Optional	Optional	Optional	Optional
Multiply, μs	24	19.2	8.8	5.28
Divide, μs	26	20.8	16	10
INPUT/OUTPUT CAPABILITY				
Data-Path Width, Bits	16	16	16	16
Direct Memory Access (DMA) Channel	Optional	Optional	Optional	Optional
Maximum DMA Word-Transfer Rate	500 KHz	625 KHz	1 MHz	1 MHz
Number of External Priority Interrupt Levels in Basic System	8	16	2	2
Maximum Number of External Interrupts	56	48	50	48
OTHER FEATURES				
Power Failure and Automatic Restart	Optional	Standard	Standard	Standard
Real-Time Clock or Internal Timer	Optional	Optional	Optional	Optional
SOFTWARE				
Assembler (1 Pass, 2 Pass, Both)	2 Pass	2 Pass	Both	Both
Relocatable Assembler	Yes	Yes	Yes	Yes
Minimum Core Size Necessary to Use Relocatable Assembler	4K	4K	4K	8K
Macro Assembler Capability	No	No	No	No
Real-Time Executive Monitor Available	No	Yes	Yes	Yes
Disc Operating System Available	No	Yes	Yes	Yes
BASIC MAINFRAME COSTS				
Basic System Price with 4K Words Including Power Supplies	$8,500	N/A	$8,400	$23,800
Total System Price Including ASR-33 Teletype and CPU	$10,500	—	$10,100	$25,000
Basic System Price with 8K Words Including Adequate Power Supplies, Enclosure, and Control Panel	$13,000	$24,000/ $14,000	$11,900	$31,800
Total System Price Including ASR-33 Teletype and CPU	$15,000	$26,000/ $16,000	$13,600	$33,000
PERIPHERALS AVAILABLE				
Magnetic Tape	Yes	Yes	Yes	Yes
Approximate Price for Operational Unit Including Controller and Necessary Options	$9,500/ $15,000	$9,500/ $21,500	$23,355/ $35,430	$23,335/ $35,430
Mass Storage Device	Yes	Yes	Yes	Yes
Approximate Price for Operational Unit Including Controller and Necessary Options	$16,000/ $31,500	$16,000/ $31,500	$12,300/ $36,000	$22,300/ $36,000
High-Speed Paper Tape Reader	Yes	Yes	Yes	Yes
Speed, Characters per Second	500	500	300	300
Approximate Price of Operational Unit	$2,100	$2,100	$3,800	$3,800
High-Speed Paper Tape Punch	Yes	Yes	Yes	Yes
Speed, Characters per Second	120	120	110	110
Approximate Price of Operational Unit	$4,100	$4,100	$4,500	$4,500

Information Technology ITI-4900 (Model 20)	Interdata 4/5	IBM 1130	IBM 1800	Lockheed Electronics MAC-16/MAC Jr.	Raytheon 703	Raytheon 704	Raytheon 706
0.975/1.75	1.0	2.2/3.6	2/4	1.0	1.75	1.5	0.9
16	16	16	16	16	16	16	16
4K	2K	4K	4K	4K	4K	4K	4K
4K	2K, 4K	4K	4K	4K	4K	4K	4K
32K	32K	32K	64K	64K/8K	32K	16K	32K
Optional	Optional	Standard	Standard	Optional	None	None	Optional
Optional	Optional	None	Standard	Optional	None	None	Optional
None	Standard	None	None	None	None	None	None
16/32	16/32	16/32	16/32	16	16	16	16
8	16	2	2	1	1	1	1
16	33	7	7	6	6	6	6
6 Hardware	15	3 Memory	3 Hardware	4 Memory	1 Hardware	1 Hardware	1 Hardware
Multilevel	None	Single Level	Single Level	Multilevel	None	None	None
1.95	3.2	4.88	4.25	2.0	3.5	2.0	1.8
Optional	Opt./Stand.	Standard	Standard	Optional	Optional	Optional	Optional
10	22.8	15.67	15.25	9	14.9	7	6.3
25	38	46.36	42.75	12	24	10	9
16	8	16	16	16	16	16	16
Optional	Optional	Standard	Standard	Stand./Opt.	Optional	Optional	Optional
1 MHz	900 KHz	460 KHz	500 KHz	800 KHz	571 KHz	1.1 MHz	1.1 MHz
8	2	6	12	8/4	1	1	1
256	255	96	384	64/16	16	16	16
Optional	Optional	None	Optional	Standard	Optional	Optional	Optional
Optional	Optional	None	Standard	Standard	Optional	Optional	Optional
1 Pass	Both	2 Pass	2 Pass	2 Pass	Both	Both	Both
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4K	4K	4K	4K	4K	4K	4K	4K
Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Yes	Yes	No	Yes	No	Yes	Yes	Yes
No	Yes	Yes	Yes	No	Yes	Yes	Yes
$9,950	$8,500/ $10,500	$25,880	$47,300	$11,200/ $7,900	$15,000	$10,000	$19,000
$12,450	$10,100/ $12,100	$25,880	$50,230	$12,800/ $9,500	$15,000	$11,900	$19,000
$15,950	$11,700/ $13,700	$34,030	$55,700	$15,150/ $11,000	$23,000	$15,600	$24,600
$18,450	$13,300/ $15,300	$34,030	$58,630	$16,750/ $12,600	$23,000	$17,500	$24,600
Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
$18,000	$9,900	—	$15,620	$6,000/ $10,000	$10,500/ $28,000	$10,500/ $28,000	$10,500/ $28,000
N/A	Yes	Yes	Yes	Yes	Yes	Yes	Yes
—	$17,400	Included	$13,500	$17,000	$21,500	$21,500	$21,500
Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
300	300	60	—	300	300	300	300
$2,500	$2,500	$1,720	—	$2,200	$3,300	$3,000	$3,000
Yes	Yes	No	No	Yes	Yes	Yes	Yes
50	60	—	—	60	110	110	110
$3,000	$3,800	—	—	$2,700	$4,200	$4,000	$4,000

MANUFACTURER AND MODEL NUMBER	Redcor RC-70	Scientific Control 4700	Spiras Systems 65	Systems Engineering Labs 810A
MEMORY				
Memory Cycle Time, μs	0.860	0.920	1.8	1.75
Memory Word Length, Bits	16	16	16	16
Minimum Memory Size, Words	4K	4K	4K	4K
Memory Increment Size, Words	4K	4K	4K	4K
Maximum Memory Size, Words	16K	64K	64K	32K
Parity Check	Standard	Optional	None	Optional
Memory Protect	Standard	Optional	Yes	Optional
READ ONLY MEMORY	None	Standard	Standard	None
CPU FEATURES				
Instruction Word Length(s), Bits	16/32	16/32	16/32	16
Number of Accumulators or General-Purpose Registers That Can Be Used as Accumulators	1	3	4	2
Number of Hardware Registers Not Including Index Registers	5	10	6	2
Number of Index Registers (Hardware, Memory, or Other Technique)	1 Memory	1 Hardware	1	1. Hardware
Indirect Addressing (Multilevel, Single Level, or None)	Single Level	Multilevel	Multilevel	Multilevel
ARITHMETIC OPERATION CAPABILITY				
Add Time for Full Word, μs	1.9	1.84	3.6	3.5
Fixed-Point Hardware Multiply/Divide	Standard	Optional	Standard	Standard
Multiply, μs	6.2	6.44	17	7
Divide, μs	11.4	6.9	30	10.5
INPUT/OUTPUT CAPABILITY				
Data-Path Width, Bits	16	8/16	16	16
Direct Memory Access (DMA) Channel	Optional	Optional	Standard	Optional
Maximum DMA Word-Transfer Rate	1.1 MHz	1.1 MHz	500 KHz	572 KHz
Number of External Priority Interrupt Levels in Basic System	1	2	64	3
Maximum Number of External Interrupts	32	256	64	96
OTHER FEATURES				
Power Failure and Automatic Restart	Optional	Standard	Optional	Standard
Real-Time Clock or Internal Timer	Optional	Optional	Optional	Optional
SOFTWARE				
Assembler (1 Pass, 2 Pass, Both)	1 Pass	2 Pass	1 Pass	2 Pass
Relocatable Assembler	Yes	Yes	Yes	Yes
Minimum Core Size Necessary to Use Relocatable Assembler	4K	4K	4K	8K
Macro Assembler Capability	No	Yes	Yes	Yes
Real-Time Executive Monitor Available	No	Yes	No	No
Disc Operating System Available	No	Yes	Yes	Yes
BASIC MAINFRAME COSTS				
Basic System Price with 4K Words Including Power Supplies	$14,900	$14,800	$14,900	$18,000
Total System Price Including ASR-33 Teletype and CPU	$16,700	$16,500	$16,800	$18,000
Basic System Price with 8K Words Including Adequate Power Supplies, Enclosure, and Control Panel	$24,000	$22,300	$20,300	$23,000
Total System Price Including ASR-33 Teletype and CPU	$24,000	$24,000	$22,200	$23,000
PERIPHERALS AVAILABLE				
Magnetic Tape	Yes	Yes	Yes	Yes
Approximate Price for Operational Unit Including Controller and Necessary Options	$12,000	$24,000	$12,900	$24,000
Mass Storage Device	Yes	Yes	Yes	Yes
Approximate Price for Operational Unit Including Controller and Necessary Options	$15,000	$19,500	$20,000	$30,000
High-Speed Paper Tape Reader	Yes	Yes	Yes	Yes
Speed, Characters per Second	300	300	300	300
Approximate Price of Operational Unit	$2,500	$3,000	$3,500	$4,000
High-Speed Paper Tape Punch	Yes	Yes	Yes	Yes
Speed, Characters per Second	120		120	100
Approximate Price of Operational Unit	$4,000	$4,000	$3,950	$4,000

Systems Engineering Labs 810B	Tempo Computers Tempo 1	Texas Instruments 960	Texas Instruments 980	Varian 620-i	Varian 620-f	Westinghouse 2500	Westinghouse P-2000
0.750	0.9	1.0	1.0	1.8	0.750	0.750	3.0
16	16	16	16	16/18	16	16	16
8K	4K	4K	4K	4K	4K	4K	4K
8K	4K	4K	4K	4K	4K	4K	4K
32K	64K	64K	64K	32K	32K	64K	64K
Standard	Optional	Standard	Standard	Optional	Optional	Optional	None
Optional	Optional	Optional	Optional	Optional	Optional	Optional	Optional
None	None	Standard	Standard	None	Optional	None	None
16	16/32	16	16/32	16/32	16/32	16	16
2	2	2	4	2	2	2	1
2	7	7	8	6	6	16	16
2 Hardware	1 Hardware	1 Hardware	1 Hardware	2 Hardware	2 Hardware	2	2
Multilevel	Multilevel	Multilevel	Multilevel	Multilevel	Multilevel	Multilevel	Multilevel
1.5	1.8	6.0	2.0	3.6	1.5	2.0	5.5
Standard	Optional	None	Standard	Optional	Optional	Standard	Optional
4.5	7.0	—	6.5	10	5	5	28.6
8.25	9.0	—	8.0	12	7	7	43.8
16	8/16	16	16	16/18	16	16	16
Optional	Optional	Standard	Standard	Optional	Optional	Optional	Optional
1.33 MHz	800 KHz	1 MHz	1 MHz	200 KHz	1.3 MHz	850 KHz	300 KHz
3	4	3	3	None	None	2	8
96	256	256	256	64	64	64	64
Standard	Standard	Standard	Standard	Optional	Optional	Optional	Optional
Optional	Optional	Standard	Standard	Optional	Optional	Optional	Standard
2 Pass	Both	2 Pass	2 Pass	2 Pass	2 Pass	1 Pass	2 Pass
Yes	Yes	No	Yes	No	Yes	Yes	Yes
8K	4K	—	4K	—	8K	4K	8K
Yes	Yes	No	No	No	Yes	Yes	Yes
Yes	No	Yes	Yes	No	No	Yes	Yes
Yes	No	Yes	Yes	No	Yes	Yes	Yes
N/A	$13,800	$14,500	$16,700	$9,950	$10,500	$9,950	$10,000
—	$15,600	$16,400	$18,600	$11,750	$12,300	$11,850	$15,000 (ASR-35)
$30,000	$19,700	$19,000	$21,200	$15,850	$13,000	$14,450	$17,400
$30,000	$21,500	$20,900	$23,100	$17,650	$14,800	$16,350	$22,400 (ASR-35)
Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
$30,000	$12,000	$12,265	$12,265	N/A	$27,900	$10,000	—
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$24,000	$16,600	$23,200	$23,200	N/A	$22,500	$14,000	N/A
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
300	400	300	300	300	300	300	300
$4,000	$2,700	$2,800	$3,250	$2,900	$2,900	$2,200	$3,000
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
100	120	60	60	60	60	120	60
$4,000	$4,100	$3,000	$3,450	$3,300	$3,300	$2,900	$4,000

MANUFACTURER AND MODEL NUMBER	Zerox Data Systems Sigma 3	Digital Equipment PDP-8/E	Digital Equipment PDP-8/I	Digital Equipment PDP-8/L	Honeywell 112
MEMORY					
Memory Cycle Time, μs	0.975	1.2	1.5	1.6	1.69
Memory Word Length, Bits	16	12	12	12	12
Minimum Memory Size, Words	8K	4K	4K	4K	4K
Memory Increment Size, Words	8K	4K	4K	4K	4K
Maximum Memory Size, Words	64K	32K	32K	8K	8K
Parity Check	Standard	Optional	Optional	Optional	Optional
Memory Protect	Optional	Standard	Standard	Standard	Optional
READ ONLY MEMORY	None	None	None	None	None
CPU FEATURES					
Instruction Word Length(s), Bits	16/32	12	12/24	12/24	12
Number of Accumulators or General-Purpose Registers That Can Be Used as Accumulators	6	1	1	1	2
Number of Hardware Registers Not Including Index Registers	2	4	4	4	9
Number of Index Registers (Hardware, Memory, or Other Technique)	8 Hardware	8 Memory	8 Memory	8 Memory	None
Indirect Addressing (Multilevel, Single Level, or None)	Multilevel	Single Level	Single Level	Single Level	Single Level
ARITHMETIC OPERATION CAPABILITY					
Add Time for Full Word, μs	1.95	2.6	3.0	3.0	7.63
Fixed-Point Hardware Multiply/Divide	Optional	Optional	Optional	None	None
Multiply, μs	7.80	3.3	4.8	—	—
Divide, μs	8.12	3.9	5.2	—	—
INPUT/OUTPUT CAPABILITY					
Data-Path Width, Bits	16	12	12	12	12
Direct Memory Access (DMA) Channel	Optional	Optional	Optional	Optional	Optional
Maximum DMA Word-Transfer Rate	850 KHz	833 KHz	666 KHz	625 KHz	295 KHz
Number of External Priority Interrupt Levels in Basic System	4	1	1	1	1
Maximum Number of External Interrupts	64	64	64	64	16
OTHER FEATURES					
Power Failure and Automatic Restart	Optional	Optional	Optional	Optional	Standard
Real-Time Clock or Internal Timer	Optional	Optional	Optional	Optional	Optional
SOFTWARE					
Assembler (1 Pass, 2 Pass, Both)	2 Pass	Both	Both	Both	2 Pass
Relocatable Assembler	Yes	Yes	Yes	Yes	No
Minimum Core Size Necessary to Use Relocatable Assembler	8K	8K	8K	8K	—
Macro Assembler Capability	Yes	Yes	Yes	Yes	No
Real-Time Executive Monitor Available	Yes	No	No	No	No
Disc Operating System Available	Yes	Yes	Yes	Yes	No
BASIC MAINFRAME COSTS					
Basic System Price with 4K Words Including Power Supplies	N/A	$4,990	$12,800	$8,500	$5,250
Total System Price Including ASR-33 Teletype and CPU	—	$6,490	$12,800	$8,500	$6,950
Basic System Price with 8K Words Including Adequate Power Supplies, Enclosure, and Control Panel	$24,000	$7,990	$16,300	$13,200	$7,910
Total System Price Including ASR-33 Teletype and CPU	$24,000	$9,490	$16,300	$13,200	$9,610
PERIPHERALS AVAILABLE					
Magnetic Tape	Yes	Yes	Yes	Yes	Yes
Approximate Price for Operational Unit Including Controller and Necessary Options	$25,000	$24,700	$24,700	$24,700	N/A
Mass Storage Device	Yes	Yes	Yes	Yes	Yes
Approximate Price for Operational Unit Including Controller and Necessary Options	$26,000	$8,700	$8,700/ $15,700	$8,700/ $15,700	N/A
High-Speed Paper Tape Reader	Yes	Yes	Yes	Yes	Yes
Speed, Characters per Second	300	300	300	300	300
Approximate Price of Operational Unit	Comb. $12,000	$2,000	$2,000	$2,000	$3,000
High-Speed Paper Tape Punch	Yes	Yes	Yes	Yes	No
Speed, Characters per Second	120	50	50	50	—
Approximate Price of Operational Unit	Comb. $12,000	$2,000	$2,000	$2,000	—

General Automation SPC-12	Interdata Model 1	Motorola MDP-1000	Business Information Technology BIT-483	Computer Automation 208/808/108	Micro Systems 800	Micro Systems 810	Varian 520/i
2.0	1.0	2.16	0.98	2.6/8.0/1.6	1.1	1.1	1.5
8	8	8	8	8	8	8	8
4K	2K	4K	1K	4K	1K	1K	4K
4K	2K	4K	4K	4K	1K, 4K	1K, 4K	4K
16K	16K	16K	64K	16K	32K	32K	32K
Optional	Optional	None	Optional	None	Optional	Optional	Optional
None	Optional	None	None	None	Optional	Optional	Standard
Optional	Standard	None	None	None	Standard	Standard	None
8/12/16	16	12	8/16	8/16	16	8/16/24	8/16
4	1	4	1	1	15(8)	2	7
8	—	9	11	8	15(8)	4	7
3 Hardware	15 Memory	3 Hardware	None	None	—	1 Hardware	1 Hardware
Single Level	None	Single Level	Single Level	Multilevel	None	Single Level	Single Level
4.2	3.0	4.32	2.3	5.3/24/3.2	10	10	4.5
None	None	None	None	None	None	None	None
—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—
8/12	8	8	8	8	8	8	8/16
Optional	Standard	Optional	Standard	Standard	Optional	Optional	Optional
430 KHz	1 MHz	400 KHz	1 MHz	68/25/120 KHz	910 KHz	910 KHz	660 KHz
2	2	2	8	3	None	8	3
256	256	64	32	64	—	64	11
Optional	Optional	Optional	Standard	Optional	Optional	Optional	Optional
Standard	Standard	Standard	Optional	Optional	Optional	Optional	Optional
1 Pass	Both	2 Pass	2 Pass	2 Pass	—	Both	2 Pass
Yes	Yes	Yes	Yes	No	—	No	Yes
4K	4K	4K	N/A	—	—	—	4K
No	No	No	Yes	No	—	No	No
Yes	No	Yes	Yes	No	No	No	No
No	No	No	Yes	No	No	No	No
$5,000	$4,950	$8,500	$9,010	$5,190/ $4,990/$5,490	$4,650	$6,430	$6,000
$6,200	$6,150	$9,700	$9,010	$7,200/ $7,000/$7,500	$5,850	$7,630	$7,400
$8,400	$7,350	$11,500	$11,250	$7,790/ $7,690/$8,090	$6,750	$8,530	$8,500
$9,600	$8,550	$12,700	$11,250	$9,800/ $9,700/$10,100	$7,950	$9,730	$9,900
Yes	Yes	Yes	Yes	Yes	No	No	Yes
$11,000	$9,900	$18,000	$18,700/ $22,500	$5,700/ $10,000	—	—	$9,000
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$6,000/ $15,000	$17,400	$12,000/ $19,500	$7,390	$6,500/ $9,950	N/A	N/A	N/A
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
300	300	300	300	300	300	300	300
$3,000	$2,500	$3,000	$2,500	$2,200	$2,750	$2,750	$2,900
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
120	60	120	60	60	110	110	60
$4,000	$3,800	$4,000	$3,950	$3,300	$3,000	$3,000	$3,300

memories. Since the memory costs are 40% or more of the total mainframe costs, performance and cost improvements in memory technology will significantly influence architectural trade-offs and mainframe costs.

Semiconductor technologies (e. g., microprograms or firmware) for memories of a few hundred words' capacity providing storage for control functions are particularly suited to this technology. A few of the recently announced small computers have the entire program stored in a read-only memory. Semiconductor or plated-wire memories, which are NDRO (nondestructive-read-out) devices, will be used for this function in the future. MOS read-only memories are available with 256 to 1024 words. However, microprograms stored in this type of memory must be programmed at the manufacturer's facility and cannot be easily changed in the field. In the future, as an extension of this technique, an alterable (read-write) semiconductor or plated-wire memory will be used for storing microprograms and other control functions in the same way that read-only memories are used in several machines at present. This technique will permit using the same kind of memory technology with the possibility of storing microprogram operations in the same memory as data and the main program.

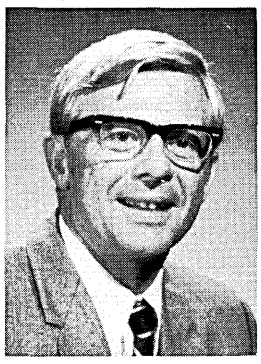
In general, memory speed is a limiting factor on the basic operation speed of a computer. Logic circuits are usually readily available that are more than capable of matching any available memory speed in minicomputers. Hence, several companies are now designing the cpu logic organization in a way that permits upgrading memory by interchanging memory modules. Although the capability of minicomputers is heavily dependent upon the memory technology used, it is important to note that for given circuit and memory speeds the performance and capability of a minicomputer are significantly affected by the organization or architecture and the instructions and functions implemented in the machine. There are many cases where a minicomputer with a memory speed slower than that of another outperforms the latter because of the greater capability in its architecture and the logical implementation of functions such as arithmetic operations, interrupt operations, and input/output control functions.

New technologies

Small computers available today are implemented with magnetic core matrix memories and bipolar integrated circuit logic. However, a number of companies are actively working on small computers using semiconductor memory and MOS logic arrays and some of these have been announced. The MOS (metal oxide semiconductor) device utilizes surface effects and is fabricated by growing oxide layers and depositing metal layers on a semiconductor surface rather than by the multiple diffusion processes used for conventional bipolar LSI arrays. The question of which semiconductor technology to use becomes very important, since the trend toward LSI (large scale integrated) logic and memories is being accelerated. MOS devices provide a higher component density in a given area silicon chip and require fewer processing steps than bipolar devices. Hence, many manufacturers in the semiconductor and computer industry believe that MOS devices will offer a lower cost approach to implementing computer memory and logic functions in LSI arrays. This is especially true for applications where speed is not paramount.

In general, MOS devices are slower than bipolar—typically by a factor of between two-to-one and five-to-one. On the other hand, MOS devices presently enjoy a significant cost advantage over bipolar. The present state of development permits larger MOS arrays than bipolar LSI arrays on a single silicon chip. The trade-off made for this high density and lower cost is one of speed. For large-scale, high-speed computers, bipolar LSI arrays are more attractive because of their speed, but the factor of speed is not as important as cost for minicomputers. Hence, MOS technology may dominate the minicomputer field for the future if satisfactory yields, reliabilities, and stability over long life periods are proven. However, because of the extensive development of bipolar devices for other applications, bipolar LSI technology has a significant potential advantage. Bipolar LSI technology will likely benefit with more extensive research and development efforts. Hence, the two technologies may approach the same cost asymptote in the future. If that occurs, the inherently higher speed of bipolar technology will become the deciding factor.

In the next few years, as the "computer on a chip" becomes a commercial reality, "general purpose" microcomputers will become an integral part of instruments, modems, terminals, and many other devices. These microcomputers will not be external pieces of equipment, but rather will be an internal (built in) part of the device itself. As technology advances continue, we can expect the microcomputer to be followed by the picocomputer—but that's the subject of another article (see DATAMATION, April 1975). ■



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Mr. Hobbs is president of Hobbs Associates, Inc. He was previously with Aeroneutronic as manager of dp engineering and has also held positions with Univac and RCA. He has a BSEE from Georgia Tech, an MSEE from the Moore School, Univ. of Pennsylvania, and an MBA from the Wharton School of Pennsylvania.

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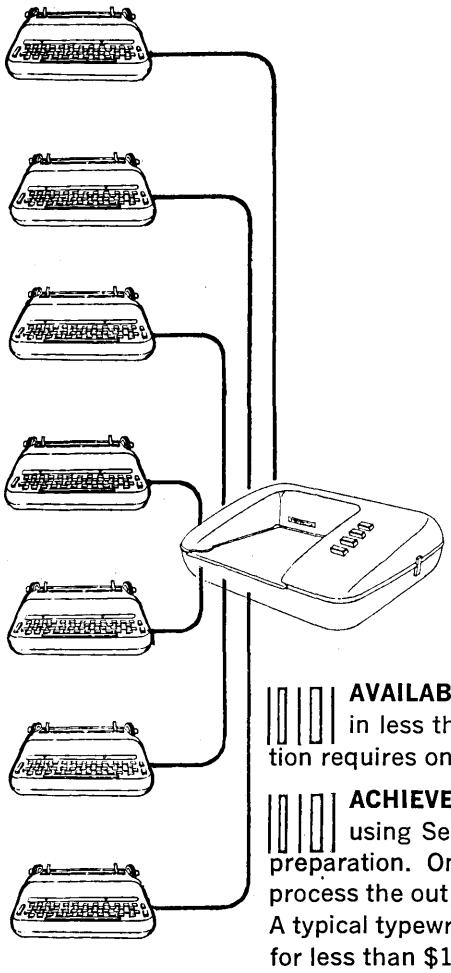

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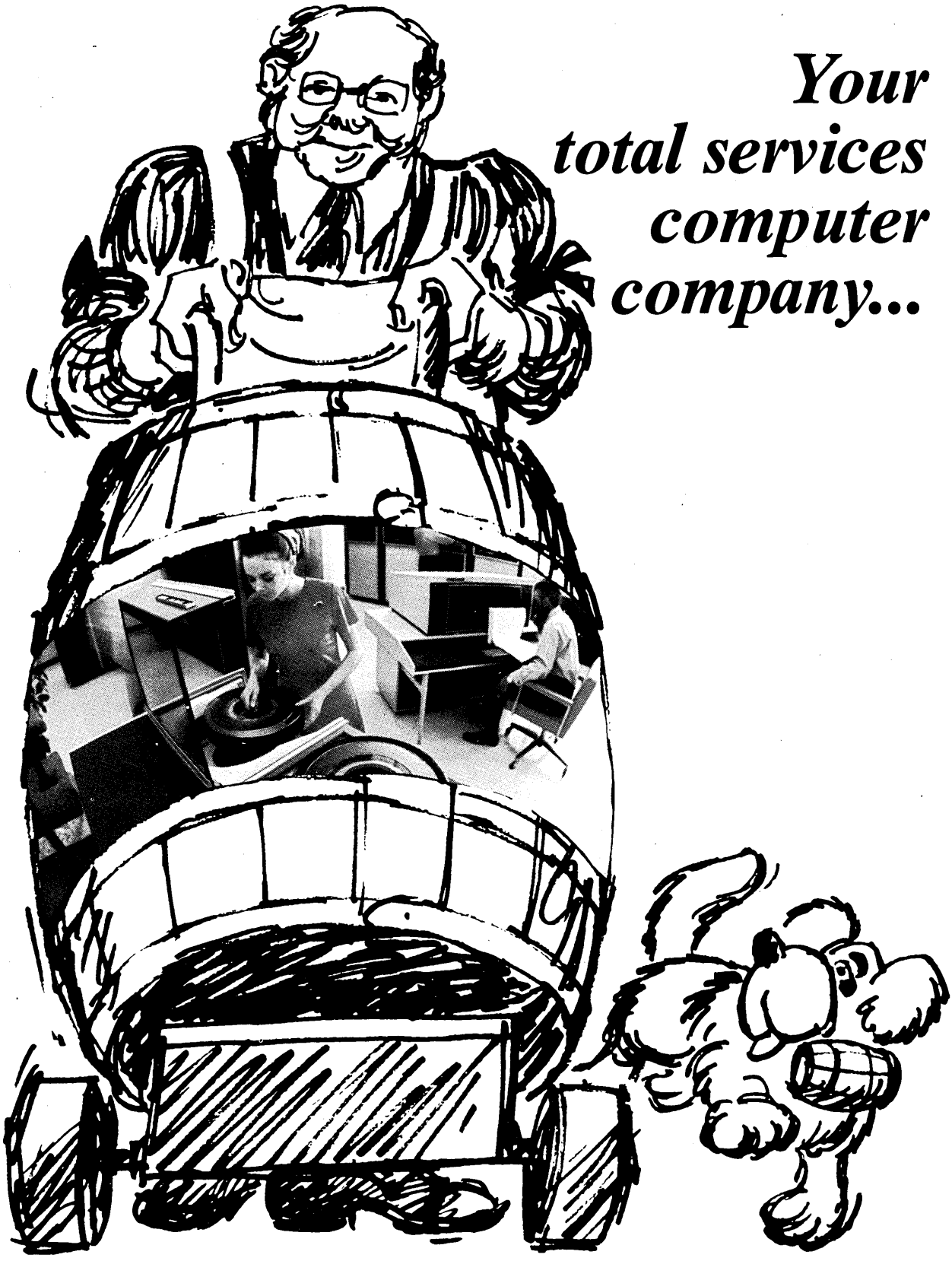

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CONTROL DATA
CORPORATION

So it didn't work out, but Viatron made one of the boldest and most ingenious tries that the industry has seen so far

The Rise and Fall of

In early 1970, Viatron Computer Systems Corp. maintained a tight lid on news of its operations. The firm was in registration, having just successfully sold $25 million worth of convertible debentures to the public. The secrecy, however, only served to heighten interest in Viatron with the result that when the lid was removed, the information that was released over the next several weeks hit with a heavy impact.

There was something for everyone, it seemed. For the skeptics who doubted that Viatron's System 21 would sell, there were 50,000 letters of intent. For the semiconductor industry, there were contracts in excess of $70 million. For those who were worried how Viatron would accommodate its huge projected growth, there was a new leased facility of nearly 160,000 square feet at the firm's Bedford, Mass., headquarters and new manufacturing plants in Hong Kong and Indianapolis; and Viatron reported "negotiations are underway for increased manufacturing in Japan." Furthermore, Viatron announced that the Hazeltine Corp. and Amphenol would assemble System 21s at Long Island and in Binghamton, New York, plants. For those concerned about new products, there was an exciting new semiconductor memory and a family of optical character readers—complete with claims that both product lines were 10 times cheaper than competitive products. And, most important of all, for the financial community, there was a comforting announcement "that for the first time in its short history, the Company is not concerned about money."

On paper, it was all pretty heady stuff. On paper.

In a few months time, in the summer of 1970, those 50,000 letters of intent virtually vanished—to the point where no one knew how many orders Viatron had and one man who looked at the company's list of orders could detect firm orders to purchase just seven System 21s. The semiconductor industry, instead of holding $70 million in Viatron contracts, was holding millions of dollars in Viatron accounts receivable. And worse, the semiconductor companies were preparing to sue. Plans to use the new facilities in Bedford, Indianapolis, Long Island, Binghamton, Japan, and Hong Kong were abandoned. New product development was dropped as the company struggled desperately to perfect its old products. And the money. Viatron was suddenly very concerned indeed—panicked might be a better word—about money, because it was disappearing fast. In fact, another $100 million was needed. And, finally, there was perhaps the unkindest cut of all: Viatron's high-flying stock had plunged from $62 to less than $2.

What happened? Talk to 100 different people and you get 100 different opinions. Most would agree, though, that what Viatron tried to do represents one of the most imaginative and daring—and unorthodox—business endeavors in the history of electronic data processing. In addition, it represents one of the most spectacular busts in the history of electronic data processing.

"You can start small and you can stay small, and you can die small," says Dr. Edward M. Bennett, former Viatron president and its guiding light. "Or you can start big, and you can grow bigger and you can die but you die a little bigger than you would have otherwise." Viatron fits the latter pattern, of course, although there is hope that the firm, which filed under Chapter XI of the Bankruptcy Act, can continue as a viable business in one form or another in the future.

The data processing game is controlled to a large extent by the International Business Machines Corporation, the consensus being that the extent of control is 70%. The traditional approach for survival in the industry by others, whether they be large mainframe manufacturers or small independent peripheral makers, is to carve out niches under the IBM Fortress. Viatron, which, from its start, possessed a drive to be different that one might call neurotic, decided that it would build its own fortress. ("By 1972, we plan to have delivered more digital machines than have previously been installed by all computer makers," said Dr. Bennett in mid-1969.)

Dr. Bennett's stone and sling was something he called the System 21, a modular low-cost system that was designed to spread data processing throughout an organization rather than have it all done in central processors. He envisioned "a catalogue of desktop pieces" that would digitize the analog functions of offices and, in the process, take over the movement of paper.

"As far as I'm concerned, the IBM approach to data processing is over," Dr. Bennett has said. "It was killed by the Japanese. Viatron's actions were all patterned after one man's belief of how the Japanese

computer industry will emerge in the U.S. I saw Viatron as the principal force that the Japanese would have to move against."

In its basic configuration, as a stand-alone data entry station, the System 21 consisted of a keyboard, two tape recorders, a microprocessor, a video display and a parallel data channel. The thing that electrified the industry was that Viatron placed a monthly rental price of $39 on that configuration. Beyond the basic configuration, the system could be built up into a wide variety of data entry systems or into data communications systems. (Most potential users viewed the System 21 as a keypunch or teletypewriter replacement.) Viatron maintained its low pricing structure on all configurations, but there were danger signals from the start that the company would have to gear up into mass production quickly if it hoped to keep its low pricing schedules when deliveries began.

Viatron

by W. David Gardner, New England Editor

Bennett learned the basic concepts behind System 21 from his experience at The MITRE Corp., the government-sponsored think tank at Bedford, Mass., where he had worked for nearly nine years. At MITRE, Bennett had been manager of Air Force Project AESOP (Advanced Experimental System for On-Line Planning), which MITRE describes as "a general purpose approach to real-time, direct access management information systems." Descriptions of AESOP and System 21 are remarkably similar and, indeed, in a summary of the Air Force project in 1966, Bennett wrote: "Although the basic prototype system was developed for use in military command and management planning and information systems, its philosophy and concepts are applicable to industrial and academic organizations."

Viatron was formally organized in November of 1967 with Bennett joining the firm in January, 1968. With him from the start was Dr. Joseph Spiegel, who many regarded as Bennett's alter ego. Spiegel had headed AESOP's engineering group at MITRE. During 1968 and 1969 Bennett and others at Viatron went on cherry-picking expeditions at MITRE, luring some 50 key people over to Viatron, which by that time had set up its headquarters across the street from MITRE. (One joke that made the rounds was that prospective employees could change jobs from MITRE to Viatron without changing car pools.)

While there were certain advantages in having a heavy representation of ex-MITRE people in the upper reaches of Viatron management, there were certain potential problems, too. MITRE is a nonprofit organization. Viatron aspired to profitability, of course, but there were indications from the start that while everyone at Viatron wanted to be profitable, many Viatron executives had difficulty shaking that MITRE governmental nonprofit mentality. As for MITRE, while the think tank was not overjoyed at the exodus of many of its top people to Viatron, the feeling was that a successful and profitable Viatron could be a fine advertisement of a government and defense spin-off that became a commercial success.

While Bennett had earned high marks as a scientist and manager at MITRE and, before that, as a member of the faculty of Tufts University for about eight years, it became abundantly evident when he left MITRE that he had at last found his true calling: He was a born hustler of venture capital. Members of prestigious Wall Street institutions—houses that tended to look upon new computer companies with the same skepticism with which they viewed uranium mining ventures—were impressed enough by Bennett and his "deal" that they backed his venture and helped raise additional funds for Viatron. As for Bennett, he always made it clear that his venture would require an enormous amount of money, although in hindsight one wonders whether anyone including Bennett really grasped precisely how much financing Viatron would need to do what the company said it would do. "The question," said Bennett recently, "was always whether you could get financing. And as soon as you did get financing, then the question was whether you could get it again."

Bennett went after the best people on Wall Street and he got them. Among the very first investors in Viatron who bought stock at 50 cents a share were a group from one of the most prestigious houses on Wall Street, Dillon Read & Co., Inc., an old line investment firm that traces its blue blood genealogy on Wall Street back more than 140 years. Although Dillon Read did not get involved in Viatron as a corporation, some of its employees invested as individuals and the name of the Wall Street firm came to be linked with Viatron. (Later, when Viatron stock rocketed to more than $60 a share—giving the Dillon Read investors an appreciation of some 12,000% on their 50-cent Viatron stock—Wall Street was rampant with tales of their success story, since they were multimillionaires on paper. However, they apparently had to hold their stock as it dropped back, since it was restricted.)

There was, of course, an extremely high element of risk in Viatron and Bennett never attempted to hide the risk involved. He once explained it like this: "Everybody who invests in a new company knows that he's shooting craps. He writes it off when he makes the investment. What he's looking for is the big win."

Indeed, the more speculative a prospectus, the more attractive a situation could look.

Viatron got a blue chip underwriter, Shields & Co., which, besides having a prestigious name, had a reputation for being extremely successful. In 1969, for instance, when Shields underwrote Viatron's public stock and convertible debenture offerings, Shields earned $10 million on gross income of $32.4 million.

In 1968 and in 1969, that segment of America that deals in and buys stocks and bonds and is sometimes referred to as "the financial community" was on the lookout for speculative deals and stocks that had the potential of becoming high flyers. The speculative fever was at its height then. Indeed, the more specu-

lative a prospectus, the more attractive a situation could look. Warnings that there might never be dividends, that the competition was fierce, that there was no patent protection, that there might be legal suits filed against the company—all these tended to titillate investors. Excited investors were lulled into a sense of safety because a negative prospectus only seemed to prove to them that the company was aware of all the potential pitfalls. "Very often," said Bennett, "if you promise enough risk, enough loss and enough catastrophe, the guy that you're talking to is going to start

"There's no experience doing a Viatron . . ."

to wonder about whether you're hiding something from him."

At any rate, Bennett found it was relatively easy to raise money, whether through public or private means. Most of Viatron's initial financial nut of $800,000 came from the founders and their families. Later, the first group of outside investors came up with more than $2 million in a private placement. The first public stock offering raised $12 million and, in December of 1969, Viatron sold $25 million of convertible debentures. All told, Bennett raised about $40 million for Viatron.

It wasn't just the speculative fever that enabled the firm to raise money. Much of the credit has to go to Bennett. The concept of System 21 represented a sharp departure from the traditional approaches to data processing and it's doubtful whether an individual from a traditional edp background could have grasped the concept well enough to sell others on the idea. As Bennett said recently: "There's no experience doing a Viatron. I know of no computer or business experience that prepares you for it. The kind of experience you've had conditions you to do what you've done before. I just don't know who had the experience to do what Viatron was trying to do."

Bennett's credentials were somewhat unusual. Besides his experience at MITRE, already noted, Bennett was associate director of the Bio Mechanics Laboratory at Tufts, a small, but first-rate New England college. He had a degree in electrical engineering from MIT and had been a member of the Electrical Engineering Department faculty at Purdue University where he received his doctorate—not in electrical engineering, but in psychology. To this day, there is a whiff of the academician about him, Professor Bennett dressed in a dark business suit and vest. His irrepressible wit and his ability to express complicated scientific and financial matters articulately and simply were another asset. Virtually everyone who dealt with him—from his associates to his competitors—was impressed with his intellect, with what one man who entered into a series of negotiations with him referred to as Bennett's "massive raw intelligence." But there were indications that his agile mind may have been too agile: Bennett had a way of changing Viatron's basic business plan at a dizzying pace.

When Viatron threw out the IBM data processing rule book, it had to produce its own book. Viatron's substitute plans represented innovations, and innovations, particularly when instituted by a new and untried company, are generally greeted with skepticism. Such was the case with Viatron's efforts to push the production of MOS circuits for its System 21 and, also, its plan to forego a large marketing force and drum up sales through an aggressive and gigantic advertising campaign.

Well, Viatron blitzed with an advertising campaign the likes of which the data processing industry had never seen before, and Viatron quickly became the most talked about company in the industry with the exception, of course, of IBM, which is always the most talked about company in the industry. (The talk on Viatron, though, wasn't restricted to its products. A conversation about Viatron—whether it was in 1968 or 1971—typically started like this: "Are they going to make it?") At any rate, Viatron was able to convert its advertising and promotional campaign into letters of intent for orders numbering some 50,000 or, if one counted what Bennett once called "the lunatic fringe," orders for 100,000 systems.

As for Viatron's plans to use MOS, the idea at first had all the attractiveness of the bubonic plague. Viatron's hopes to utilize metal oxide semiconductor devices in its systems immediately conjured up memories of Victor Comptometer's highly-publicized flop in attempting to use MOS in one of its electronic calculators. The semiconductor industry simply couldn't come up with the devices for Victor in 1967 and the widespread feeling in 1968 was that if Victor Comptometer couldn't do it, then Viatron couldn't either.

But Viatron did do it.

Nearly all of the leading semiconductor houses in the country—possibly fearing they could be left behind as Viatron led the drive into production of the new technology—made heavy and costly commitments in developing custom MOS devices for Viatron. In addition, Viatron built its own microelectronics facility at great expense. By demonstrating its own commitment to MOS by building its own facility, Viatron certainly proved to any doubtful semiconductor houses that it was serious about MOS. Also, by having its own microelectronics design and manufacturing capability, Viatron could better control the design and purchasing of the circuits.

It is probably impossible to fix an exact pricetag on the development of Viatron's MOS devices, but it undoubtedly was very expensive—$5 million, $10 million, maybe even $15 million. The estimates vary. (In an example of Bennett's resiliency and adaptability which were to become his hallmarks at Viatron, he believes that the right technology now is custom bipolar devices, although he feels that MOS was the right technology at the time Viatron was starting up.) In short, however, Viatron licked the MOS problem, although many feel the enormous expense wasn't worth it. In an exhaustive and extremely bullish report on Viatron by the highly regarded consulting firm of Arthur D. Little, Inc., the verdict was that Viatron's design and development stage went remarkably smoothly. The report was dated December, 1969. Although the cost of the MOS development was high, there was a feeling that all would be well if the company could get the System 21 into mass production.

(The second and concluding part of this article will appear in an early issue.) ■

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*Supplied standard with unit: One 64 character font with 5 x 7 dot matrix.

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Also Sprach Von Neumann

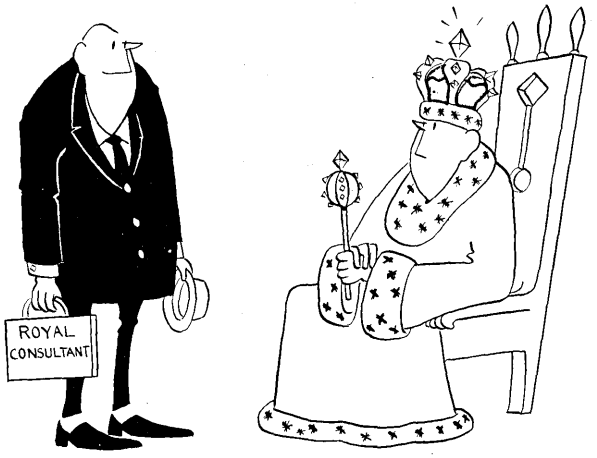
CHAPTER FIVE

by Eric Blodax

with illustrations

by Stew Burgess

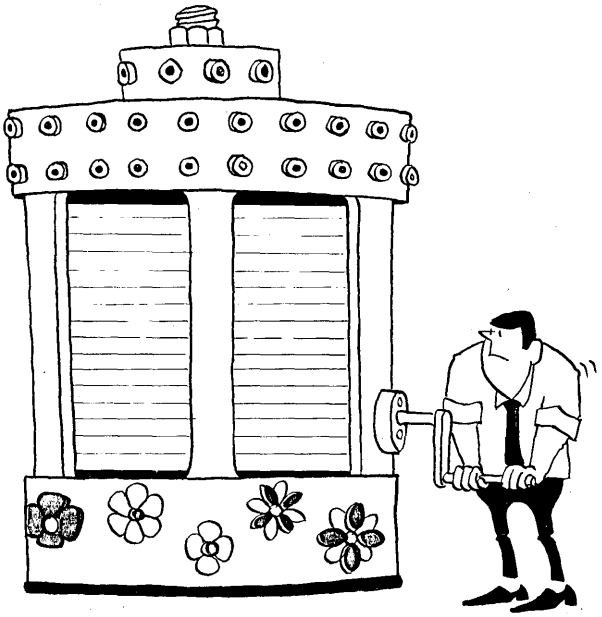
GTHE PRECEDING EVENTS: The author, beginning his career in computationative sciences at the Airship Foundry, is drawn, through some celestial alchemy, to the vast and vertical hierarchy of the Intelligible Assurance Society. This call from Valhalla proves to be false. The author returns to the mundane and simple idiocy of the Airship Foundry to lurch forward in pioneermanship as one of the early day system builders. Having gotten a system actually to work, he is



called forth from the ranks to work on a gigantic proposal for a ballistic missile system.

The proposal effort for the Hammerhead missile was as well organized as most such things at the Airship Foundry. Six-hundred-eighty-seven disgruntled engineers were assigned to the proposal, and support, leadership, and unity of purpose were sometimes notable for their absence. There was no absence of ridiculous scheduling. I managed to miss six months of Saturdays at home, plus half of the Sundays and all of the holidays. Nine-thirty p.m. was an early hour at which to shut it down on any evening.

In spite of the apparent disorganization of our



effort, we came in with a winning proposal. The competition was more inept than we were. Along with most all hands who participated in the Hammerhead proposal, I was rewarded with an incentive bonus consisting of a bag of sunflower seeds and a pat on the head. I also had a new position on the Hammerhead missile project with an opportunity to work longer hours at no increase in pay.

This unnerved me sufficiently so that I began to lay

plans to launch into a new career. It seemed that anyone with the qualifications of a working system and a winning proposal behind him was surely qualified to be an independent consultant. This seemed to be a most desirable thing. Had I known then what I know now, I might not have thought so.

Summoning all my nerve, I wrote a series of letters to all the high-ranking people I could think of who had come to see the Stratobarn system work. The replies were mostly notable for their nonexistence. But a letter did come from Harley Corrall, General Manager of the Computer Division of Ibex Corporation. He offered me a consulting contract with a minimum, covering a period of time. The moment had come. I was a free-lance consultant.

Ibex Corporation was a conglomerate before the word had been invented. They had the Light Bulb Division, the Indoor Plumbing Division, the Cannon Breech Division, the Farm Tractor Division, and many other divisions. The Computer Division, under Harley Corrall, reported up through the senile Group Vice President, Electronic Technology, who also had radios, circuit breakers, dry batteries, and Crookes tubes. This Group V.P. continually gave Harley fits of ulcers by his view of the Computer Division as "a bunch of upstarts."

Harley himself had come out of the dry battery operation, and had, in fact, once written a thesis on battery design, but he was so harrassed, though an otherwise competent manager, that he had no time to learn much about digital computers, and was, as a result, highly susceptible to a well-planned bum steer.

Ibex sold a lovely, rugged, and slow drum computer. They had built a modest but tidy cross-section of users, and were doing somewhat well.

Through some series of corporate indecisions, a ukase had been issued calling upon the Computer Division to come forth with a next generation machine as a faster replacement for the drum box. The architecture of this new entry was somewhat ill-defined. Rumors out of the back room, which engineering tried hard to keep locked, indicated that there was something there looking suspiciously like a brontosaurus.

At that particular time, system software was the latest something every manufacturer had to supply (or thought he had to). Ibex Computer had no experience with system software. All they had was Jack Blam in a cubby-hole corner office. He kept track of serial numbers of programs in the "users' library."

Ibex had set out to build a system software effort. The job obviously required someone of stature. But in Ibex, stature was synonymous with seniority, and seniority extended company-wide. Thus it was that Enoch Dewlap was called from the research laboratory of the Plastic Bag Division to head system software at Ibex Computer.

Enoch Dewlap had zero background in anything relating to programming. He also refused to look at anything done so far. He preferred to reinvent the world, doing it his way this time.

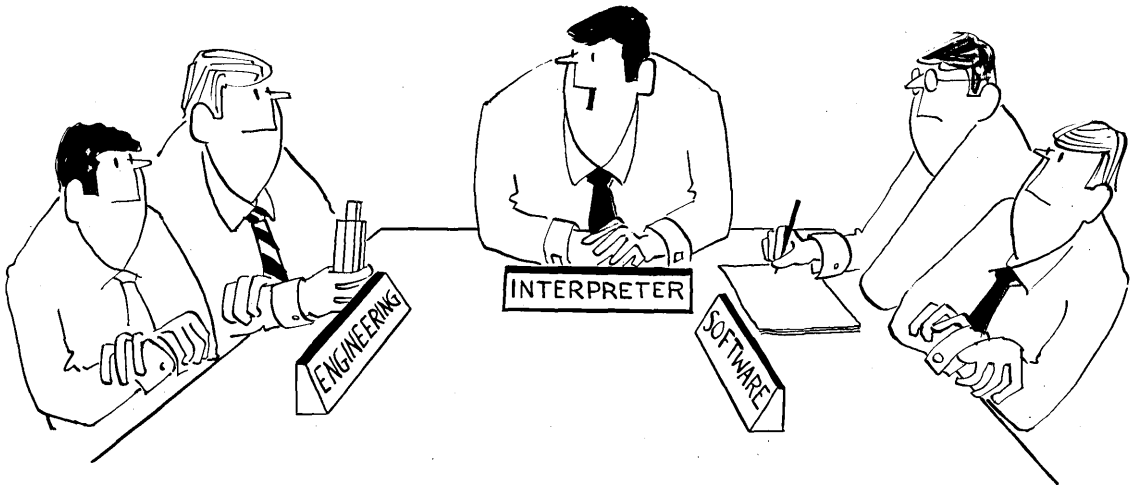
Harley Corrall apparently had some suspicions that not all was going smoothly, for he gave me as a first assignment the liaison between software and engineering. Fred Moxie, the Chief Engineer of Ibex Computer, was a different sort than Enoch Dewlap. He was quiet, polite, and reticent. It took a bit of time to discover that, in Fred's engineering department, there was room for only one genius, and Fred himself filled that chair.

I launched into this first assignment with vigor, but met with almost immediate frustrations. Typical conversations with Enoch went like this:

"That sounds very elegant, Enoch, and surely very learned, but so far, to the best of my knowledge, programmers have not written source code exclusively in Greek alphabet notation."

"Then they've been making a stupid and ridiculous mistake which is probably indicative of the kind of clod who's been permitted to do this important work in the past."

Liaison meetings which I carefully set up between software and engineering (Enoch had so much seniority that software did not report to engineering) were ghastly. Fred Moxie was apt to say only two words per hour, and these were said with an obvious sneer. Enoch Dewlap delivered a six-hour tirade in which he stated unequivocally that the new circuitry which programmers wrongly called "interrupt" should, of course, be called "interruption" by any literate person.



I reported to Harley Corrall that all did not indeed seem well, but during the report he had a bad ulcer

twinge, and I am not sure he heard.

With little improvement in the software-engineering interface, Harley assigned me to sooth the marketing troops, or find out what was in their craw. Since the schedule had been continually slipping for months, and orders kept getting booked, slid and canceled, the whole market crew had a motto called "the hell with it." Those not out job hunting sat around and played bridge. Since I was a poor bridge player, I had a hard time establishing much rapport.

Harley's particular target of ulcerated venom was Ben Pewter. He headed the department, under marketing, which was supposed to produce the slick support literature, as opposed to the raunchy engineering specs. Since he was getting zero input from the technical troops, Ben Pewter had very little to do except revise drum computer manuals.

Harley kept calling me into his office.

"What does that son of a bitch do?" he would ask.

"Well, Sir, I . . ."

"I haven't seen that son of a bitch do anything for three months. Next week I think I'll can him. Do you think I ought to can him?"

"Well, I . . ."

"I ought to kick his ass out in the parking lot. Next week I think I'll do that."

About the week that Harley looked mean enough actually to carry out his threat, Ben Pewter resigned, solving one of Harley's problems. He became the new president of Checki-Ticki, a computerized credit rating service that enjoyed instant and outstanding success.

The world of Ibex Computer was so disturbing to me that I began to look about for a larger assortment of consulting contracts to take the place of what I believed must be the forthcoming Ibex disaster. Some of the operational and strategic problems of the consultant began to make themselves known to me.

A free-lance consultant, usually not having unlimited overhead, has his office in his home, possibly in a corner of what his wife believes is her sewing room. From this vantage point he must make all his phone calls. To book work he needs to call chief engineers, secretaries, general managers, vice presidents, and presidents. Many such people are not available at first, second or Nth call. Therefore the consultant must leave word, and trust that some of the pieces of cast bread will float back into the harbor.

As it frequently happens, when the president of General Motors, say, does actually return the call, consultant is indisposed. His six-year-old son takes the call and says something like:

"My Daddy is in the bathroom, and I can't write. Goodbye, man."

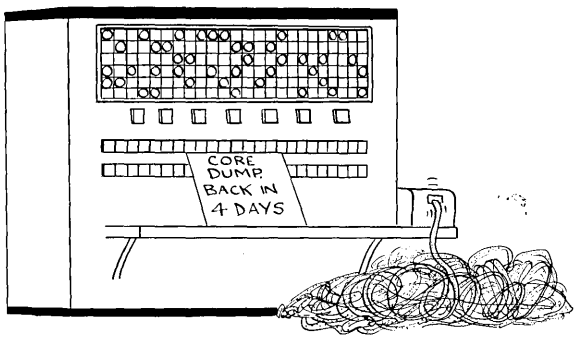
By the time the lightning struck Ibex Computer, I had negotiated a contract with Bloptex Industries. Meanwhile, Harley Corrall resigned from Ibex, having found a much more suitable job which cured his ulcers. The Ibex Corporate hatchet man was assigned to manage the division, which he promptly sold at an exorbitant price to the Financial Mother Corporation.

Bloptex Industries was a major contractor on the SATSCAN System. This was a way-out development in which a series of satellites in orbit squirted out data on command. The military ground installations collected the information and computed the very kazoo out of it.

While Bloptex was prime computer and software contractor, the whole program was monitored for the military by the Research Laboratories of Abercrombie Institute, acting as System Manager. Like many "contractors" who do not spend their own money, Abercrombie Research Labs took a completely arbitrary and high-handed view of the whole project.

The Bloptex Computer was militarized, ruggedized, and homogenized. It was built in a cast-iron box and had a weird opcode set. In the SATSCAN system in which it resided, there was most restricted input and output consisting primarily of punched tape. This made things like assembly or memory dump take days rather than minutes.

Software for SATSCAN was late and error-ridden. Dr. Grinch, the Lab Director, was ominously threatening to cancel Bloptex on the software part of the contract. I got him to defer this decision till a more



appropriate time by finding an error in the math model which had been supplied by Abercrombie Labs.

Meanwhile, Bloptex Management agreed to put their first team on the problem. We set up a round-the-clock attack.

The satellites orbited over the Abercrombie Lab at odd hours. We stood by at one in the morning for a particular satellite pass. When it came over the horizon, we collected data for some fifteen minutes. Then we had to punch out a complete dump to insure that the reception had been properly done.

However, listing the raw record gave a most unintelligible listing. We had the Lab's large, commercial computer, a TINHAC II, standing by to reformat and list on its high-speed printer.

We started tape reading. At a half-mile or so of tape in, the TINHAC went down. We called the customer engineer.

At 4:30 in the morning, he got TINHAC back on the air. Once more the reading was begun. At about 17 feet into the punched tape, reading stopped with no apparent sign of trouble. We looked on in amazement and exasperation. The customer engineer shook his head. He started opening his tool kit and unlimbering his scope. Then someone noticed that John Steam, boy programmer extraordinary, was standing on the punched tape where we had conveniently dumped it on the floor to be read.

Not all consulting contracts involved tight schedules or near-disasters. My contract with the System Division of Pianissimo, Inc., came off quite well. The computer system which Pianissimo supplied to a

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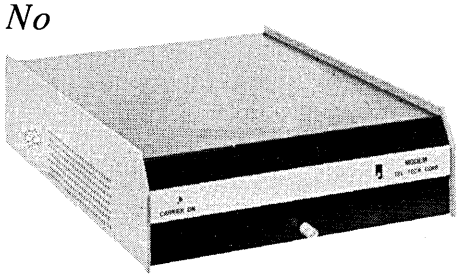
Why decide between a 201A and a 201B? Get both. The Tel-Tech 201A/B data set gives you all the features, capabilities, and compatibilities of both a TT-201A and a TT-201B—in one compact unit . . . and for the same low price of a TT-201B alone.

A simple mechanical jumper switches the modulation scheme from Bell compatible 201A to 201B. In the 201A mode the data set operates half duplex over the dial up net at 2000 bps. Switched to 201B operation, the set can be used at 2400 bps on C2 conditioned lines over 4-wire full duplex. It will also operate 2-wire half duplex or 2-wire simplex circuits in both modes.

The TT-201A/B is available in both end user and OEM configurations—it can easily be built into a high speed terminal, giving customers a choice of dial or dedicated service.

Bell compatible 201A? Or 201B? Get a Tel-Tech 201A/B. *No question.*



11810 Parklawn Dr.,
Rockville, Md. 20852
(301) 933-8170

TEL-TECH CORP.

In Canada: Canteltech, Ltd.

foreign government was required to pass a 24-hour acceptance test without glitch. The best it had done so far was five hours, and the foreign government was holding up a few million bucks in payments, which made Pianissimo very nervous indeed.

The software was supplied by the foreign government, and a careful examination indicated that there was an error in it. The record also indicated that there was no test procedure at Pianissimo, and no history of the abortive previous attempts to pass acceptance.

With the background of the Stratobarn system it was a simple matter to build a test procedure which Pianissimo could follow, defining the conditions of their attempts to pass the test. After the software error was corrected, there were two successive hard errors in test passing attempts, resulting in 12- and 17-hour runs successively.

Board changes took care of the hard error, and the third attempt produced a successful 24-hour run, all within three weeks after the concerted effort began.

I never succeeded in getting another consulting contract from Pianissimo.

One learned, in following the consulting route, that many contracts are not to do what may commonly be considered "real" things. Some clients want to buy an outside corroboration of their own ideas. This is, apparently, to convince their own management that they must be on sound ground, since someone outside the company concurs.

Other clients seek an outside hatchet man. They need someone not in the company on whom to pin the recommendation that Flub-up Freddie should, at last, be laid off, and that his department which has done nothing for ten years might be disbanded without harm to the corporate structure.

Still other clients want an outside opinion or study so that they can disregard it and do exactly what they had intended to do in the first place. This gets them off the hook of acting arbitrarily, or failing to pay any attention to other points of view.

There are other hazards that the consultant can learn to avoid. To every employee of any technological company, the world of the consultant looks like an endless green pasture. In the outsider's view, the consultant comes in occasionally, offers a few, high-level opinions, and sends an exorbitant bill which is paid in full within thirty microseconds. Such a person does not realize, apparently, that the consultant is apt to be his own sales force, accounting department, secretary, and overhead pool.

Phone calls from would-be joiners are one bane of the consultant. The friendly fellow who has met consultant on the job calls and indicates he would be willing to join up. He has no experience booking clients, and would, of course, need a steady 30K annual guarantee, but can start most any time.

Demands for free recruiting are another plague of the free-lance consultant. These fall into two categories. There is the fellow seeking an employee with particular characteristics, and he would be happy if consultant would keep it in mind, and, of course, not devote more than a week or so to the problem. The alter ego of the employee-seeker is the guy looking for a job who wants free referrals and touting service.

These people apparently have not heard that the world is full of employment agencies, executive search firms, and other similar people who are in the business of recruiting—for a fee, of course. The statistics show clearly that such agencies are in ample proportion to the employable population, and that any one, picked at random, is apt to be equally incompetent when measured against any other.

Another source of travail to the consultant is the professional man in some foreign field, such as medicine or law. Such a person, usually being moderately wealthy from charging fees that consultant would consider sinful, has some kind of axe to grind, and some kind of small nest egg to invest.

"Let's rush ahead," Doctor, for instance, will say, "and set up an electronic board manufacturing plant in South Israel. The government will pay for 206% of the capital investment, the profits will be enormous, and I'll put up the rest of the capital."

It is useless to explain that Doctor doesn't know an electronic board from a busted stethoscope or a bent tushi. Nor can he find South Israel on the map. He has read something in the biweekly publication, "Hot Tips for the Investing Practitioner," and he is off on cloud nine, ruining consultant's evening with endless phone calls.

Another plague is the professional loser who has just skidded down the tubes for the seventeenth time. He has, let's say, just gone broke in consultant's neighborhood where he ran an incompetent taxicab service.

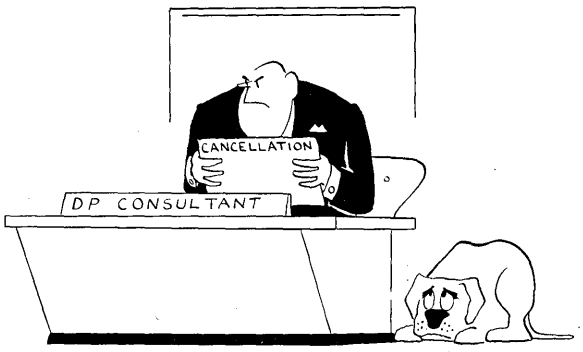
He calls on consultant, humbly:

"I have," he says, "a great idea for a new, electronic taxicab. All I need is a little backing . . ."

There is one rule that the consultant must carve in stone and learn to follow faithfully:

Free Advice Is Worth the Price!

Consulting can be a rewarding and interesting career, but it has built-in frustrations. The consultant

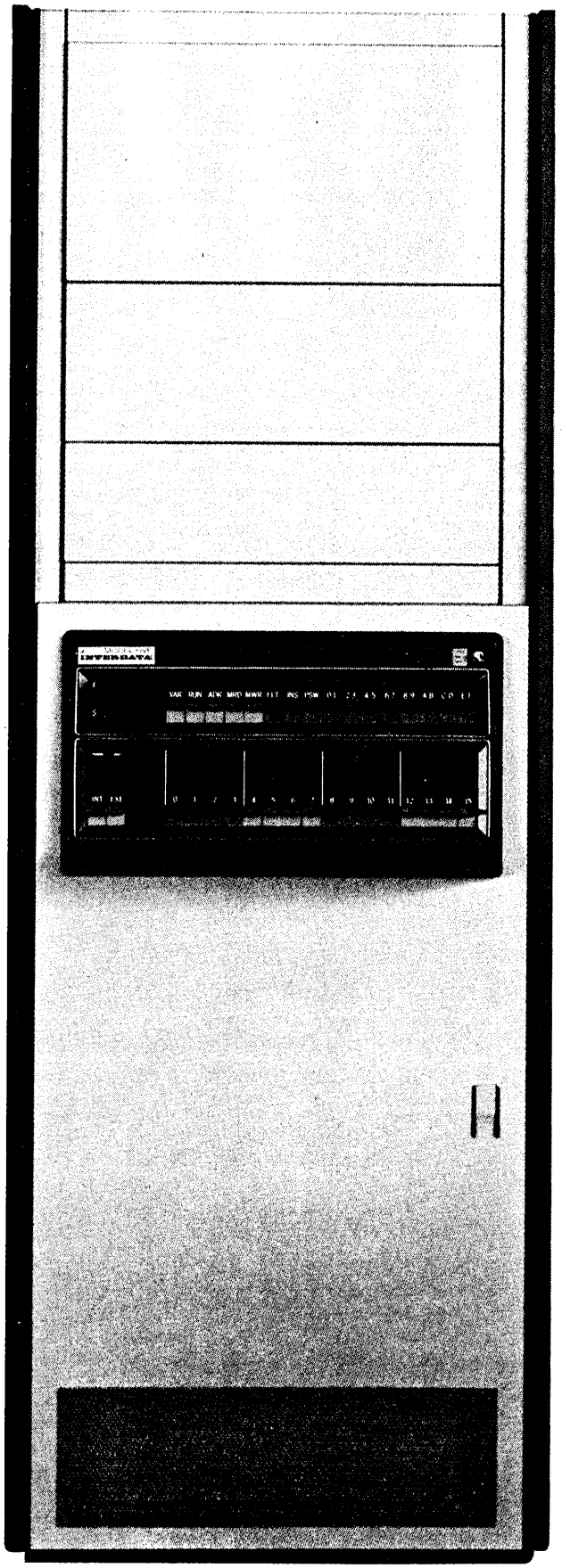


will do well to have an old dog that he can kick, or a stone wall in his yard to throw bottles at.

For the consultant, while he may have many things, has no authority. He can make nothing happen in his client companies. He can only suggest and attempt to persuade. He can reason, and argue, and view with alarm. He can draw up plans and studies, but he cannot order anything done. Such a world can bring feelings of frustration and impotence that are only partly dispelled by the cushioning effect of the received receivable, if the client should remember to pay.

The feeling of accomplishment earned in the occasional Pianissimo contract is, of course, the kind of thing that makes it all worthwhile.

(Chapter 6 will appear eventually.) ■



Price: $10,500*

Performance:

The Interdata Model 5 minicomputer makes the power of a systems computer available to the OEM.

Why it can do the job. The Model 5 optimizes throughput with its comprehensive I/O package. Programmed block I/O. Automatic I/O. Cycle-steal selector channel I/O. Plus masking capability for immediate interrupt and low overhead automatic service.

Its software is systems oriented. A Real Time Operating System (RTOS) for multiprogramming, simultaneous I/O operations, interrupt acknowledgement and automatic scheduling. And a Basic Operating System (BOSS) for single task system control.

What makes it so efficient. The Model 5's fast floating point arithmetic operations save subroutine storage and linkage. Store and restore operations are reduced by 16 general purpose registers. And greater core efficiency is realized through its 16-bit and 32-bit instructions.

Why it's easy to work with. The Model 5 cuts coding and debugging time because its powerful set of 113 instructions include many which are multi-functional. Of its 16 general purpose registers, 15 can be used as index registers. All core memory is directly addressable. And programming is made easier by the automatic interrupt, supervisor call instructions and floating point arithmetic.

Why interfacing is so simple. The Model 5 can control up to 256 devices, yet has only 27 I/O lines for you to worry about. And you can get general purpose I/O boards and low-cost daughter boards to conveniently modify many existing controllers.

How it assures high up-time. The Model 5 optional system protect package keeps you on the air with memory parity, privileged instructions, memory protect and power fail/auto-restart.

How you can find out more. About the Model 5, its complete line of peripherals or the other members of the Interdata family of minicomputers. Call or write Interdata, 4 Crescent Place, Oceanport, New Jersey 07757. (201) 229-4040.

*Quantity discounts available. 20 units, for example, cost only $8,400 each.

The Interdata Model 5

The unparalleled boom in new company start-ups is at an end... there seem to be good reasons why

New Business Boom:

The mid- to late-1960s saw an historically unparalleled growth in the number of new companies formed in technology-oriented fields. Between 1965 and 1969, more than 4,000 companies, mostly in computer-related areas, but also in such fields as lasers, communications, integrated circuitry, and automatic control were established, received financing, and undertook operations. The apparent success of former colleagues who had left large companies to become stock market millionaires through participation in new ventures, and the relative ease of obtaining financing for new business in technology areas, led a large number of individuals to become entrepreneurs with hopes of making a great deal of money very quickly.

The attractiveness of the venture area to potential entrepreneurs was further increased by a growing economy that seemed capable of supporting an unlimited number of new competitors, especially in the computer field, and an over-the-counter stock market that seemed to place a premium on the publicly traded securities of young companies in technology fields. In fact, the stock market was so tantalizing that investors raced to participate in companies whose businesses they did not understand, whose activities were unprofitable, and whose potential, if examined carefully, showed little promise. They did this in many cases because they had access to stock at the initial offering price to the public and, in the late '60s, such stock could be counted upon to provide a very high return in a short period of time.

What has happened to the many companies that were formed during this period? Faced with a deteriorating economy, increased competition, and the advent of tight money, virtually all of these enterprises have experienced extreme difficulty in remaining viable and gaining the additional financing that is often required by young companies beyond the initial capitalization. Many have had trouble surviving and, in fact, a great number of these ventures are currently in bankruptcy proceedings or have simply disappeared. The more fortunate ones have been merged into larger companies, but generally at unfavorable terms, and most often simply to escape bankruptcy.

To say the least, the experiences of these companies have been disappointing to entrepreneurs as well as investors and have led to questions concerning the reasons for their getting into trouble. The problems are numerous and vary from situation to situation, but it seems safe to say that entrepreneurs as well as investors must share the blame for the current situation.

The major weakness exhibited by entrepreneurs was that they often did not have a realistic understanding of what it means to operate and manage a business. Attracted by the apparent successes of former colleagues who had started their own ventures, these entrepreneurs founded companies for which a market need did not exist, and often went into business areas that they knew best, but that did not offer the greatest business opportunities. Among the significant problems that existed with these companies are the following:

Technological management operation. Management often had a strong technological orientation that emphasized products at the expense of marketing and other general business considerations. Most small companies lacked a realistic marketing approach and the resources necessary to develop and implement a viable marketing plan. These weaknesses were often manifest in the selection of products for which there did not exist real market opportunities. For example, within an 18 month period 35 companies entered the minicomputer field, with products that were in general quite similar to each other. While most of these companies emphasized what they considered to be the advanced technological characteristics of their products, it was in fact the ability to produce reliably relatively large quantities of machines, and to offer marketing support to existing and potential customers, that differentiated the few more successful competitors, such as Data General and General Automation, from most of the other companies in the field.

Weak financial know-how. Management lacked strong capabilities required for financial planning, cost control, and the raising of funds. These weaknesses manifested themselves in a lack of definitive corporate objectives, large amounts of capital being expended without anything of importance being accomplished, and an inability to raise capital in an effective manner. Small companies often became associated with underwriters and other sources of capital that were opportunistic, unreliable, and not suited

Requiescat in Pace

by Barry Weinberg

to their needs. The major consideration was taking the company public at the earliest opportunity. This often turned out to be the worst thing that could happen to a small company, since it placed tremendous requirements on management and made it virtually impossible to raise capital at a later date. Of course, these underwriters were most often unable to help when the company got into trouble. Those relatively few companies that established relationships with dependable sources of capital have, for the most part, been able to obtain additional financing in spite of tight money considerations.

Small companies often became associated with underwriters and other sources of capital that were opportunistic . . .

Poor business planning. Most small companies lacked a realistic business plan that gave sufficient consideration to longer term factors. Too often a company was founded on the basis of offering one or two products, and no thought had been given to what role the company would play when the end of product life had been reached. This was typical of the more than 100 companies that entered the computer terminal field in recent years, because there seemed to be a need for a terminal device with specific characteristics. They failed to recognize that all terminal manufacturers would eventually have to offer products that were very similar in nature and completely overlooked the ease of entry into these fields by other ventures, with the result that they were unprepared for the intensity of competition that developed. Because of this situation, it is extremely difficult for a small company to establish a long term position of strength in the terminal field.

Lack of objectives. Management was often unable to establish a proper set of objectives for the business, and this resulted in a lack of priorities. Too many projects were often started without any accomplishments being realized, and there was a lack of direction toward specific objectives when it came to allocation of resources. Typically the managements of these companies were unable to make decisions in a professional way on alternatives that were available, such as building up the marketing force vs. developing a new product. Perhaps the perfect example of this situation is the now infamous Viatron Computer Systems Corp., which experienced losses of more than $18 million in its last three years. Before shipping any reasonable quantity of its first product, the System 21 computer terminal, the company announced two other families of products, and was said to have more than 30 separate R&D projects under way in its laboratories.

While most of the blame for the recent failures of young companies lies with management, investors have also played a key role in creating the environment in which those failures have occurred.

Much of the recent investor interest in venture capital, the practice of investing in high-risk, start-up type situations, arose from the spectacular successes of a relatively few such investments. One example constantly cited is the case of American Research and Development, whose early investment of about $60,000 in Digital Equipment Corp. had a recent market value of nearly $250 million. Other big venture investment winners include Scientific Data Systems, Teledyne, Memorex, Polaroid, and Control Data. The attraction of these successes had brought a variety of financial institutions (many not experienced in, or qualified for, making venture type investments) into the field, and led to the financing of many new companies that should never have been established. A major interest of these investors (including investment banking firms, insurance companies, banks, and hedge funds, as well as individuals) was to have the company go public at the earliest possible date, so that their investment could be withdrawn when desired. The greatest concern of these investors was generally not the welfare of the company, but rather a stock play for large capital appreciation in a relatively short period of time. The availability of a large number of unsophisticated sources of venture capital created an environment in 1968, 1969, and early 1970 characterized by the following:

High securities prices. Prices paid by investors for small company securities were disproportionately

high with respect to the potential offered by the company. This often led inexperienced entrepreneurs to have an unrealistically high opinion of the value of their companies, and led to great difficulties when it came to subsequent financing, especially as money became tight. For example, it was not uncommon to find a few men with an idea, but no product yet developed, raising money for a start-up in the computer terminal field based on a value of $2 million for the company. Such men often drew large salaries from their young companies, and in essence experienced none of the personal risk that is normally associated with entrepreneurial activity.

Weak company evaluation. Many start-ups received financing without sufficient prior investigation on the part of the investors. Investors did not understand the businesses in which the companies were involved, and in their rush for venture situations, often overlooked the effect of increased competition caused by the sudden entry of a large number of competitors. These investors, many of whom should have known better, evaluated companies on the basis of their quick public underwriting prospects, without taking into account either potential technological changes or the substantial differences that existed in capabilities among companies in the same field. One of the reasons that this was not done, of course, is that traditional investors tend not to be capable of evaluating technology-oriented start-ups. Indicative of the weaknesses is the fact that in 1969 and early 1970, Channing, Rothbard & Weinberg, Inc., reviewed about 400 venture capital situations for its clients, only about 10 of which met its investment criteria; yet all but perhaps 30 easily identifiable losers received financing from one source or another.

. . . traditional investors tend not to be capable of evaluating technology-oriented start-ups.

Lack of involvement with investments. Investors showed an unwillingness or inability to work with small companies and make available to them nonfinancial resources such as management assistance and marketing advice subsequent to making an investment. This type of assistance is of extreme importance to a young company no matter how good the prospects for its success are. Many investors simply did not have the capabilities or technological know-how to provide such assistance. Other large institutional investors, such as insurance companies, whose investments in venture type situations were small relative to their total investments, were unwilling to commit large numbers of man hours to the care and feeding of their young ventures.

Investors, many of whom should have known better, did things that were irrational even with respect to their own situations. They created a boiling over-the-counter stock market, supported by less than ethical underwriters, in their rush to invest in young technology companies, that allowed enterprises with no economic viability to go public six months after founding, and to achieve premium prices. The opportunity for venture investors to achieve liquidity so quickly attracted additional enterprises and investors and created a vicious circle that ended only with the total collapse of the over-the-counter market as an outlet for young companies.

The difficulties experienced by most venture capital investors have recently created a condition in the money markets in which it is extremely difficult for a young or start-up company to get capital. This is true in spite of the fact that certain fledgling companies are promising and deserve to receive financing. Most investors, however, are unable to differentiate between companies in technology fields, and have chosen, to all intents and purposes, to withdraw from making venture type investments—at least for the present. As a result of the problems that they have experienced, financial institutions have been showing a tendency to place venture capital funds into the hands of specialized professionals who understand the venture field, and have specialized talents in the market areas in which such investments are made. This seems to be especially true for technology fields, where the concepts involved in a small company or start-up situation tend to be esoteric for the traditional investor. While this may improve the environment for start-ups in the future, it seems certain that entrepreneurs, in establishing a business, must ensure that the following conditions are met:

1. The business is based on the existence of a market whose need is met by the product or services offered.
2. The enterprise has a proper balance of product line, marketing, and management capabilities, as opposed to an over-emphasis of the product and its technology.
3. There exists a realistic business plan defining the objectives of the company and the approach for accomplishing those objectives.
4. There is available adequate financing provided by investors who understand the business and are in a position to offer continued financial and nonfinancial support.

Meeting these conditions, while not ensuring success, will go a long way toward overcoming the kinds of problems that have been experienced in the past. ■

Mr. Weinberg is currently president of Channing, Rothbard & Weinberg, Inc., an investment advisory firm specializing in areas of high technology. The firm identifies and evaluates investment opportunities in these areas for various financial institutions. Prior to founding Channing, Rothbard & Weinberg, Inc., he worked in the management consulting and computer fields. He is a graduate of MIT with BS and MS degrees in electrical engineering, and has the MBA degree from New York Univ.

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If anybody offers you a price that looks better than ours, you'd better make sure you know exactly what you're getting.

We've just built a low-priced FDM data transmission system that's the best value on the market: the GTE Lenkurt model 25C. Go inside and take a look around . . . you'll find intermixable speeds from 110 to 600 baud. You'll find a built-in 20 mA local telegraph interface for on-premises printer applications. You'll find local/remote test features and a built-in carrier alarm lamp. You'll find it meets TTL, S-level and EIA/CCITT interface standards. And you'll find all the quality and precision we've been known for during 25 years of building data transmission systems.

The 25C comes as an attractive single-channel subset. Or the same duplex channel unit can be shelf mounted — up to 8 channels per shelf with a maximum of 18 channels (110 baud) on each VF line. So it lets you use just one voice channel rather than a lot of data lines. And it lets you do it at a very reasonable price. Add to that the 25C's economy of maintenance and you end up with a bundle of savings.

Write GTE Lenkurt Incorporated, Dept. C720, 1105 County Rd., San Carlos, CA 94070. We'll send you all the inside information.

GTE LENKURT

Virtual memory is the
RCA's new computers

Virtual memory. A lot of people are talking about it, asking for it, and getting it.

But not with an IBM 370. They don't have it.

RCA has it. We've had it working for some time now. Working so well we put it in our new computers. RCA 3 and RCA 7.

RCA pioneered in virtual memory. But what does that do for you?

Virtual memory makes a computer work as though its memory were unlimited.

Which means it's hard to outgrow. And one of the main reasons most 360 users have to move to larger, more expensive computers is that they outgrow memory.

trend of the future. have it. IBM's don't.

An RCA computer with virtual memory can do the work of a larger IBM computer with regular memory.

And work on more kinds of things. You can do regular batch jobs at your computer site, pipe work in from across the country, and put your people on time sharing terminals—all simultaneously.

With all that capacity, our virtual memory RCA 3 and RCA 7 are highly efficient.

Many regular memory systems get bound up by lack of memory and so don't work at full efficiency.

35% of the orders for our new RCA series are for computers with virtual memory.

It's practical right now. RCA 3 is about half the price of any previous virtual memory system.

RCA 7 is equal to or better than IBM's regular memory 370/155 in price/performance, and has sophisticated time sharing capabilities the 155 doesn't have.

Virtual memory is the future of the computer business. A lot of people already need it. So we're making it. For you. Now.

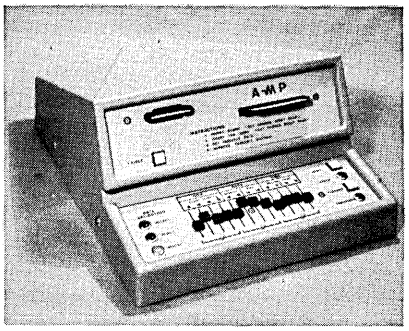
RCA
COMPUTERS

SJCC 71

ATLANTIC CITY
MAY 18, 19, AND 20

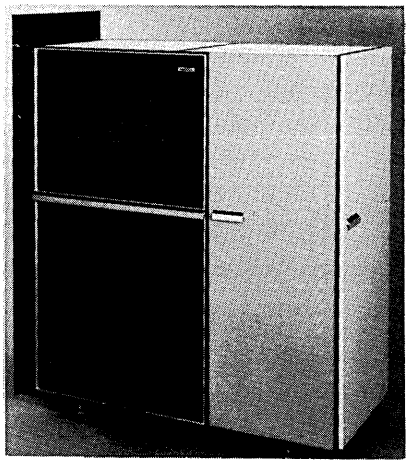
PRODUCT PREVIEW

AMP, INC.
Harrisburg, Pa. Booth 1165
Badge reading, 80-column card reading, and the collection and checking of limited data input through slide switches are done by



the Syscomp data collection terminal. The oem unit can be configured for ASCII or other code transmission and for a tty or other low-speed interface. The price is around $3K depending on quantity and options. Delivery is 12 to 15 weeks ARO. For information:
CIRCLE 575 ON READER CARD

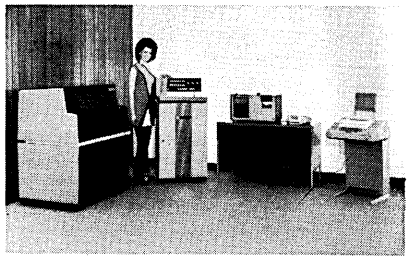
AMPEX CORP.
Culver City, Calif.Booth 2210,12,17
Now that the plug-to-plug compatible equipment builders are offering



replacements for nearly every peripheral, they seem to be eyeing the mainframe of the 360 more and more. One of these days we may see a plug-compatible cpu replacement offered, but for now this manufacturer announces mainframe memory replacements for the models 65, 67, and 75. Called the ARM-2365, the 750-nsec core comes in 256K modules priced at $308,600 and renting for $7400/ month. Four of these modules can be hooked up to the 65 and 67 models, while the 360/75 can accommodate eight of them. Delivery is 60 days ARO for the ARM-2365 memory, which appears to be about 20% under IBM'S price for comparable units. For information:
CIRCLE 558 ON READER CARD
The numerous 360/30 users haven't been forgotten, either. Available to them (60 days ARO) is the ARM-30 in 16, 32, and 48K sizes. The 1.5-usec core is priced at $32K for 16K bytes, or may be rented for $805/month. For information:
CIRCLE 559 ON READER CARD
For oem's at the show, 1800 Series 18-mil, 650 or 900 nsec core ranging in size from 8K x 18 bits to 128K x 36 bits will be displayed. The 3-wire, 3D design is TTL and is priced at something under 2¢/bit in quantities of 100. For information:
CIRCLE 560 ON READER CARD

AURICORD DIV., SCOVILL
Long Island City, N.Y. Booth 2424
A lower cost version of the CAS-10 digital cassette tape deck introduced at the last JCC, the CAS-20 has a read/write speed from 1½-15 ips (single direction), dual direction search from 40-400 ips, optical EOT/BOT sensing, inertia flywheel damping of tape speed variations, and cassette-in-place and file-protect sensors. All speeds are adjustable. Where the CAS-10 was priced around $300 each, the CAS-20, including the two-track head but minus electronics, is priced at $276. Prices drop to under $100 in large quantities. For information:
CIRCLE 547 ON READER CARD

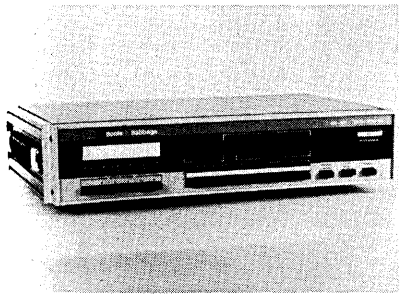
ATRON CORP.
St. Paul, Minn. Booth 1461, 63, 65
The latest model of the Datamanager remote batch terminal line is for the 360 model 20 and comprises a tty, line printer, card reader, and the controller with necessary software.



Features include communications rates from 2000-9600 baud, or Telpac/Dataphone-50 upping the rates to 19.2 and 40.8 kilobaud, respectively. Printers range in capability from 300-1250 lpm, and 300-1000 cpm readers are offered. Prices range from $38,950 to $66,790 depending on specifications. Monthly rentals range from $1165 to $2120. For information:
CIRCLE 589 ON READER CARD

BIOMATION CORP.
Palo Alto, Calif. Booth 1337
The model 802 Transient Recorder uses an analog/digital converter with 1K of MOS shift register memory to capture and store the digital equivalent of an analog signal as a function of time. The bandwidth is 500 KHz, and the time sweep can be varied from 500 usec to 20 seconds. The stored information can be output to oscilloscopes or strip chart recorders, or alternatively in digital form to a computer. The price is $2950. For information:
CIRCLE 554 ON READER CARD

BOOLE & BABBAGE, INC.
Cupertino, Calif. Booth 1520, 22
A line of system utilization measurement products called the Measurement Engine will be introduced at the show. The control module is the ME-1011 event monitor for sampling from six probes placed in the system by the user. The 10 sampling rates

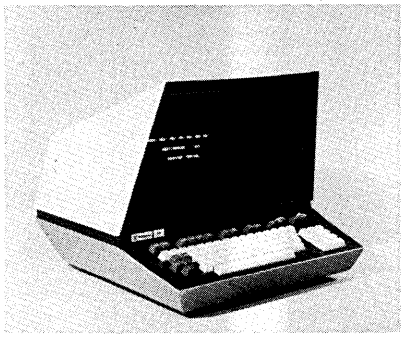


range from five seconds to eight hours. The price of $8K includes the ME-1011, the first installation, a user's guide, applications notes, and training on how to place the all-important probes in the system. After that the user is on his own. Also available 30 days ARO is a line of optional supporting peripherals, including the ME-2011 printer, the ME-2021 trend recorder, and the ME-2031 tape drive. For information:
CIRCLE 541 ON READER CARD

BRIGHT INDUSTRIES, INC.
San Francisco, Calif. Booth 1219
The BI 2600 oem tape unit can be ordered as a 7- or 9-track model, with NRZI or phase-encoding; 200, 556, 800, or 1600 bpi densities; and synchronous speeds for recording at 1-37½ ips, and bidirectional readout at 4-37½ ips. The maximum transfer rate is 60,000 KB. Optionally available are interfaces, buffers, and controllers. Prices start at around $3200 for orders of 100 units, which come with a 13-month warranty. For information:
CIRCLE 582 ON READER CARD

CALMA CO.
Sunnyvale, Calif. Booth 2143, 45
Here is a complete stand-alone system for generating integrated circuit masks without requiring the help of outside computers. A 4 x 5-foot tracing area holds the mask sketch for a proprietary digitizer with a resolution of .001 inch. A moveable keyboard is used to enter the appropriate coordinates into the system, and a crt permits segments of the source drawing to be displayed, magnified, etc. The software allows addition/deletion of segments, and the plotter can generate a drawing to compare against the original sketch. Finished masks then go onto IBM-compatible tape. The Graphic Data Station - Intergrated Circuit Maskmaker is available 120 days ARO for something under $100K. Up to five additional terminals can be added to the system for $32K each. For information:
CIRCLE 556 ON READER CARD

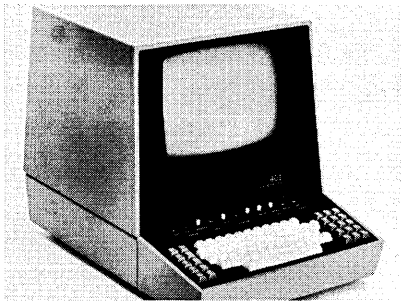
CANADIAN WESTINGHOUSE CO. LTD.
Hamilton, Ontario Booth 2001
The model 1600 crt terminal is a plug-to-plug replacement for tty's and is primarily marketed to oem's. It will also operate at up to 9600 baud through RS232C interfacing



and function either synchronously or asynchronously. The 9 x 7-inch screen displays a maximum of 20 lines of up to 80 characters. A 64-character ASCII set plus a separate numeric pad and function keys comprise the keyboard. In quantities of 1-24, prices are around $3400 each. Delivery requires about 90 days ARO. For information:
CIRCLE 590 ON READER CARD

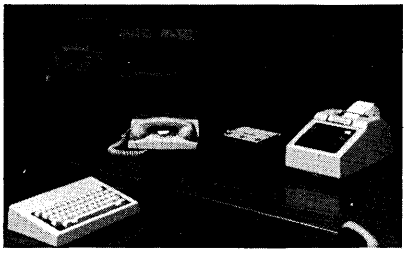
CODEX CORP.
Newton, Mass. Booth 1153
The 7200 modem features automatic adaptive equalization and is designed to operate at 7200 baud over Type 3002 C-2 conditioned telephone circuits. It is a voice band modem which uses what is claimed to be a unique modulation scheme, combining both phase and amplitude techniques. Built-in diagnostic aids allow the user to verify operation of the terminal, phone line, or modem. Options include multiple channels of 4800 and 2400 baud and an alternate voice/data telephone handset. The price is $8750, and delivery requires 60 days ARO. For information:
CIRCLE 588 ON READER CARD

CONRAC CORP., CONRAC DIV.
Covina, Calif. Booth 1513
The modular approach seems to have been carried as far as is practicable in the design of this firm's CONRACTOR oem crt terminal series. The display, keyboard, controller, serial distributor, and serial distributor expander components of the line allow the purchaser to combine them to form stand-alone or cluster

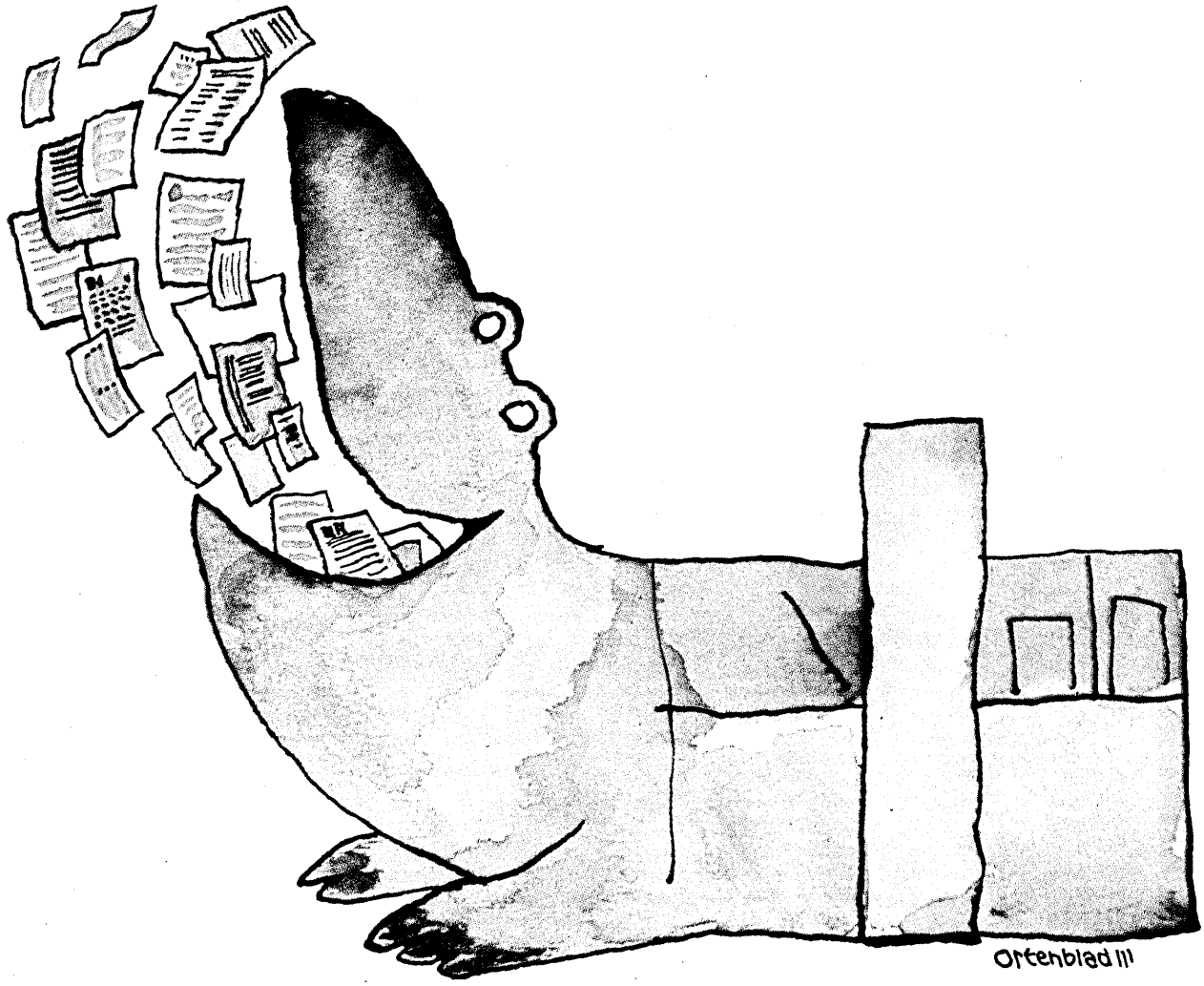


display configurations. Various combinations of characters/line and number of lines are possible for displaying from 1-2K 5x7 or 5x9 dot matrix characters. Also optionally available are communication interfaces, printer or cassette attachments, editing capability, etc. For non-do-it-yourself types, the model 401, including 1K characters, 64 ASCII set, cursor controls, and editing features, is priced at approximately $2800 in orders of 25. For information:
CIRCLE 564 ON READER CARD

CUSTOMIZED DATA SYSTEMS, INC.
Corpus Christi, Texas Booth 1525
Many source data collection problems could possibly be solved using this system, a slightly modified 10-key adding machine called the



Adapta-Data 5210, to record onto a magnetic cassette. The cassette then transmits to an 024 or 026 IBM keypunch equipped with a $20 RPQ interface and the data is punched onto cards at 10 characters/second. Optional is a keyboard for entering alpha information. Prices start at $1988. For information:
CIRCLE 542 ON READER CARD
(Continued on page 59)



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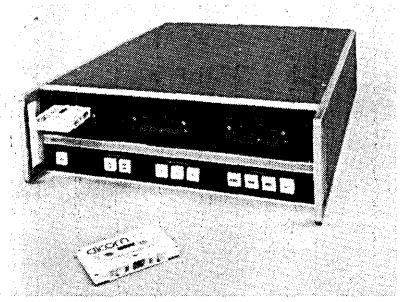
Scan Optics Inc

DICOM INDUSTRIES, INC.
Sunnyvale, Calif. Booth 2444

A variety of cassette-related products from this firm make their bow at the show. Among them, the CMTOS (Cassette Magnetic Tape Operating System) provides Hewlett-Packard, Data General, and DEC PDP-8 users system capabilities



without the need for paper tape or more expensive mtu storage. One transport of the three-drive unit contains the system library, a second cassette handles the source input, while the third transport records the output. Included in the $7250 price is the interface kit and cables, and software consisting of loaders, executives, I/O drivers, editors, assemblers, FORTRAN, ALGOL, and diagnostics. Optional BASIC is offered the H-P user, FOCAL is optional for DEC's minicomputers, and BASIC can be obtained for the DG line. For information:

CIRCLE 567 ON READER CARD

Also checking into Atlantic City is the model 440 Cassette Vacuum Transport (CVT). Using the proposed ANSI/ECMA standard for information interchange via cassettes, the maximum data transfer rate is 5 KB. Utilizing dual tracks, the transfer doubles. Volume oem deliveries are scheduled for September, with an order of 500 CVT transports bringing the price down to $400 each. For information:

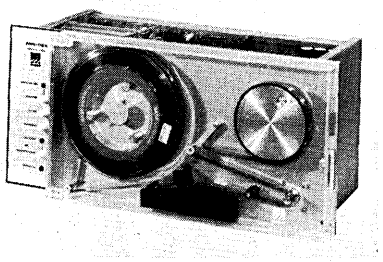
CIRCLE 568 ON READER CARD

The model 171 oem cassette transport module operates at up to 15 ips to provide bidirectional block-synchronous read/write capability. The maximum data transfer rate is 1.5 KB. Prices are $150 in large oem quantities. For information:

CIRCLE 569 ON READER CARD

DIGI-DATA CORP.
Bladensburg, Md. Booth 1560

The MINI DEK is a synchronous, 12½-ips unit said to be compatible with many existing controllers and interfaces, including both 7- and 9-track, 800 and 1600 bpi gear. The rewind speed for the 7-inch reel size unit is 50 ips. In quantities of 100,



MINI DEK mtu's are priced at $1450 each and are available 60 days ARO. For information:

CIRCLE 566 ON READER CARD

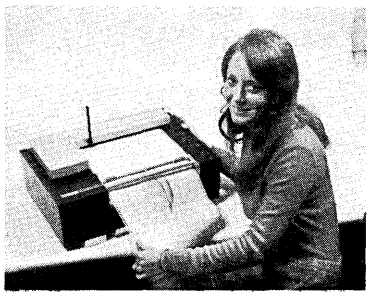
DOCUMATION, INC.
Melbourne, Fla. Booth 1343

At the last JCC, potential customers of this manufacturer's line of oem card equipment wanted larger hopper/stacker capacities. So the M 1200 model is a case of "demand and supply" offering 2,250-card capacity, 1,200 80-column cpm read speed, a vacuum picker mechanism, and infrared light emitting diodes for reading 12 bits simultaneously. The single quantity price is $7800, and the M 1200 is available 90 days ARO. For information:

CIRCLE 565 ON READER CARD

ELECTRONIC ASSOCIATES, INC.
West Long Branch, N.J. Booth 2521

Incremental plotting in the time-sharing mode is the forte of the model 230 Dataplotter. The desk-



top unit handles ASCII, input of 10 or 30 cps and is compatible with keyboard terminals and acoustic couplers. Its maximum speed is 270 steps/second, with .010-inch steps (.005-inch optional). The plotting area on fan-fold paper is 11 inches by 144 feet. It uses either ball point or fibre tipped pen. The model 230 is priced at $6250, is supplied with some FORTRAN subroutines, and is available 30 days ARO. For information:

CIRCLE 587 ON READER CARD

ELECTRONIC ARRAYS, INC.
Mountain View, Calif. Booth 2643, 44, 45

A line of MOS shift registers, including a quad 32-bit, 1-64-bit variable, 256-bit, 512-bit — all dynamic — and a dual 100-bit static register will debut at the show. In quantities of 100 the prices range between $4.40 and $6.35 depending on the specific register desired. For information:

CIRCLE 563 ON READER CARD

GE COMMUNICATION SYSTEMS DIV.
Lynchburg, Va. Booth 1526, 28

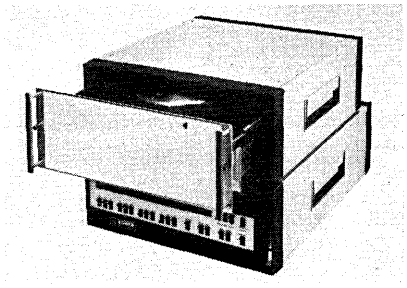
A tape cassette accessory will be available in July for the TermiNet 300 teleprinter. It uses standard Phi-

lips cassettes and transfers data tape-to-tape at up to 1200 baud. Recording is incremental, and reverse is provided to permit character-by-character editing. Cassette capacity is 50K characters. The unit may be installed on existing TermiNet 300s in the field without modification. The price is $1500. For information:

CIRCLE 578 ON READER CARD

GENISCO TECHNOLOGY CORP.
Compton, Calif. Booth 2105, 07

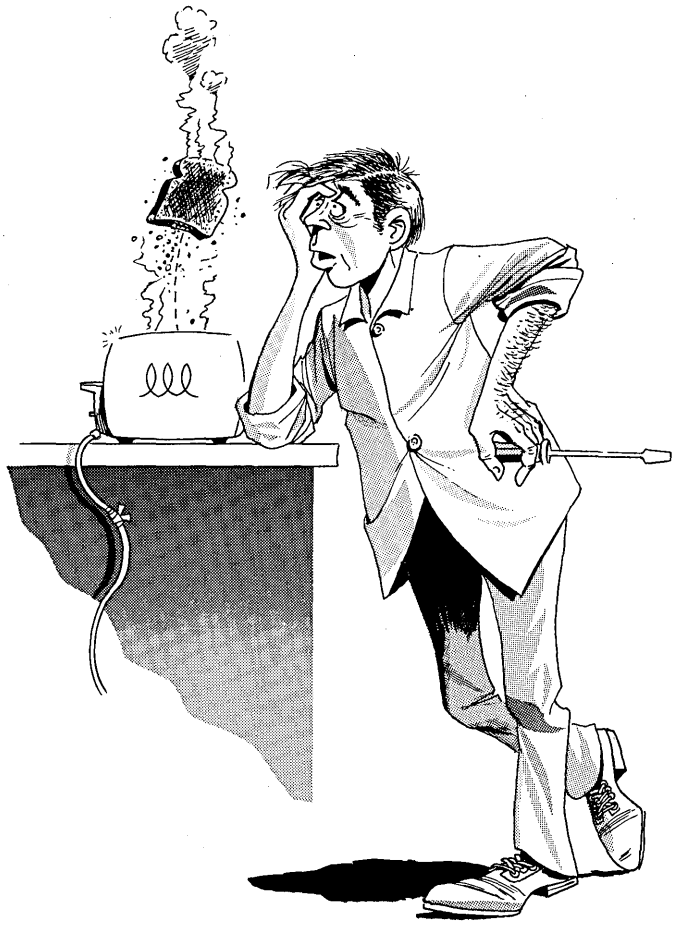
Both 4- and 8-megabit models of the DS1 line of cem disc storage systems



are available. After data is accessed in an average of 16.7 msec, it is transferred at 600 KB. The maximum head positioning time is 440 msec

a thought about you...

Perplexed



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across 240 tracks storing 17K bits/track. Options include internal power supply, interface logic and software for specific computers, etc. In quantities of 25 prices start at $2180 for the 4-megabit model, and $2420 for 8 megabits. For information:
CIRCLE 557 ON READER CARD

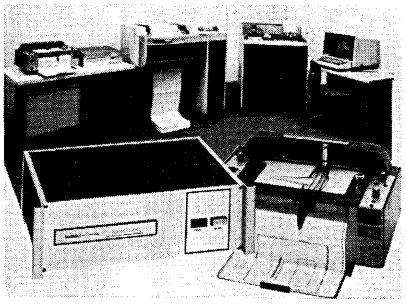
GTE LENKURT, INC.
San Carlos, Calif. Booth 2111, 13

The 25C Data Set is a frequency division multiplexor using FSK techniques to accommodate up to 18

channels of intermixable data speeds ranging from 110-600 baud. The device is RS-232C compatible and is priced at approximately $450/channel. For information:
CIRCLE 561 ON READER CARD

HOUSTON INSTRUMENT
Bellaire, Texas Booth 1747

A controller for interfacing the DP-1 or DP-3 plotter to the CDC 200 user terminal has been developed by the



manufacturer of those plotters. Once in place — less than one hour, with no hardware or software modifications said to be required — the BTC-7/200 allows plotting at up to 300 steps/second. The controller is priced at $1950, or, with the DP-1 plotter, rents for $275/month. Delivery is 30 days ARO. For information:
CIRCLE 546 ON READER CARD

INFORMATION STORAGE SYSTEMS, INC.
Cupertino, Calif. Booth 1239

The model 715 is an oem disc drive that records on 406 cylinders of a standard IBM 2316 disc pack, yield-

ing 58 megabytes. The 715 has one of the quicker access times available for this type of device at 29 msec. The storage transfer rate of 312KB is standard 2314 speed. In quantities of 50 the 715 is priced at $14,500 each. For information:
CIRCLE 544 ON READER CARD

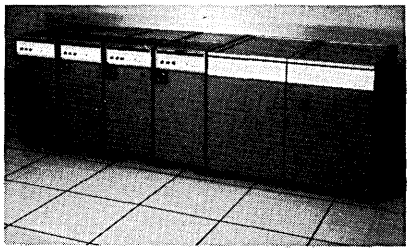
INTERCOMPUTER CORP.
Phoenix, Ariz. Booth 1176, 78

The little i-50 minicomputer we said *could* be incorporated into an IBM 2701/2/3 replacement (Jan. 15, p.62) has been, and it's called the i-270n. The BTAM/QTAM-compatible front-end can handle up to 176 mixed-speed lines. Typical configuration prices compared to IBM prices show about a 40-45% drop, with 15 low-speed lines listed at $32,800 ($54K for IBM), 32 lines at $47K ($82K), and a mix of 16 low- and 16 medium-speed lines priced at an even $100K ($171K). A PL/I subset can be supplied the purchaser to program the i-270n for other applications. For information:
CIRCLE 579 ON READER CARD

MARSHALL DATA SYSTEMS
San Marino, Calif.
Booth 1949, 51, 53

The second generation of 2314-type disc storage devices saw access times plummet from 60-75 msec down to around 30. Systems like the M2900 might be considered the start of a third generation — offering twice the capacity of the 2314 by recording on 400 tracks instead of 200. On the M2900, up to eight packs can be configured, each storing 58 megabytes for a total capacity of 466 megabytes. The remainder of the specifications look like a 2314, with 30 msec average access time and a 312KB transfer rate.

OS/360 or DOS/360 treats the M2900 system as if it were two



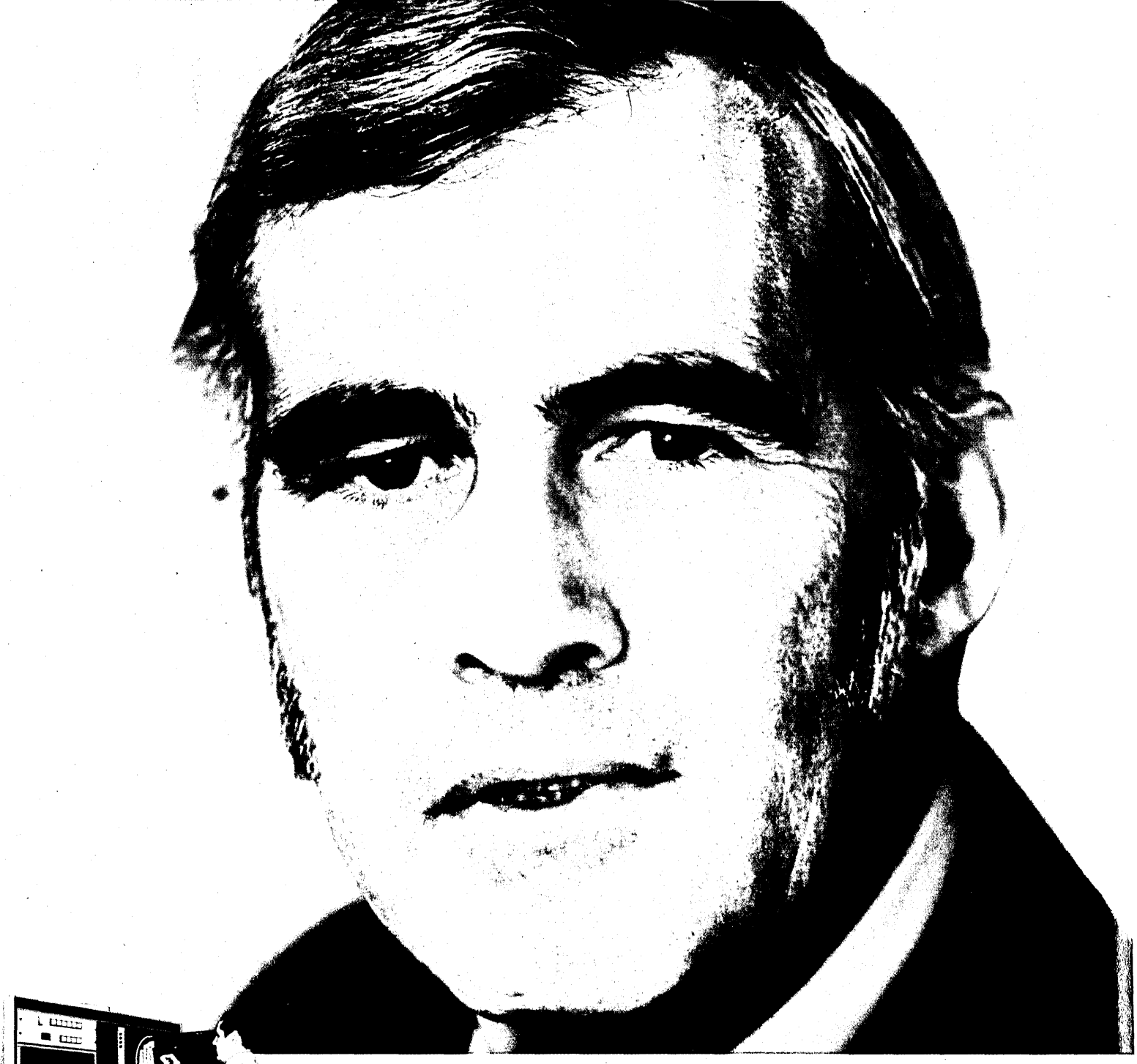
2314s, while the hardware side of the interfacing is plug-to-plug compatible with such units. The M2800 controller with Dual Density Adapter rents for $1550/month, and each M2900 double density drive lists for $455/month. The systems will be ready for delivery in July. For information:
CIRCLE 540 ON READER CARD

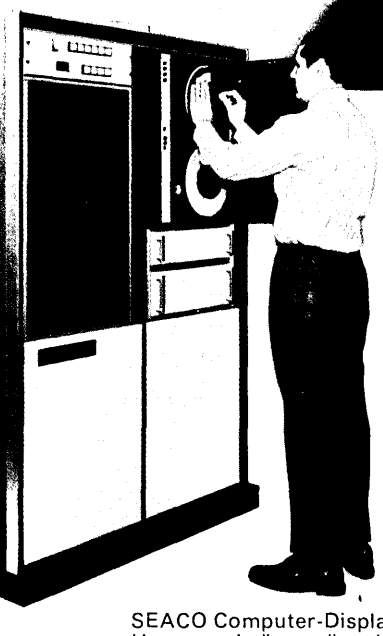
MEMORY TECHNOLOGY INC.
Sudbury, Mass. Booth 1331, 33

The PDP-ROM provides 1-32K of random access read-only memory for PDP-8 minicomputers. The PDP can access the memory contents within 1.6 usec and data can also be transferred at up to 1.6 usec per 12-bit word. Programs stored in the ROM can be treated either as a table of data and be transferred to core, or they can be called up by name and transferred to core using an optional loader program. An operating program may also call another program into core. Thus, programs that would be too long to fit into core can be segmented and chained for continuous calling into core from ROM. Price is $2500 for 4K, and delivery requires 90 days ARO. For information:
CIRCLE 577 ON READER CARD

NORTRONICS CO., INC.
Minneapolis, Minn. Booth 2442

Digital cassette dual-gap read-after-right magnetic heads meeting the specification of the European Computer Manufacturers Association





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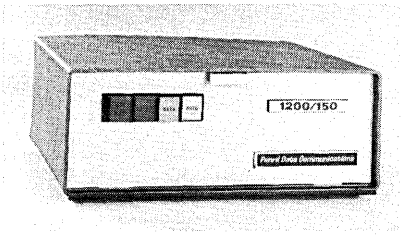
(ECMA) will be displayed by this firm. The DC12P series is especially designed for compatability with European systems utilizing the Philips-type cassette. All heads in the series are designed for 800 bpi phase incoded recording, and models are available for use up to 25 ips. Prices range from $150 each down to $25 each in quantities of 1,000. For information:
CIRCLE 592 ON READER CARD

NUCLEAR DATA, INC.
Palatine, Ill. Booth 1140, 42

Although the Tape Cassette System/ND 812 is primarily intended for the firm's own 812 minicomputer (Dec. 15, p. 84), it is also compatible with PDP-8 series machines. The unit accommodates one, two, or three 960,000-bit cassettes under program control of the host computer. Each cassette is independently controlled, providing separate files. Data is written on two redundant tracks to provide single bit error correction on a character-by-character basis. All I/O logic levels are DTL/TTL compatible. Prices are $2900 for a single cassette unit, $3600 with two, and $4200 with three cassettes. Delivery requires about 30 days ARO. For information:
CIRCLE 583 ON READER CARD

PENRIL DATA COMMUNICATIONS, INC.
Rockville, Md. Booth 1345

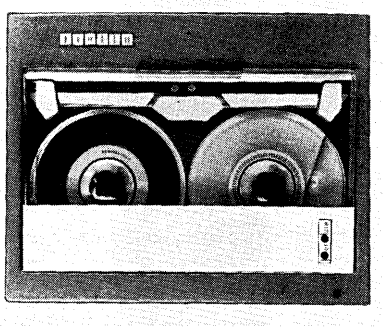
The PDC-1200/5-150, a Bell 202C-compatible modem, is for oem's requiring 1200 baud transmission. A



strap option permits 150 baud operation using FSK modulation. It sells for less than $400 and is available 30 days ARO. A free standing model including power supply is also offered. For information:
CIRCLE 586 ON READER CARD

PERIPHERAL DATA MACHINES, INC.
Hicksville, N.Y. Booth 2426, 28

An IBM-compatible line of four tape drives ranging in speed from 25-75 ips will be shown. The D-600 series offers 200, 556, and 800 bpi densities in 7-track format; and 9-track, 800 bpi NRZI or 1600 bpi phase-en-



coded recording. Rewind speed for 10½-inch reels is something under 100 sec. Additional features include dual-capstan indirect drive with start/stop times of 5 msec at 75 ips, bi-directional operation, and DTL/TTL compatibility. Prices start at $4900 for 1600 bpi, 25 ips models. Units are available 30 days ARO. For information:
CIRCLE 548 ON READER CARD

QUADRI CORP.
Phoenix, Ariz. Booth 1409, 11

Maybe it's that Arizona sun that keeps the model 811-01 bipolar read/write memory cycling at 70 nsec, though the manufacturer assures potential oem customers it will run equally as fast elsewhere. Complete with drivers, decoding, and sensing electronics, 10K bits to a card is priced at 7¢/bit in orders of 100. For information:
CIRCLE 549 ON READER CARD

Also being shown is the 809-01 field alterable semiconductor ROM. It is expandable from 64 words x 8 bits up to 1K x 16 or 2K x 8 in increments of 64 x 8. The cycle time is 80 nsec. Field modification of 16-256 bits on each memory board is possible without removing any of the memory device packages. Pricing is approximately 7¢/bit for the smallest version in quantities of 100. For information:
CIRCLE 550 ON READER CARD

The 811-02 MOS read/write memory system ranges in size up to 1 megabit with a basic module size of 40K bits/card. Cycle times of 500-750 nsec are available. An order of 100 cards brings the price per bit to 2¢. For information:
CIRCLE 551 ON READER CARD

As fast as many semiconductor memories, the Q Core has an access time of 75 nsec and a cycle time of 200 nsec. Pricing is approximately 1.5¢/bit for an order of a hundred 100,000 bit systems. For information:
CIRCLE 552 ON READER CARD

The Nanoprogrammer ROM is offered to aid in the debugging of microcoded programs. It accepts programs from paper tape or even magnetic tape and then is switched into ROM mode. Should there be an error detected during checkout of the microcoding, the Nanoprogrammer can be switched into the alter mode to allow contents to be changed. It cycles at 160 nsec and can be expanded to 245,760 bits. Prices start at $11,142. For information:
CIRCLE 553 ON READER CARD

QUINDATA ELECTRONICS, INC.
Springfield, N.J. Booth 1654, 56

The QuinType-70 is a repetitive/revision typewriter which also provides ASCII code output. It uses a

modified Selectric typewriter plus a paper tape reader/punch. The paper tape can be used in conjunction with a Teletype, or the QuinType may be used with an acoustic coupler or modem for data transmission. The basic price is $6900 with delivery from stock. For information:
CIRCLE 574 ON READER CARD

RCA COMPUTER SYSTEMS
Marlboro, Mass. Booth 1257

Somewhere near the RCA-3 computer that will be shown to the public for the first time at the show will be the model 8740 remote data terminal. It simultaneously receives up to 1,200 cps (9600 baud) transmission and prints at up to 600 lpm using a 64-character set. Four models are available with lease prices ranging between $850 and $1135 per month on a one-year contract, including maintenance. Optionally available to the 8740 is the 8741, an 80-column card reader capable of reading up to 300 cpm for transmission over dial-

(Continued on page 65)

DTS 100 speaks in many tongues!

Inside every DTS 100 remote batch data processing terminal is a little bit of IBM. UNIVAC, too. Also, CDC and BURROUGHS and GE and others.

We designed it that way. We made DTS 100 programmable to communicate with any computer you need—when you need it. In its own language. In-house or on a time-sharing basis. By simple operator-loaded programs. You merely load the language of your choice, dial-up and get on-line.

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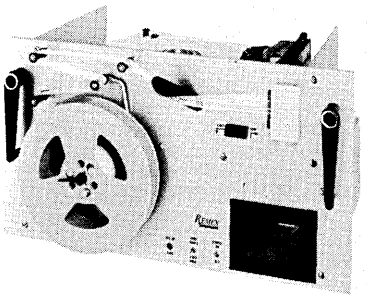
up or private lines to a cpu, or, in local mode for printing the cards out on the 8740 printer. The 8741 reader rents for $207/month including maintenance, also on a one-year lease. For information:
CIRCLE 570 ON READER CARD

Linked to the RCA-3 will be the model 8752-200 video data terminal. Available next month, the standard unit offers a choice of 20 lines of 54 characters or 14 lines of 81 characters for display on the 12-inch diagonal screen. An optional display suppress feature allows confidential information, such as file access codes, to be entered on the 96-character keyboard without being displayed or printed. The unit rents for $190/month including maintenance. For information:
CIRCLE 571 ON READER CARD

REMEX
Santa Ana, Calif.
Booth 1551, 53, 55

Paper and mylar 5-, 6-, 7- and 8-track tape is punched at 75 cps with



the RPS-1075. The TTL-compatible unit has an integral power supply and accommodates reel sizes up to 8½ inches. Available within eight weeks ARO, the RPS-1075 is priced at $1690. Typesetter versions are also available. For information:
CIRCLE 562 ON READER CARD

SINGER-LINK DIV.
Sunnyvale, Calif. **Booth 1713**

The 6020 computer output microfilm unit incorporates a 1-usec, 24-bit, 8K controller for primarily graphics applications, though the unit does have page printing and composition capabilities. The software package includes programs for converting information stored in a customer's current format into that used by the 6020, a program for emulating a line printer, forms software, character generation software, etc. Optional are two hardware character generators, and either hardware forms flash or carousel equipment. Prices are around $240K and delivery is 120 days ARO. For information:
CIRCLE 543 ON READER CARD

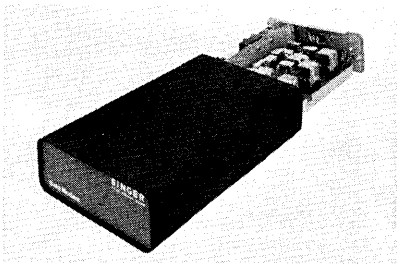
SINGER-LIBRASCOPE DIV.
Glendale, Calif. **Booth 1719**

Completed just in time to go to the show is the L1107 line of oem head-per-track discs. An 1,800 RPM version accesses 7 megabits of capacity in 17 msec and has a transfer rate of 2.1 MHz. Doubling the RPM cuts the access time in half to access 4 megabits and ups the transfer rate to 2.4 MHz. In quantities under 10, the L1107 series is ballpark priced at $7K with delivery 90 days ARO. For information:
CIRCLE 580 ON READER CARD

Models have been added to the L107 head-per-track disc storage product line expanding the capacities to 3 megabits accessable in 8.5 msec, or to 3.7 megabits accessable in 17 msec. Prices start at approximately $5550. For information:
CIRCLE 581 ON READER CARD

SINGER TELE-SIGNAL CORP.
Woodbury, N.Y. **Booth 1828**

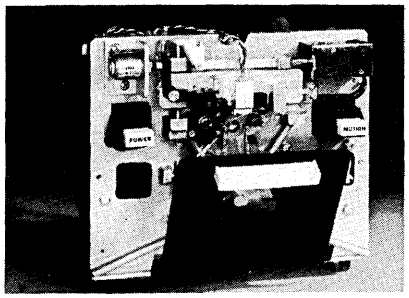
The 883P modem is a 2400 baud, half-or full-duplex unit, strap option compatible with the Bell 201A or



201B. Designed for multipoint polled systems, it provides faster response and features a limiter rather than an AGC amplifier, plus a rapidly synchronizing receiver clock. The quadrature-phase, differentially coherent modem has a single unit price of $1450. For information:
CIRCLE 591 ON READER CARD

SYKES DATARONICS, INC.
Rochester, N.Y. **Booth 1524**

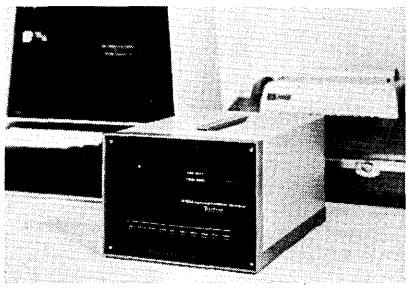
The Model TT 120 is an I/O-oriented cassette transport designed for use by oem's in such applications as key-to-tape systems, terminals, and minicomputer peripherals. It operates both incrementally and sequentially and features a direct access capability that allows any block of data to be located at 120 ips with the head disengaged and then be read or written incrementally, a character at a time, if desired. Specifications include two-track recording at up to 1000-bpi density, transfer rate of 12,000 baud, and maximum storage of 39,600 characters in the incremental mode or 720,000 characters in the sequential mode. Speeds are 6, 10, or



12 ips. Unit price is $490 in 1,000 quantities. Delivery varies from stock to 120 days, depending on quantity. For information:
CIRCLE 572 ON READER CARD

TECHTRAN INDUSTRIES, INC.
Rochester, N.Y. **Booth 2627**

The 4100 communications terminal is a tty-compatible cassette-loaded unit meeting RS-232B specifications. It may be used as a stand-alone unit. The standard 4100 is available with any two speeds between 110 and 600 baud; a third speed between



1200 and 2400 baud is optional. Coding is ASCII. Operational characteristics are identical to paper tape equipment for ease of updating such systems. One cassette is provided, with 70,000 characters of storage, two-track tape, and about 1000-bpi density. Prices start at $1650. An IBM 2741-compatible model is also available at $1700, and a dual-cassette model is in the works. Delivery requires 30-45 days ARO. For information:
CIRCLE 573 ON READER CARD

(Continued on page 67)

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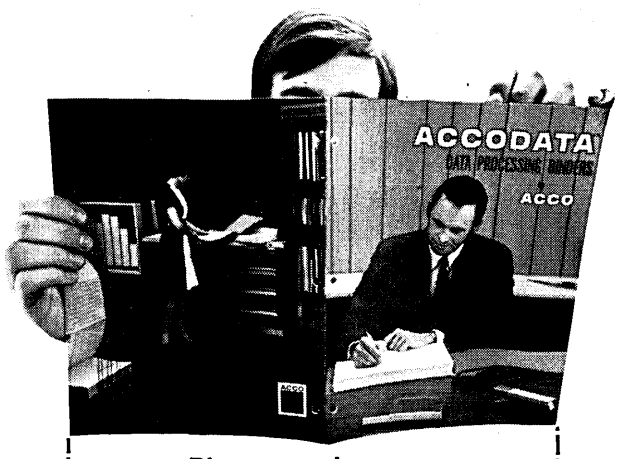

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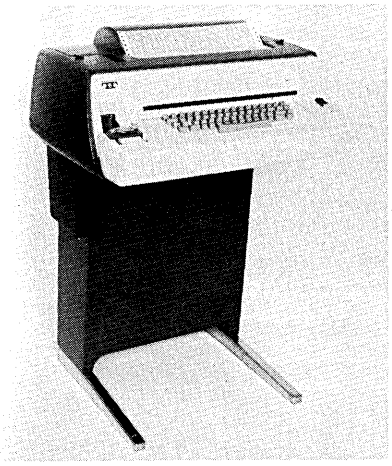
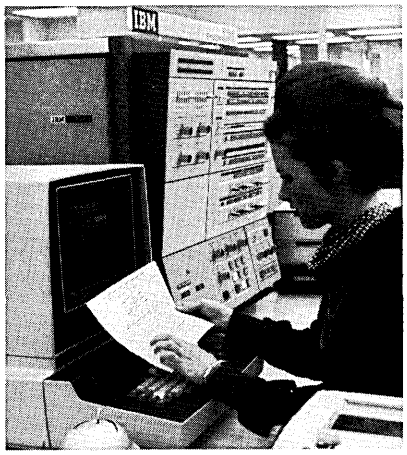
TELETYPE CORP.
Skokie, Ill. Booth 1145
The Teletype product line does change. With the Teletype 38 RO, KSR, and ASR models, upper and lower case printout is a feature, along with a wider platen that allows use of standard computer paper stock and 132-character line widths. And while the 38 shares a great deal with the 33 series, it does generate the full 128 ASCII code combination with vertical parity, operates at a speed of up to 100 wpm, and has a red-to-black-ribbon shift that can be activated on-line. Should the user require faster on-line speeds, a model 4210 magnetic tape data terminal can be added for a 2400 word/minute rate. Delivery of the Teletype 38 is scheduled for second quarter



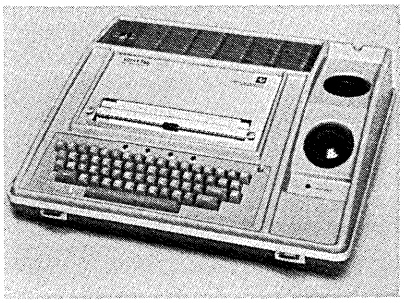
1972. Purchase price range reportedly will be $150-200 higher than the $813-966 for Teletype 33 terminals. For information:
CIRCLE 585 ON READER CARD

TEKTRONIX, INC.
Beaverton, Ore. Booth 2501
Split-screen display capability has been added to this firm's 4002 graphic terminal along with an A to the model number to denote the difference. The split-screen is tied to a computer and operator-addressable scratchpad memory allowing communication between scratchpad and operator and computer and scratchpad, all without disturbing the contents displayed on the main portion of the screen. A total of 39 lines of 85 italic or vertical characters can be displayed choosing from a repertoire of 128 ASCII codes. The 4002A is tty compatible, and the use of a data communication interface unit permits full- or half-duplex communication through RS-232C interfaces at switch-selectable speeds ranging



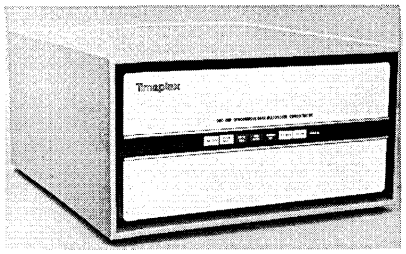
from 100-9600 baud. The 4002A is compatible with a number of hardware options, including joystick and hard copy unit, as well as with FORTRAN packages for data communications interfaces and assembly language routines for tty interfaces. The 4002A is priced at $8800, with interfaces for most of the major minicomputers priced from $600-750. The 4002A will be available during the third quarter. For information:
CIRCLE 545 ON READER CARD

TEXAS INSTRUMENTS, INC.
Stafford, Texas Booth 1505
Time-sharing users who can't seem to leave their work at the office should consider the latest addition to



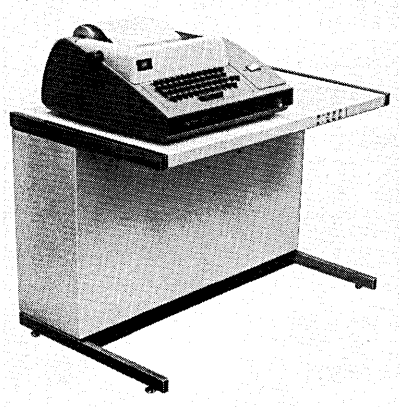
the "Silent 700" line of portable terminals. Packaged in a luggage-type carrying case, the model 725 contains an acoustic terminal allowing switch-selectable transmission in either half- or full-duplex mode at 110, 150, or 300 baud. The 725 prints its 94 ASCII characters in 80-character lines on heat-sensitive paper. It is priced at $3300 and is available 30 days ARO. For information:
CIRCLE 555 ON READER CARD

TIMEPLEX, INC.
Norwood, N.J. Booth 1664
Hundred of low-speed, synchronous data sources can be handled by pyramid SMC-200 multiplexors, claims its maker. A single unit can bit-interleave up to 32 synchronous or asynchronous data streams at rates up to group band, T1, Telpac, or megabit microwave transmission speeds. Low-speed channels can also be handled. I/O buffers and automatic phasing circuits insure bit integrity. The SMC also has built-in test and



system diagnostics. Available 45 days ARO, it is priced at $4300. Additional channel cards are $115 each. For information:
CIRCLE 584 ON READER CARD

WILTEK, INC.
Wilton, Conn. Booth 1419, 21
A terminal specifically designed for corporate communications networks will be shown at SJCC. Principal characteristics include storage for 50 Kilobytes allowing data to be sent and received at up to 2400 baud without interrupting data entry. The model 300 uses a 33 KSR tty, while the model 500 uses a 2K-character crt display with editing and formatting features. The communications interface emulates the IBM 2780 ter-



minal, enabling data to be transmitted in a bisynchronous mode with block checks and automatic transmission in the event of error. Prices start at $3900 for model 300s and $3500 for model 500s. For information:
CIRCLE 576 ON READER CARD ■

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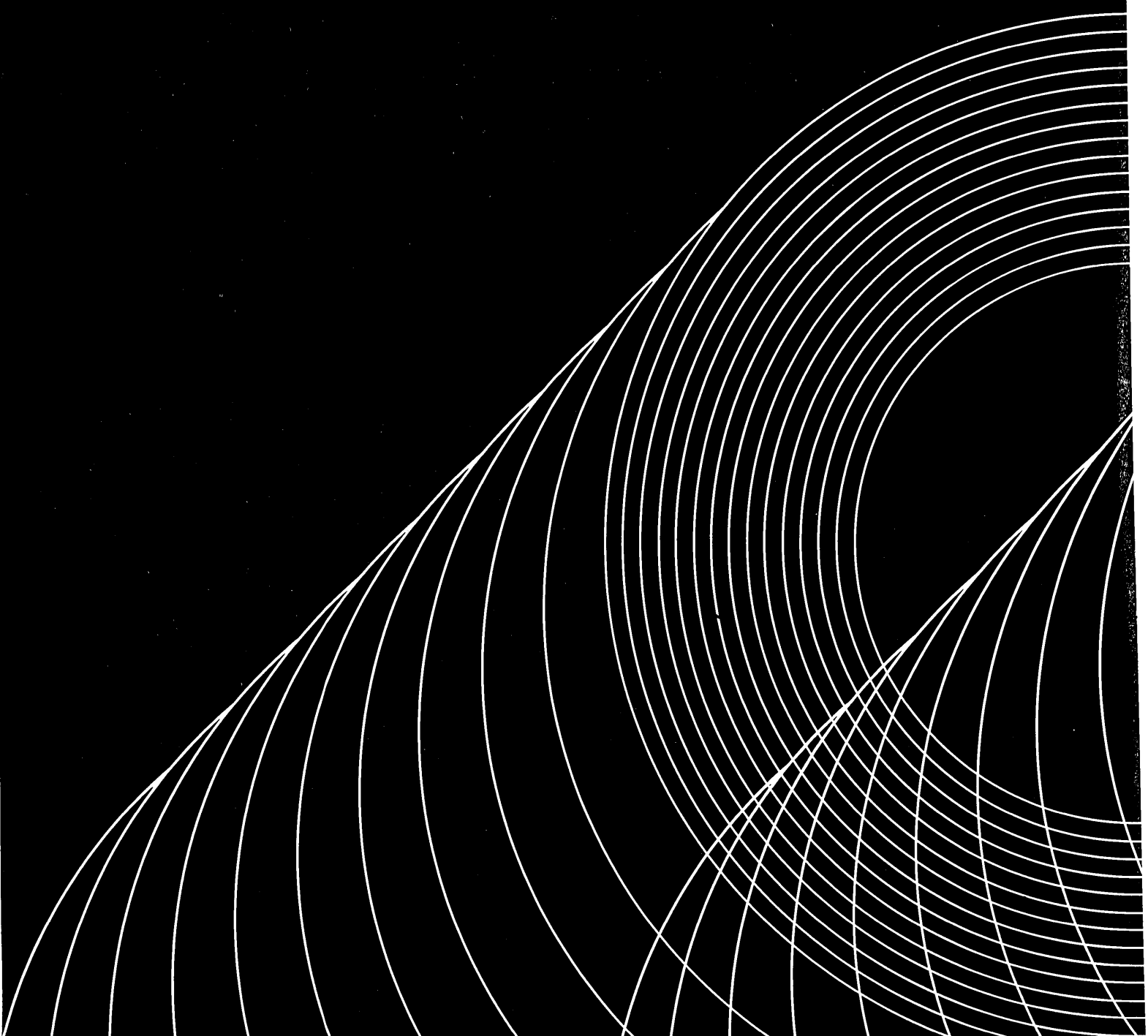

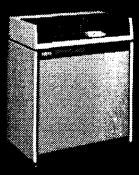

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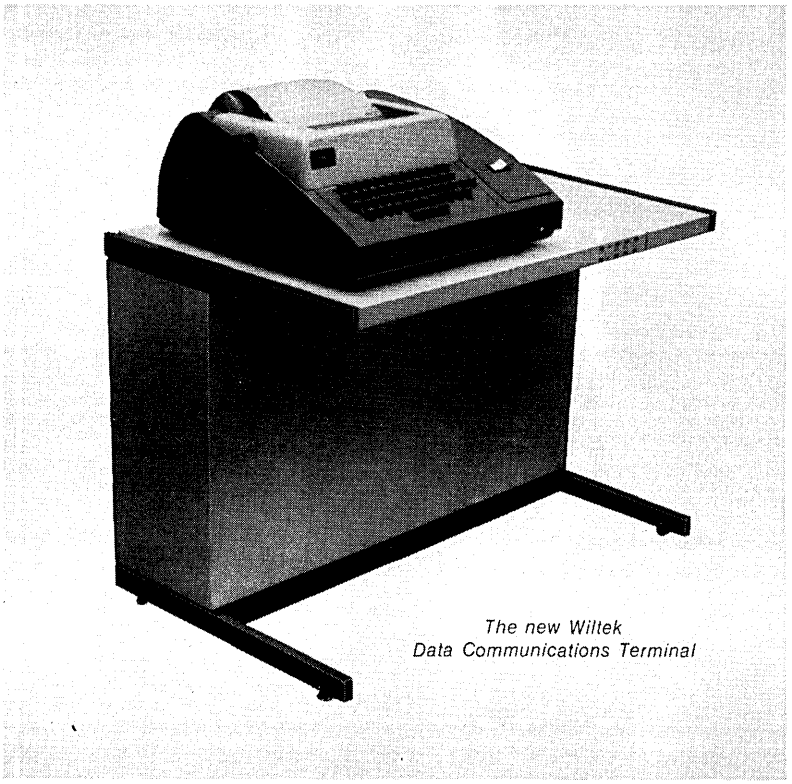

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except one.

Imagine a high-speed terminal designed specifically for the communications networks of large corporations.

A terminal that can automatically send and receive at speeds up to 2400 bps with no interruption of data entry.

A terminal with unique first-in/first out, 50,000-character storage buffers on both send and receive . . . with no cassettes to load, no tape to rewind, no paper tape to handle.

A terminal that transmits in a bi-synchronous mode with block checks and automatic retransmission in event of error.

A terminal priced so attractively that a communications system built around it will cost less than your present 83B3 teletypewriter system.

A terminal so efficient and automatic it can make a startling reduction in line costs.

And big savings on line costs are good news for every big company in America . . .

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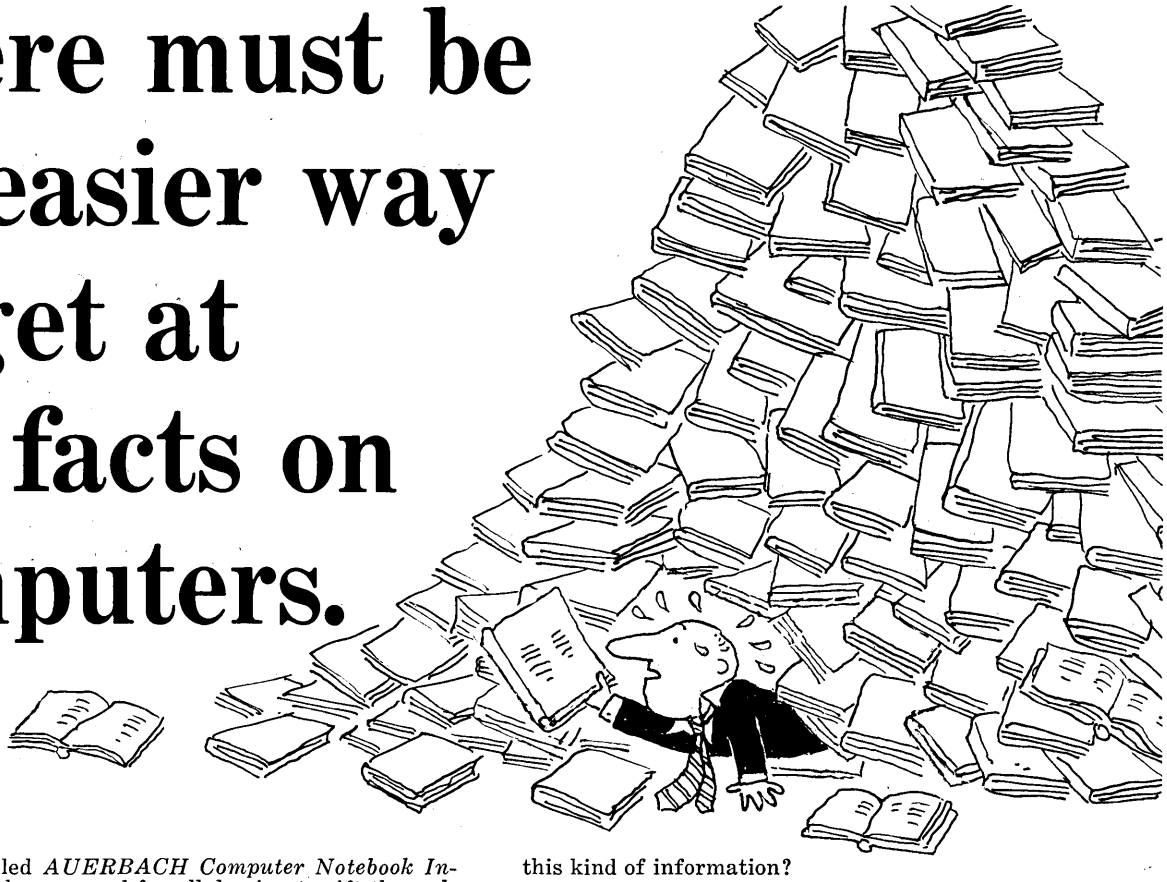
WILTEK

See the new Wiltek Data Communications Terminal at Booth 1419-1421 at the SJCC. Or call for a data bulletin. Wiltek, Inc., Wilton, Conn. 06897. Tel. (203) 762-5521.

There must be an easier way to get at the facts on computers.



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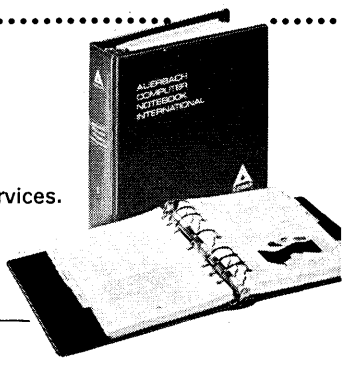

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D-5

PERSPECTIVE

an interpretive review of significant developments

New York City Computing: Good, Bad, Confused

Computing in New York City is decentralized; some of it is very good, and some is unbelievably bad. And no one is in charge. The only thing all City computers have in common is that the City paid for them. All 95 of them, ranging in size from a few minicomputers and 13 Monrobots to several 360/50s. Among governmental bodies in the U.S., only the federal government and the state of California stand more on computing.

The disadvantages of decentralization are apparent. An installation or a system is only as good as the city agency that designed it, runs it, or hires the consultants. But, of course, New York City is too big to have centralized computer operations. It's always difficult to compare the city with any other because New York City actually *includes* five counties; thus, it has many functions under its authority that are normally performed by other governmental organizations. Chicago and Los Angeles have centralized computer organizations, but their functions are considerably fewer than those handled by New York, and their annual computer budgets are only about $4 and $8 million, respectively, while New York spends $30-32 million.

Some minor centralization has taken place in New York, but mostly the city's various agencies go their own way with computer applications, constantly re-inventing the wheel. Nowhere is this more evident than within the City University, a combination of colleges that were once more or less independent. One college may have tight physical security for its computer center, while another draws the venetian blinds to keep out fire bombs. One may have an excellent system for updating transcripts, while another's transcripts are so routinely bungled by computer processing that they must all be manually corrected.

Power of the purse

If there is a bit of centralized authority, it apparently resides with control of the purse strings. When one talks about computers with city employees, the name of Edwin Brenman often pops up. Brenman is director of Municipal Data Systems for the Bureau of the Budget. All requests for computing equipment are referred to him, giving him a great deal of power over the acquisition of hardware, but little control over its use once obtained. Brenman is also vice president of the Metropolitan Information Exchange, a user group representing 25 large cities. Some say Brenman inspires to become "computerczar" of New York City.

Centralization would probably give Brenman more personal power, but whatever his private goals are, he acknowledges that centralization of the computer function is impossible in an organization as large and diverse as New York City. What Brenman seeks instead is more multiple-user installations with larger central computers. This could be effected through increased use of terminals and remote job entry, though city departments each tend to warrant their own private computer, just as occurs in commercial organizations.

Brenman's own Bureau of the Budget has what it calls a budgetary management information system — no, not in the grandiose sense of the term, nor the sort of definition that has nearly driven MIS from our vocabularies in disrepute, but in the sense that budget information is readily at hand, and the city is able to maintain a "living" budget, constantly updated, with instant access to relevant information. And that's for the second largest budget in the U.S., after the federal government. Brenman doesn't have a crt on his desk, but there's one right next to it, and he can quickly access most anything about the city budget: personnel information, salary figures, how much what agency is paying which vendor, etc.

The MIS is based on a 360/40 linked to 2260 and 2740 terminals. The information itself is restricted according to users. Individual agencies can't access information irrelevant to their own functions. Only the Bureau of the Budget can access the entire budget. Not that there's anything confidential about the budget — it's all there in a 1,500-page book with small type, if you want to dig for it, though the book isn't constantly updated. So the MIS, in a way, is a centralized function, and the Bureau of the Budget is clearly in charge.

It is difficult for an outside observer to judge the usefulness of a system such as the budgetary MIS, but the system has attracted the interest of the federal government, which has sent personnel to study how the city manages to keep its running budget. At the same time, the opinion of some city personnel outside the Bureau of the Budget is that the MIS is just a plaything or, at best, a status symbol, performing functions that could be done more cheaply by manual procedures using desk calculators.

More decentralization

In addition to Brenman, another de facto computer chief is found under Mayor Lindsay's chain of command. He is Dr. E.S. "Steve" Savas, a First Deputy City Administrator, holding what is normally a political appointment, though Savas says his political affiliation wasn't even known at the time of his selection. He was formerly manager of urban systems at IBM and has served the city nearly four years. Savas' function in the computer realm is primarily computer systems planning and management science, and one constantly hears rumors that he and Brenman are in conflict, although this is denied by both men. Savas heads a staff agency, and its formal approval is not necessary for the expenditure of money.

Savas and Brenman may in themselves be symptomatic of the diversity of New York City operations. Their offices are on opposite sides of City Hall Park, yet Savas occupies a large, modern office with a commanding view of the Brooklyn Bridge, while Brenman is tucked away in a crowded corner of a dingy building with his view facing the wrong direction. And while Savas is an appointee, Brenman is a veteran of city civil service since the Depression.

Brenman apparently holds real power with his physical responsibility and is more often mentioned by personnel within city departments, while Savas is well known outside the city administration for his participation in such activities as the annual ACM Urban Symposium. And while Brenman seeks multi-agency use of individual computers, Savas notes that one avenue to greater efficiency would be to foster an internal service bureau approach for the benefit of smaller city agencies.

Perhaps the ultimate in decentralization occurs within the police department, whose major achievement is the Sprint system, which provides computer-assisted dispatch of patrol cars. It's also an MIS of sorts in that it keeps track of the status of all cars and how many requests for aid are being processed at any moment and stores this information on-line for 12 hours, then stores it off-line for future study, such as efforts toward improved resource allocation.

The primary intent of Sprint is to reduce the time between the answering of a call to the emergency 911 phone number and the dispatch of aid. Through Sprint, the "turret man" who answers the phone can quickly establish the precinct and sector from which the request emanates, based on such input as address, intersecting streets, major hotels, etc. In fact, getting the necessary descriptors into the system — including different names used to describe the same street, common misspellings, etc. — caused many initial difficulties in the system, necessitating recourse to manual procedures by the turret men.

Sprint began functioning on a limited basis in October 1969 but did not blanket the whole city until last August. The initial difficulties may account for Sprint's poor reputation with lower ranking police department personnel. Phone problems may also account for some criticism misdirected against Sprint when callers can't get through to the 911 number. At any rate, the system is actually called a failure by some patrolmen and is said to have accounted for such long delays in dispatching as would seem impossible when one considers the alternate manual procedures that are still available.

The high-ranking police officers who were instrumental in the development of Sprint regard it as a great achievement, however, and they point with pride to the many visitors from police forces in other states and even foreign countries who have come to observe Sprint. As far as they know, no other department is implementing a Sprint-like system, but the officers point out that the problems of New York's police department are often unique, so that the city's solution wouldn't necessarily be helpful elsewhere.

The Sprint system uses a 360/40 cpu which, together with lots of peripherals, amounted to a $3 million hardware investment. Nearly $2 million more completed the Sprint bill.

No high rents here

It should be noted that the city buys its computers, instead of renting them, as this has been found not only to be more economical in the long run, but it's easier for a municipal government to raise money for capital expenditures since it can generally get a lower interest rate through such devices as tax-free bonds. And avoidance of rentals also eliminates budget problems in the future by keeping ongoing expenses down.

The city's decision to purchase was made as a result of a 1960 study, which predated the federal government's similar decision. Since that time, New York has spent "well over $30 million in purchases," according to Brenman.

Hardware costs are declining in relation to personnel costs, however. The acquisitions of computers have been decreasing in the last two years, but efforts have been made to improve personnel policies. Civil service titles have been revamped to include logical career paths for computer personnel with salaries that are competitive with private industry, especially when side benefits of city employment are considered. No one worried about it two years ago, but today the job security provided by civil service is a significant recruiting lure.

In some cases, however, the new titles still don't reflect the duties of the actual personnel in that agencies are prone to hire whom they need at whatever salary is appropriate, then search for a title with that salary. Thus, a senior systems analyst might find himself entitled "Computer Systems Manager," for example.

And then there's the problem of getting on the payroll. In one incident last year, several new computer personnel didn't get paid for a few weeks because of complications apparently arising out of the disputed authority of the hiring agency to obtain more employees. It wasn't a computer error, but a bug did arise when income tax deductions could not exceed $999.99 per check, though more was called for as a result of the accumulated back pay.

Computers still have a long way to go in New York City. At present, Savas sees the need for a "significant number" of additional systems analysts, for which titles and salarys are already authorized, but the budget freeze prevents their being hired. He also notes that a private firm with a budget the size of the city's — about $9 billion — would probably spend about 10 times as much on computers as the city does.

And there are untouched applications galore awaiting attention. Traffic and parking tickets adjudication has recently been streamlined through computerization, probably because the resultant fines should make such violations profitable to the city. Such problems as those of the criminal courts and prisons must eventually be solved with the aid of computers. It's only a matter of time and money.

—Barry Nelson

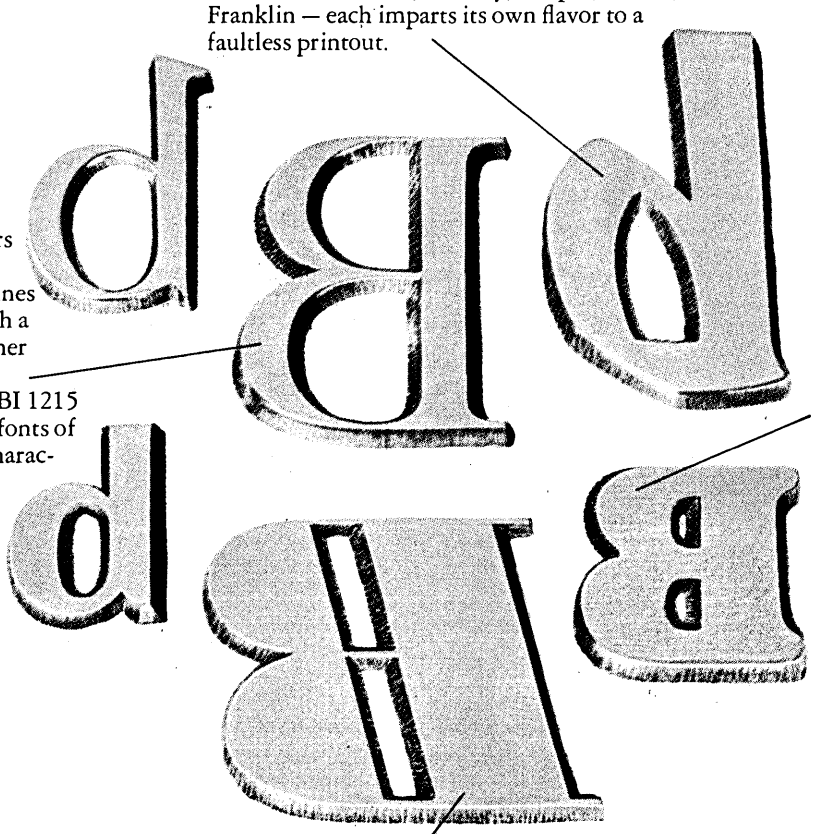
Peripheral Firms Tell Investors All Is Well, the Drive Is On

Independent peripheral makers marched to New York last month to reassure the financial world that all is well despite IBM's pricing and legal moves against their penetration of the market.

Said Laurence Spitters, president of Memorex: "Leading users have legitimized the independent." Added Lester Kilpatrick, president of Cali-

These characters illustrate only a few of the elegant, distinctive type faces you can select on the Bright Industries' BI 1215 Bar Printer. Bodoni, Century, Cooper, Futura, Franklin — each imparts its own flavor to a faultless printout.

These characters print crisply, cleanly at 300 lines per minute, with a precision no other line printer can approach. The BI 1215 accommodates fonts of 64, 96 or 128 characters, up to one-quarter inch high; fonts can be changed in the field in minutes.



These characters print with such an exact vertical and horizontal alignment that the BI 1215 can go back to overprint, underline or add phonetic symbols. Only an oscillating bar printer with an individual hammer for each column can achieve a printout so exceptional you'd be proud to sign your name to it.

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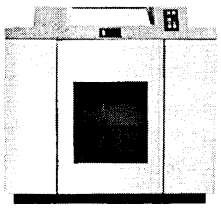

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fornia Computer Products (CalComp): "The independents' penetration is going faster than IBM wanted."

Kilpatrick put no figure on the bite taken, but did say if the drive continued, IBM could lose 20% of its peripheral installations and might, after several years of "gradual erosion," retain only 70% of the peripherals on its own computers. IBM could take it all back, he admitted, but probably wouldn't because of the effect that necessary moves like further price cutting would have on gross revenues.

Kilpatrick and Spitters spoke before the New York Society of Security Analysts. Later, Spitters, Richard Riffenburgh of Mohawk Data Sciences, and Steven Jatras of Telex were on a panel at the annual meeting of the Institutional Investors Conference.

Jatras said it isn't clear what IBM accomplished by cutting prices, since everyone else cut their prices and jockeyed back into the same position they had been in before. It slimmed profits, of course, but this hit the small and financially weak. They agreed, happily, the effect of the price cuts was to keep newcomers out of the plug-to-plug subindustry. Spitters says that to be effective against IBM, a firm must have revenues of $100 million. "The capital investment is overwhelming," he said.

Finance points

The Memorex president, more than the others, hammered home points on financing. He articulated the difficulties created by IBM's non-pay-out lease approach. The giant has "educated the user to expect it." But the independent cannot grow on rental revenues alone, and neither, for long-term profitability, should he give up the residuals on such equipment by making outright sales to users or third-party leasing companies. The exclamation point to that is that he must operate in "large scale in early development to achieve the economics of manufacturing and develop a large marketing force." The answer is vast capital resources.

Spitters seems to be asking for more awareness from the investors of what it takes to build a competitor for a multi-billion-dollar corporation. "The financial community has not been responsive to the world's needs, has not been innovative, has not solved the problems."

Part of Memorex' financial strategy has been to establish the Independent Leasing Co., which currently has capital to buy $200 million of Memorex equipment. (Memorex ran into troubles with the SEC over its accounting treatment of sales to ILC, now resolved.) Memorex, in partnership with 12 financial firms, now has minority ownership and an option ultimately to buy most or all of ILC. Whereas dealing with outside lessors usually means losing all residuals, Memorex, once it has paid all costs to ILC, will resume ownership of its equipment.

Jatras, agreeing with Spitters, noted that Telex hopes to retain more equipment ownership than in the past, but he did not indicate the methods to be used. Telex in 1970 had lessor agreements for purchase of $110 million worth of its equipment.

Richard Riffenburgh of MDS seemed to underscore the need for capital resources when he noted that after more than five years MDS rental revenues on its thousands of installations were finally exceeding sales for the first time.

What are the future plans of these firms vis-a-vis IBM? Jatras summarized that Telex, with 1970 sales of $57.3 million, will continue broadening its product lines, customer base, and geographic area and continue providing performance advantages and price breaks. It will continue to emphasize plug-to-plug compatible products because of the savings in hardware and software development and maintenance. Its means of doing this seems to be changing, however. It has been buying its disc drives from Information Storage Systems. But ISS is being bought by Itel and is likely to develop its own end-user attack. Telex now has two agreements with Control Data under which it is building controllers for CDC-made printers and disc drives. But, says Jatras, Telex will develop its own "spindle capability." The 2314-compatible drive deliveries will begin dropping the end of '71, he noted.

Spitters' ball

Spitters' frank and bullish presentation before the NY Security Analysts reportedly put some of the negative Wall Street reports on Memorex out of date. Like Telex, Memorex will stay in the plug-to-plug compatible market, which, of course, means building units like the 3330 disc drive. But some of its emphasis is shifting to products that are not dependent on IBM's lead. Its computer-output-microfilm and teleprinter units are two such products. Although COM sales were very disappointing in 1970, Memorex accounted for half the units sold the last six months of the year, and it intends to be the "dominant supplier." Memorex, with 1970 sales of $79 million, also intends to enter the systems market in a big way. Midwest Systems Corp. has been set up as a subsidiary to build "problem-solving" systems, based on configurations of Memorex products and complete with software (no computer manufacturing, though). This company will gross $10 million in '73, he projected. A variation on this is a joint venture with Columbia Broadcasting System, CMX Systems, which will produce a data retrieval system using video recording and disc drive technologies. Memorex is also emphasizing a continued build-up of all resources, particularly the sales and service force. It went from nil to 500 in 1970, handling 400 installations. Spitters said Memorex will have 1,000 installations by June. A similar sales force build-up is under way abroad, where Memorex has 15 offices. Sales for '71 and '72 are projected at $175 million and $250 million, respectively.

Mohawk Data Sciences has not attacked the plug-compatible market, although it has competed with IBM, replacing thousands of keypunches with its key-tape systems. Its long-developing approach has been the configuring of peripheral and terminal products into stand-alone and on-line systems, going "around the IBM family." Now it has announced the model 2400 peripheral processor, whose aim is to "take functions away from the central processor." Beamed Riffenburgh, "We intend to sell thousands and thousands of them." Continuing its program of acquisitions, MDS recently brought Atron Corp. and Colorado Instruments, which manufactures data acquisition systems.

—Angeline Pantages

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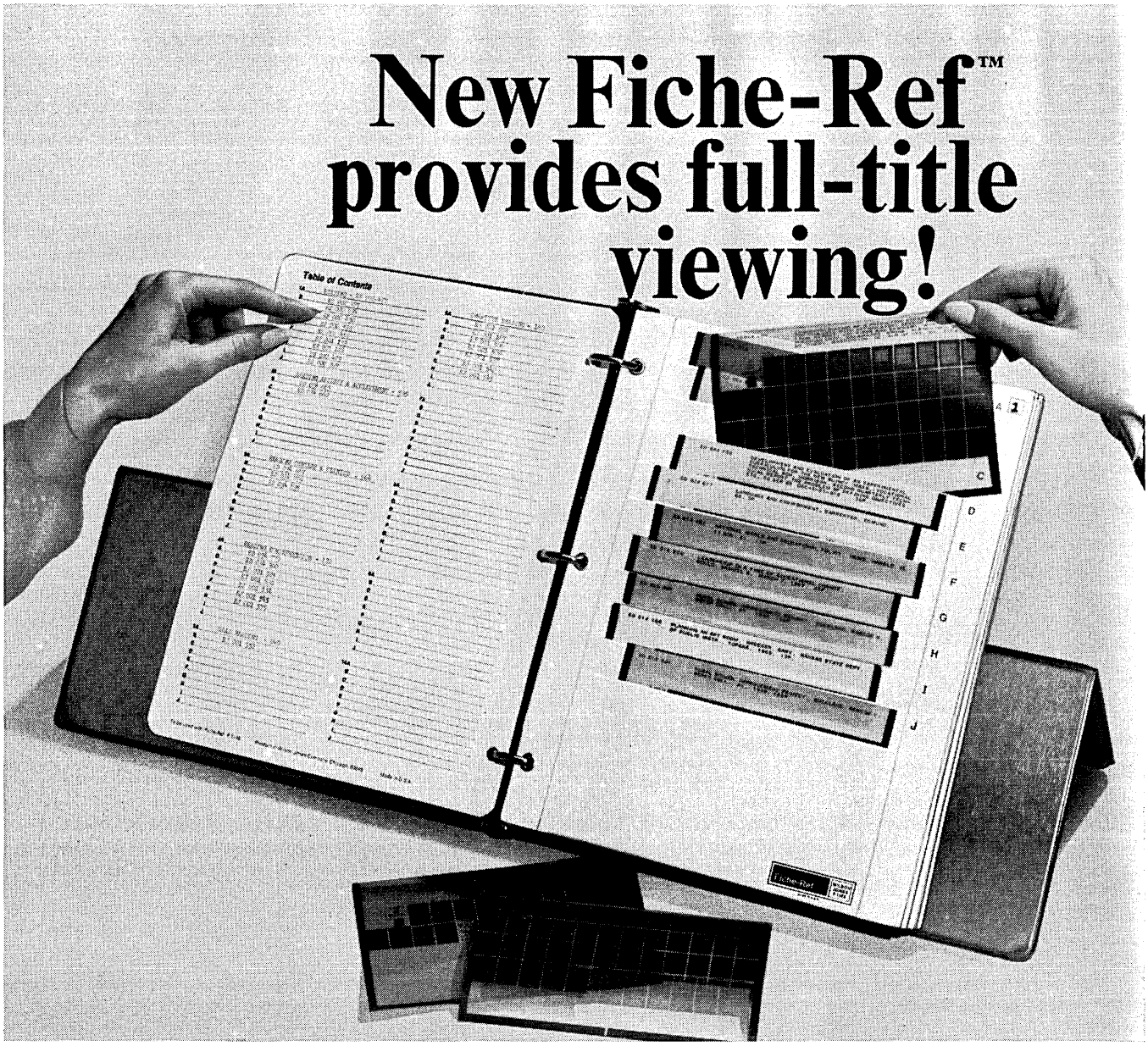

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NEWS SCENE

Memorex Counters IBM With $1 Billion Suit

Santa Clara County, located south of San Francisco, is one of California's fastest growing counties and also leads the state in average personal income. In legal documents filed in the Santa Clara Superior Court, IBM is suggesting that one heavy contributor to this affluence might have been Memorex Corp. through the sky-high salaries it's been offering to lure IBM employees from the big computer maker's San Jose plant to nearby Santa Clara where Memorex hangs its shingle.

IBM has been developing a giant disc drive, the Merlin 3330, at the San Jose plant since 1965. In recent years, says an IBM complaint filed last December in Santa Clara Superior Court, Memorex has been bleeding the San Jose plant dry of employees — always those possessing trade secrets concerning the 3330 disc drive. The suit came six months after IBM announced it would deliver 3330s in the fall of '71 and Memorex announced at the same time it would have a similar device then, too.

The IBM suit asked the court to bar Memorex from producing, marketing, or making use of anything that is interchangeable with the 3330 or its parts for a total of 30 months. It also sought to enjoin Memorex from hiring IBM employees for the sole purpose of obtaining IBM trade secrets.

Memorex had denied IBM claims of trade secret misuse and last month filed a suit in the same court asking for $5 million in damages and an additional $1 billion in punitive damages. Memorex filed a general denial of IBM claims along with the cross complaint. Its defense is based on IBM's alleged monopoly position in the computer industry, and, in effect, questions IBM's right to have trade secrets if it is a monopoly. An antitrust expert said that although it is not clear in the suit, Memorex's allegations have raised a general question that ought to be answered: If IBM has disclosed secrets to selected customers under nondisclosure agreements, are they secrets any longer? A second question concerns IBM's right to have trade secrets if it is found to have a monopoly of peripheral gear. This suggests that success or failure of the cross complaint may depend on whether this or some other court can determine whether IBM does have a monopoly.

The Memorex claim, which although filed in a state court reads very much like a federal antitrust suit, could be lumped with that of Control Data and Greyhound Computer as a class action in Minneapolis, indefinitely tying up the original IBM plea for the 30-month injunction to keep Memorex from selling a 3330. Or, IBM could decide that through the preliminary "discovery" proceedings it's learned enough of what Memorex knows about the 3330 and offer to settle out of court, an offer which Memorex, heavily burdened as it says it is by the litigation, probably would accept. The outcome is anybody's guess.

Not so doubtful, however, is the effect of IBM's highly publicized litigation against Memorex and its pricing maneuvers of the last 11 months. In displaying this concern, the computer colossus may have showered unintended credibility upon the independently made compatible peripherals — to the extent, perhaps, that a dp manager who used to play it safe with the one source may now risk a mixed installation and the wrath of IBM, real or imagined, in order to win points with his economy-minded financial management. In fact, his credentials as an astute and up-to-date dp manager may be in question if he doesn't.

Three Firms Figure in Keypunch Adaptor Suit

IBM has been charged with delaying production of a keypunch verifier adaptor for the 029 punch while it was preparing the 129.

The complaint was filed early this spring in the Southern District Court of New York by Data Research Corp., International Data Terminals, and Western Union Computer Utilties, Inc. The three are developer, manufacturer, and marketer of the device, respectively. According to Data Research, it developed the punch verifier adaptor during 1968 and in April 1969, with WUCU, approached IBM with the proposition that IBM either manufacture or market the unit under license, or take a contract to do installation or maintenance.

IBM, the complaint reads, professed genuine interest in the adaptor and in Data's offers for participation. And Data states that it disclosed in confidence all information, know-how, trade secrets, and inventions necessary to contruct the adaptors.

But by September of 1969 IBM had said no to both offers and also refused to inform users of the 029 that attachment of an adaptor would not bring refusal of maintainance by IBM field engineers. Data considered the last refusal to be wrongful and unreasonable.

Despite IBM, Data went ahead with manufacture of the unit, which was done by IDT, and states that WUCU and IDT had commenced to lease some prior to the introduction of the verifier at the 1970 BEMA Exposition. Within a week, according to the complaint, IBM introduced the Model 129 keypunches in which punching and verifying are combined.

The three companies charge that IBM, through "intentional misrepresentation and wrongful and misleading conduct," deliberately delayed the introduction of the punch verifier adaptor, and through combining of the punch and verifier, plus premature announcement of the 129 (delivery was set for April 1971), and refusal to endorse attachment of the verifier to 029 units, excluded them from manufacturing and marketing it and also from the manufacture and sale of other products that could have been sold to satisfied customers of the punch verifier adaptor.

They ask judgment on two alternative counts of violation of Section 2 of the Clayton Act: (1) that IBM perpetuated and enhanced its illegal monoplies in the computer and punch verifier markets and destroyed competition in these markets by unfair and dishonest means; and (2) that IBM attempted to monopolize the computer and punch verifier market.

Data Research executives decline to say how many users of the $28/month punch verifier adaptor there

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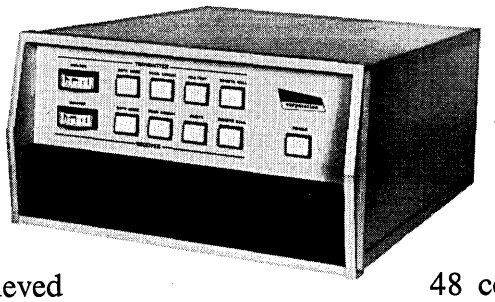

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are. The complaint, however, places damages for each count at $16 million for Data Research, $115 million for IDT, and $6 million for WUCU. With interest, plus fees and costs, and trebled in accordance with Section 4 of the Clayton Act, it adds up to at least $411 million, should the court find in their favor.

IBM believes "the suit is entirely without merit."

Designers Laud Security Cover

Datamation magazine has won a 1971 Magazine Design Award of Excellence of the Society of Publication Designers in New York. The award was presented to Cleve Marie Boutell, Art and Production Director, for her design for the May 1970 front cover.

A design of parallel lines resisting the force of concentric circles as they revolve around a central axis was selected to represent the theme of that issue: security of computer-based information.

In her 11 years as the magazine's art director, Miss Boutell has won numerous design awards from the Western Society of Business Publications and Illustrators West, as well as two previous awards from the Society of Publication Designers. The society is an organization of art directors, designers, and editors involved in graphic arts for more than 100 major magazines. Its annual competition is open to all consumer and business publications in the country.

Systems Firms Hungrily Eye "Ronald's Place"

McDonald's Hamburgers last month was on the verge of deciding on an automated system for "your kind of place."

There were many contenders who saw the 1,592 McDonald's hamburger stands as their kind of places. Bud Vivian, director of systems and data processing for McDonald's Corp., said some 25-28 companies "have come knocking at our door" since the company began evaluating automated systems for ordering and inventory control more than two years ago. But, at this writing, it looked as if Documentor Sciences, Santa Ana, Calif., had the inside track.

Documentor has been working closely with McDonald's in the two-plus years of evaluation. And, "while we've looked at a lot of other systems, it looks right now as if Documentor's is the only one which will do everything we want," said Vivian in mid-April when the schedule called for one more month of evaluation. What McDonald's was looking for was a system that would improve the speed and efficiency of window ordering; cut time, paperwork, and pilferage; handle complete inventory control; compute payroll; and have the potential of ultimately tying into a central IBM 360/30 in its Oak Brook, Ill., headquarters as part of a total management information system.

We approached McDonald's cold, says Bob Crain, vice-president, product systems for Documentor. "We installed a prototype for them first, found deficiencies and corrected them, then went in with a full program in five company-owned stores in which we continued to test and correct. We learned a lot and they learned a lot." Crain was unable to pinpoint the price of a Documentor system. He said this would vary a lot depending on core requirements, number of windows (McDonald's stands have from 3 to 14), and whether the store was franchised or company owned. Vivian put the price in "the five-figure area per unit."

Crain said the Documentor system differs from others on the market in the completeness of the inventory control it provides. Raw food inventory coming in from a purveyor is entered on a true inventory form, he said. The point-of-sale window units provide a report on how much of what was sold. In addition, waste such as items dropped on the floor and promotional items such as give-aways to police are entered into the system. At the end of the day a physical closing inventory is taken of controllable items such a meat, buns, and cheese. This data is entered and the system comes up with an item variance and a dollar variance. If this exceeds an established tolerable amount, the manager has some checking to do. This feature, Crain said, was set up as a control for absentee ownership situations, though he noted that this was not the case for McDonald's.

Of the 1,592 McDonald's stores around the country, approximately 1,200 are franchise operations and some 300 are company owned. Vivian said any contract the corporation would draw up for automated systems would include a firm order for the company-owned stores and an established price structure for franchises. The latter would not have to buy, but it would be made easy for them, he said. It probably would be

Datamation's art director Cleve Marie Boutell with editors Bob Forest, Bill Rolph, and Ed Yasaki — and the award-winning May 1970 issue.

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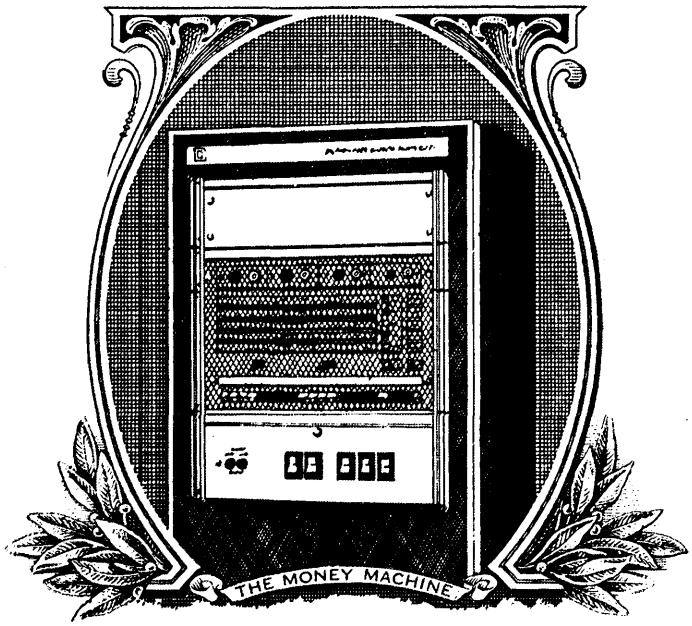

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difficult for them to go a different route, for, as anyone who's ever visited several McDonald's stores knows, it's hard to tell one from another.

And there should be something in it for the corporation if the franchisees go along with whatever system is chosen. In 1970 company-owned McDonald's stands averaged $520K in revenues, while franchised stores brought in an average of $430K. Since franchisees pay the corporation a percentage of gross, a little tighter control might change this picture.

But at least one franchisee, a two-man outfit with four McDonald's stands in Orange County, Calif., is doing a little looking around on its own. They have installed a TRW Data Systems' System 1300 in a stand in Tustin, Calif., on a test basis. Jim Andrews of TRW said the system is working well and no down time has been experienced. He said TRW wanted to try out its system in a small way before approaching McDonald's corporate headquarters. Vivian said he has had one look at the TRW system at a National Restaurant Assn. show about a year ago and "at that time it lacked some of the features we want." He specifically mentioned display for customers (which Andrews said they can now provide), remote activation of cash drawers, and the ability to handle more than six windows. One TRW system (priced at $4,500) can handle three terminals, and at two windows to a terminal this falls short of McDonald's maximum need for 7 to handle 14 windows.

But the TRW System 1300 apparently is working well for some fast-food outfits. Units are installed in a testing stage in various outlets of Kentucky Fried Chicken, Carl Juniors, A&W Root Beer, Foster Freeze, Burger King, Tennessee Fried Chicken, and Bartel and Blain. Jim Power of TRW said they are negotiating with A&W for a chain-wide installation. A&W would buy units from them, and then lease them to their franchisees through their own leasing company.

TRW's System 1300, like Documentor's system, uses mark sense for input. Other companies offering mark sense units for the fast-food business include Motiograph of Chicago, which calls its unit the Digitmaster (described by Vivian as primarily an order-taking device more suitable to drive-ins), and Tallymate Corp., a new Newport Beach, Calif., company which to date has built only one prototype. Keyboard-based systems are offered by Comptar of Pennsaucken, N.J., Honeywell, AMF Electrosystems Div., and Systems Science & Software, La Jolla, Calif., among others.

But the big competition for all, according to TRW's Power, is NCR with its cash register. "It's a question of educating people to think computers."

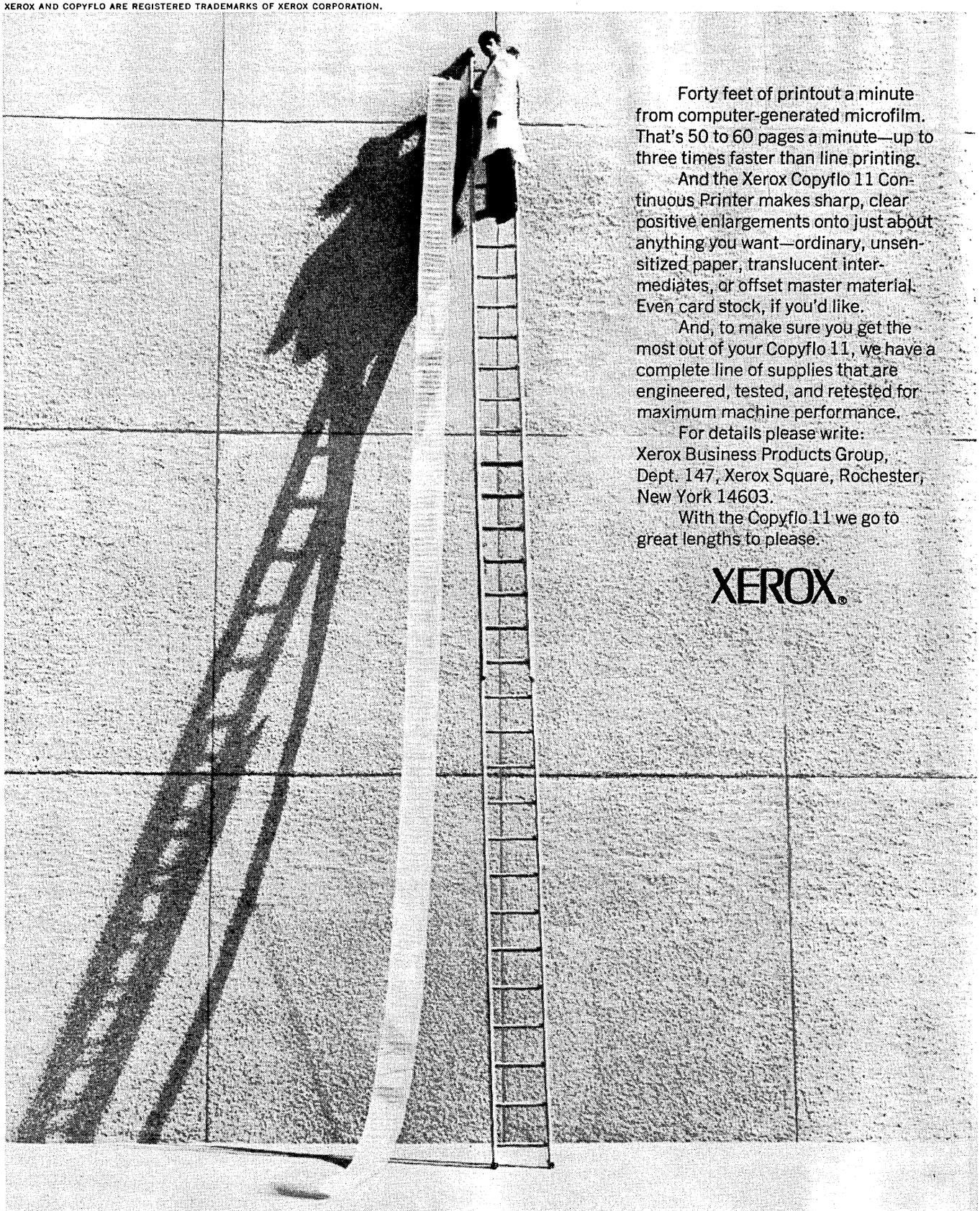
The Mariott Corp., which operates a chain of Hot Shoppes and Junior Hot Shoppes, has been taking a hard look at two systems which combine keyboards and minicomputers. One is AMF's which uses a PDP-8. The other, Sytems Science & Software's Star system, can operate with any one of five minis but will be supplied with either a General Automation or a Cincinnati Milacron. Mariott also is looking at the Documentor system and a Honeywell system and had reached no decision at this writing. Mariott owns the Roy Rogers chain, named by McDonald's as its biggest competitor; and while this chain might be influenced by a corporate decision, it wouldn't be bound by it, as any decisions for it would be made by Mariott's Restaruant Franchise Div.

At this point it appears the smaller names in the industry have the edge in the fast-food field. According to Norman Reilly, president of Computer Marketing Planning & Research, Los Angeles, which studied the field for TRW Data Systems, this is because they have learned first that the time has come in the computer industry when vendors must study their markets, learn to know their customers' industries as well as they know their own. But the situation could change. Even IBM approached McDonald's, but, says Vivian, "they had nothing we could use, only a second generation thing they called Porta Punch which since has been taken off of the market."

How big is the fast-food market for the computer industry? TRW's Andrews sees it at $20 million over the next three to four years for his firm alone and set the overall market at five times that. And the biggest plum is McDonald's. After all, 7 billion hamburgers is a lot of meat.

—Edith Myers

(Continued on page 83)



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Half Survey Tries To Give Whole Picture

Starting salaries for edp professionals are down in '71 compared to '70 according to a survey conducted by Robert Half Personnel Agencies. Headquartered in New York, the firm based its statistics on a comparison of "more than 5,000 individual job orders" as well as placements at its 34 branches in the U.S. (at least there are people starting). The survey differentiated among large, medium, and small dp installations, but overall the decline in salaries was around 5%.

In a medium-size installation, for instance, a system analyst's starting salary dropped from $11.5-12.5K in '70 to $11-12K this year, while a "programmer-jr. exp'd" went from $9-12K to $9-11K. The largest decrease is in the position of manager of dp in a large installation, which went from $20-40K to $19-35K. Also in a large installation, a regular "programmer-analyst" (as opposed to "programmer-lead or sr.") is now $12-14K, compared to $13-15K a year ago.

However, spokesmen for other personnel agencies offered varied interpretations of dp employment conditions. One view was that salaries have not dropped but that better people are being demanded for the same jobs; clients are being more selective. If there is a decrease, perhaps it can be attributed to the decline in service firms, which traditionally had to offer higher pay for the same work in order to lure people into their rather risky endeavors. Fewer jobs in the service firms would tend to lower the statistics.

Another opinion substantiates client demand for better qualified personnel for the same price, and cites a large change in job-hopping salary increases. In the past, boosts of 20% were not unusual in luring away a desired employee. An increase of 10% is seldom seen now. One curious development is that applicants in some cases are downgrading their past salaries in the effort to secure employment. However, the Half survey did not include data from applicants.

Berkeley Computer Down for the Count

Following a long struggle for survival, Berkeley Computer Corp. last month gave up, shut its doors, and hung a "for sale" sign on its big Model 500 time-sharing machine.

The company, which had worked the kinks out of the machine and started selling time on it in January, had been negotiating with "a number" of potential investors since that time to no avail. So, the company born of an idea on the campus of the Univ. of California at Berkeley, when president and founder Dr. Melvin Pirtle was working on the Advanced Research Projects Assn.-funded GENIE project, became three men with a computer for sale. The three are Dr. Pirtle, assistant to the president Ted Edlin, and vice-president Dr. Wayne Lichtenberger.

They'll be trying for more than just a sale of the machine, said Edlin, who admitted he didn't think a sale would bring back the $2 million-plus it cost them to develop and build it. "We're still hoping we can find someone will-

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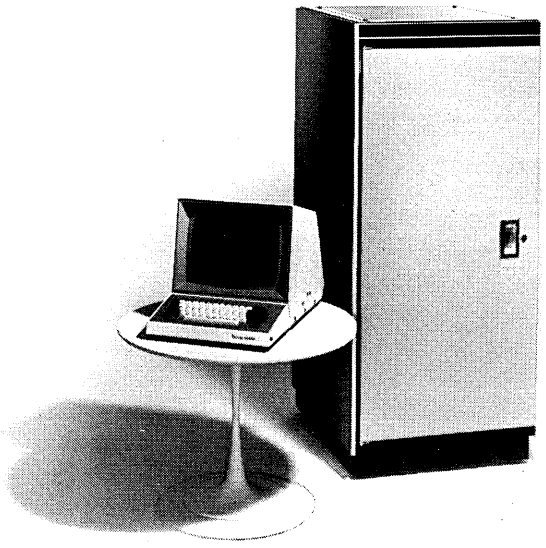

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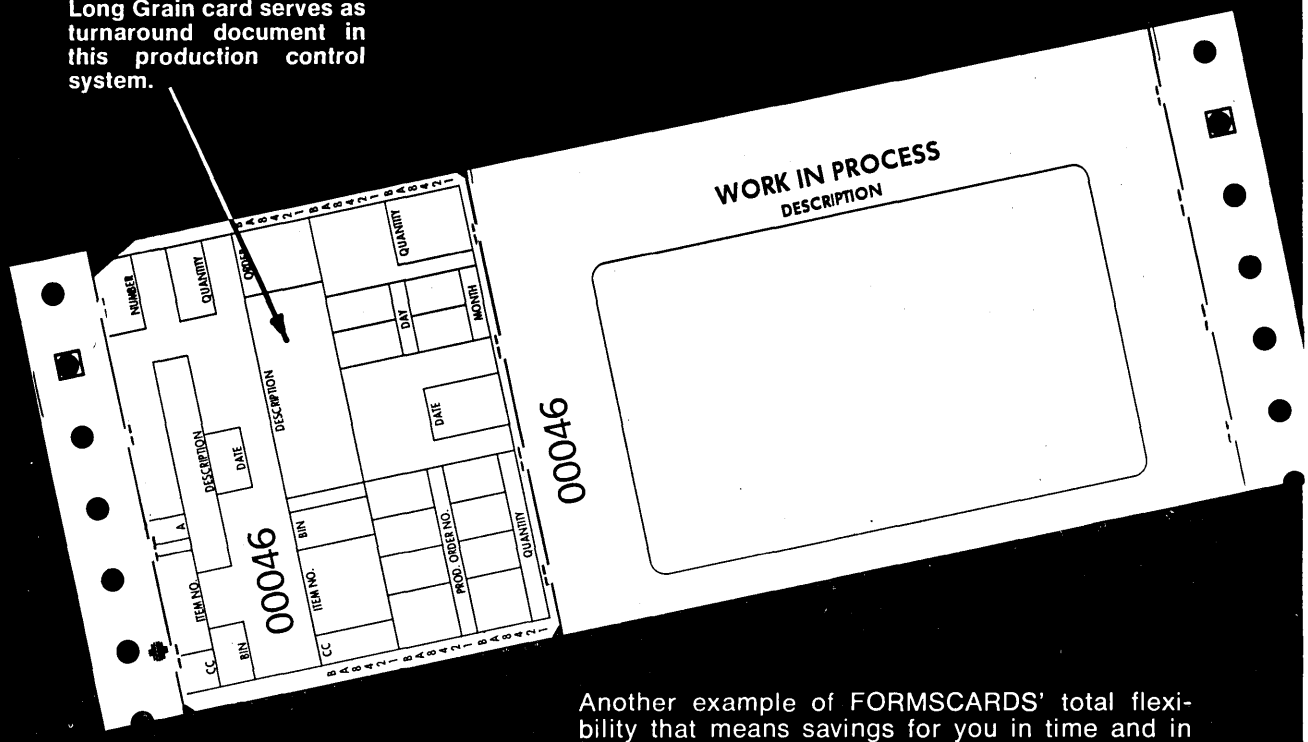

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ing to invest enough to get the company going again either as a service bureau or as a manufacturing operation." The original Berkeley plan was to be both. The big Model 500 and a planned second version were to be the basis of a service bureau operation. A proposed Model 1000, a production version of the 500, was to be manufactured and sold once the service bureau operation got going.

Berkeley was founder-financed when it got going early in 1969. In the spring of that year Data Processing Financial & General bought in, committing $2 million which Berkeley had used up by last summer when they first got their big general-purpose machine up and running and DPF&G was in no position to fork over more. A life-saving $1 million from the Univ. of California kept the firm going.

Interest in the big machine, designed to service 500 simultaneous users with a response time of less than 2 seconds, was always high. Many of the ideas behind it came from the GENIE program, primarily a study in time-sharing. The GENIE group, which included Pirtle and Lichtenberger, designed alterations to an XDS (then SDS) 930 which so impressed XDS they included some in the 940 system. When GENIE funding was cut off, Pirtle and others left the university, taking their time-sharing philosophy with them, and Berkeley Computer was born.

At its peak during the days of the DPF&G money, the firm employed 165. They began laying off assembly workers last June when the first machine was almost complete and money was running low. By mid-November all assembly workers were gone and the staff down to 30, with the mean age 27. It was a young, devoted group, according to Pirtle, who said all were working 14 hours or more a day with no thought of overtime pay. From November until January it was a matter of refining software and looking for money. The former was accomplished. The latter wasn't. But there were no big debts, no pressure from creditors, and, according to Edlin, no plans for any kind of bankruptcy proceedings, and still some hope on the parts of the three men left. But the big machine, which could handle up to 20,000 remote terminals, was idle.

ARPA Net To Have Trillion-Bit IR System

By 1974, the Defense Dept. plans that universities and research centers that are part of its ARPA Computer Network will have a new capability — access to an on-line information storage and retrieval system with a trillion-bit memory. Equally important, that system ultimately will be located with and on-line to the giant ILLIAC IV at the NASA research facility in Ames, Calif.

The Advanced Research Projects Agency (ARPA) has awarded Computer Corp. of America, Cambridge, Mass., a contract for the first year to begin development of the "datacomputer." Its charter is to assemble an "integrated hardware/software facility" that will store large files "at minimal cost" and provide a community of users with file-sharing ability, a uniform method of accessing remote

files, and advanced data management services. Precision Instruments' trillion-bit laser memory, the Unicon 690, has already been selected. CCA will develop most of the software and select a "large computer," other peripheral equipment like disc drives, and additional software. It's expected the entire system will cost about $3 million.

Participants of the network, started in 1969, are now linked to each other via DDP-516-based Interface Message Processors (IMP), which handle 50KB lines in round-robin communications among the participants. They will be linked to the datacomputer by the IMP's as well. The new system will store such files as a 100 billion-bit data base of historical meteorological information and have only "simple" computation ability since it is meant primarily to pass the needed information to the user's computer for processing. Ultimately, where a problem requires massive amounts of data and computation, the datacomputer will be able to transmit its files locally to the ILLIAC IV via high-speed lines.

EDS Medi-Cal Contract Questioned by Auditor

Medi-Cal and its costs are sensitive subjects in California these days. The program faced a $70 million deficit in state funds at the end of the current fiscal year. Funds were being cut, restored, and debated in legislative committee and in the courts last month.

And in some quarters in Sacramento there was concern over "millions of dollars of state welfare funds" passing out of state to a profit-oriented organization.

The organization is Electronic Data Systems, Dallas, which received more than $8 million in Medi-Cal funds in 1970 under a subcontract it has with Blue Shield, one of three organizations processing Medi-Cal claims for the state's Dept. of Health Care Services. The concern was expressed by the state's Auditor General which recently completed an audit of the edp operations of these groups.

State auditors were permitted free access to the books of Blue Shield, Blue Cross North, and Blue Cross South, but not to those of EDS. The three companies, all nonprofit organizations, have "no-profit, no-loss" contracts with the state for the Medi-Cal work, signed in 1966 and continued on a year-to-year basis.

Blue Shield found itself unable to cope with the rapid increase in claims (from 60,000 per day in 1966 to a peak of 150,000 a day last year) and in Sept. 1969 signed a subcontract with Electronic Data Systems Federal Corp. The auditor contends this contract was entered into without the prior knowledge or consent of the Dept. of Health Care Services and has asked the California Attorney General to investigate its legality.

A spokesman for EDS said this was a fixed-price contract with Blue Shield, not the state, and therefore there was no reason to permit state auditors to examine its books. There is the added factor that EDS was handling the processing of Blue Shield's own claims in addition to those for Medi-Cal. He said EDS has cut the backlog of unpaid claims in half since taking over processing from Blue Shield and has reduced the time of claims payment by the same factor.

The auditor readily admits the subcontract with EDSF "has resulted in improved performance of Blue Shield" but calls "highly questionable" the propriety of welfare funds passing to a profit-oriented subcontractor under a no-profit, no-loss prime contract.

The auditor also questions the state's liability for $400K in development costs funneled to EDS through Blue Shield for a system EDS will be able to use for profit for other health care customers.

The auditor's recommendations appear to based on the premise that improved efficiency in a system run for the state where it results in costs savings should end with these savings being passed back to the state and, as an end result, the taxpayer.

In the case of EDS, the auditor believes, but could not verify through direct audit, that the processing cost per claim did go down as efficiency improved, but the cost to Blue Shield

(Continued on page 91)

Give us your hopeless computer tapes.

Now that more and more computer people are feeling the economic pinch, they're starting to do some pinching of their own. Penny pinching.

They're discovering GKI Tape Service—the national leader for 12 years—and the way we can restore even "hopeless" computer tape. The tape they get back is sparkling clean, fresh as new, ready to provide satisfactory service again. At a fraction of the cost of new tape.

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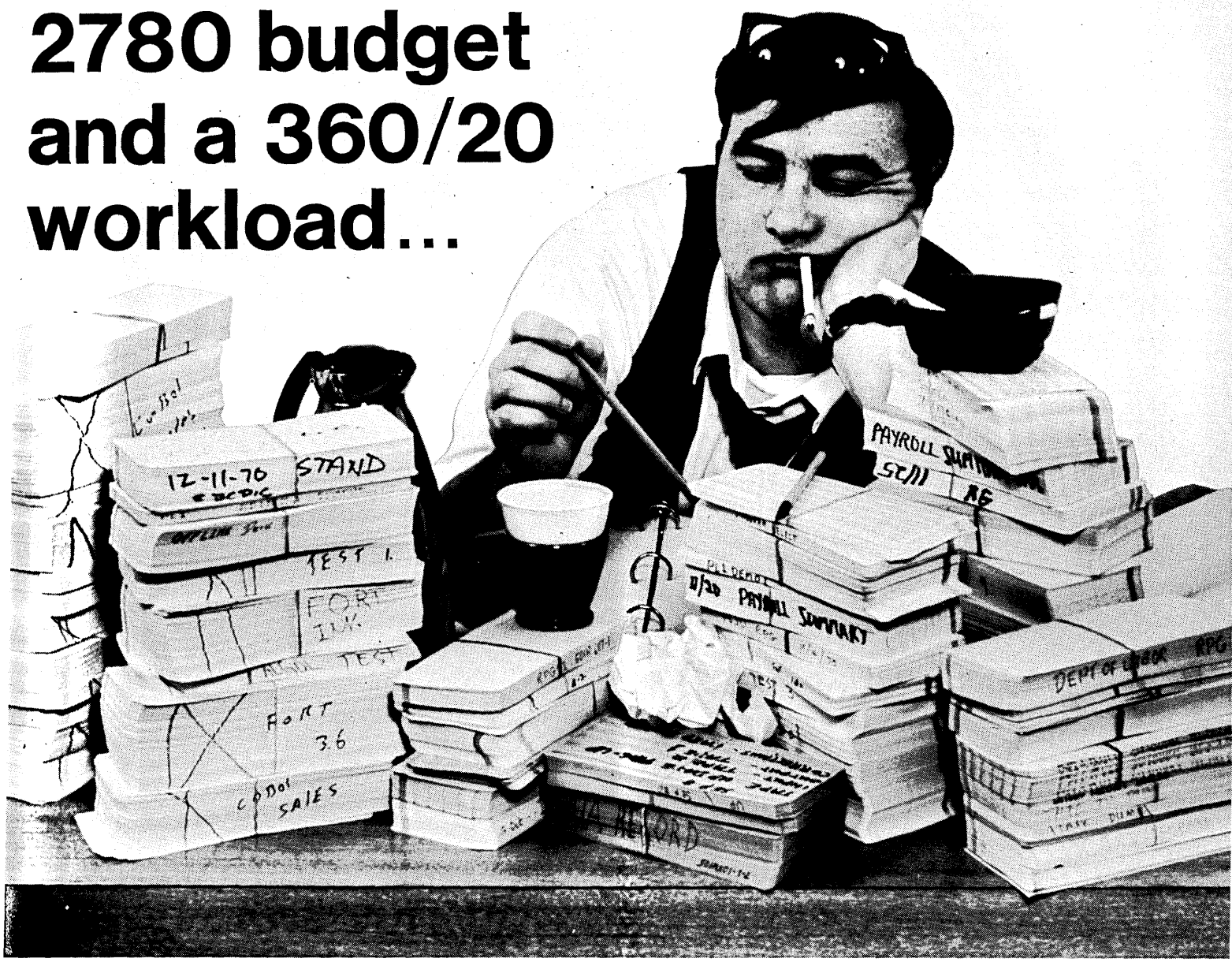
"We get a little bit more out of your tape."

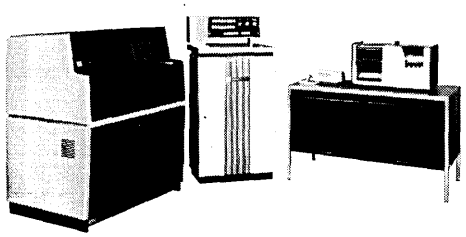
If you have a 2780 budget and a 360/20 workload...



You used to have a problem.

No more. The Atron 360/20-I and 20-II are here. They're comparable in performance to IBM 360/20 remote batch terminals, but *rent for 25 to 37% less!*

For example, the ATRON 20-I with similar peripheral hardware as a common Sub-model 2 configuration (300 LPM printer and 600 CPM reader) rents for $833 less . . . including maintenance. And the 20-II will take $763 *less* out of your monthly budget than IBM's Submodel 5 (1100 LPM printer, 1000 CPM reader)!



So, without having to head another "budget reapportionment" campaign, you can have all the conveniences of a 360/20 operation — high-speed or TelPac communications, interleaving, job status checks and stand alone computer capabilities.

What about maintenance with ATRON equipment? You won't find better. We have a network of over 75 service facilities across the country. If you have a problem, we're equipped and ready to help NOW.

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CIRCLE 59 ON READER CARD

CalComp doesn't claim to be driving IBM right out of the business, of course.

But together with our disk drive subsidiary, Century Data, we're claiming a pretty fair share of the market. And a bigger share every month.

Last month, for example, we received orders for more than 300 disk drives.

And while over 90 percent of them will replace compatible IBM devices, we doubt if IBM will replace any of ours. For several reasons.

First, with average access times of 30 to 35 milliseconds, our disk drives are twice as fast as theirs.

Second, with electromagnetic positioning instead of mechanical pawls, detents and gears, ours are simply more reliable.

And third, ours cost less. Ten percent less on a year's lease than IBM's new, low-priced 2319 system, to be exact.

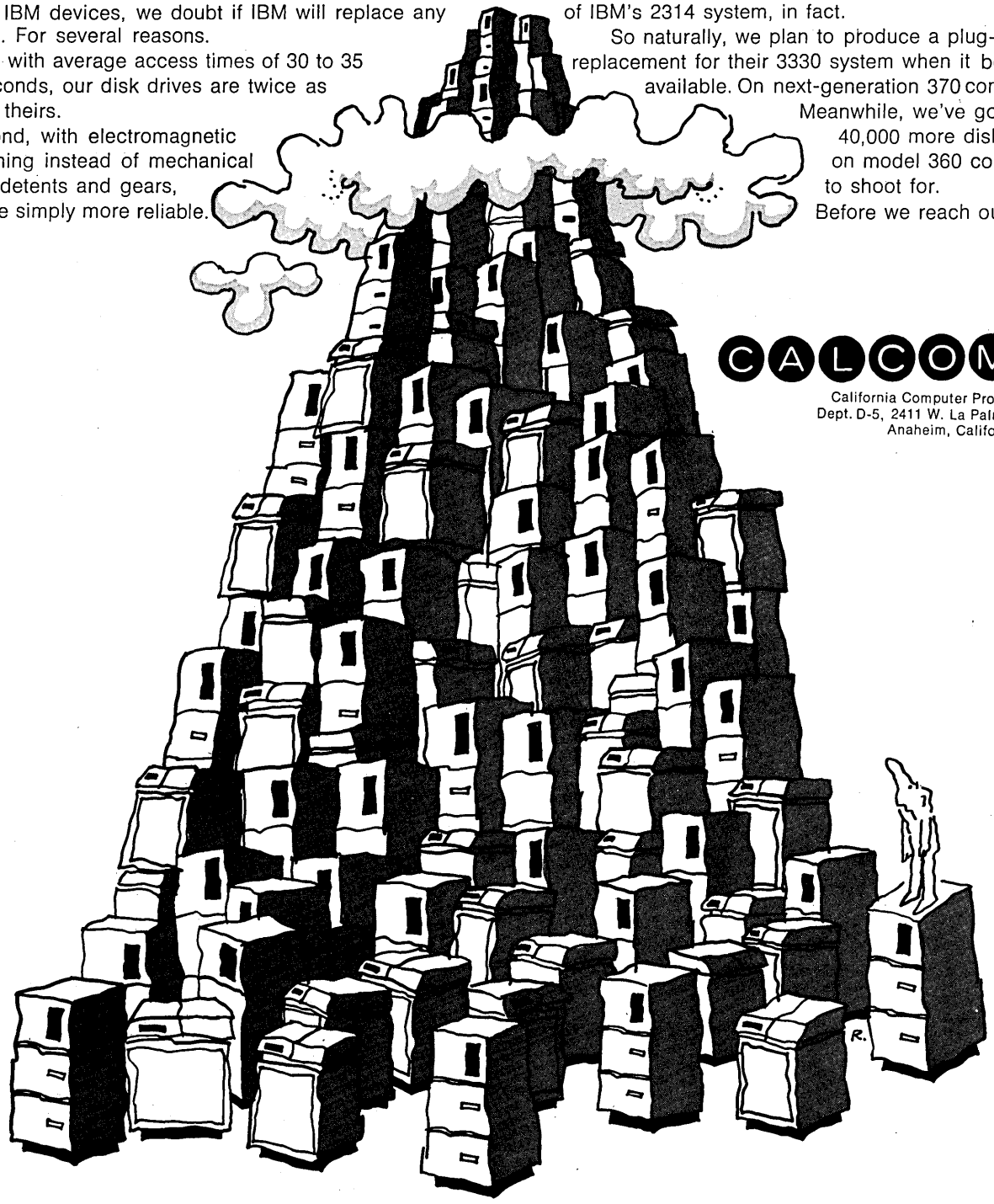
What's more, we've announced a new system of our own, called the CD 1015/215. In addition to being twice as fast as anything IBM delivers, it costs less and stores twice as much per spindle.

CalComp is the leading independent disk drive producer. The first independent to deliver a complete equivalent of IBM's 2314 system, in fact.

So naturally, we plan to produce a plug-to-plug replacement for their 3330 system when it becomes available. On next-generation 370 computers.

Meanwhile, we've got about 40,000 more disk drives on model 360 computers to shoot for.

Before we reach our peak.



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Dayton, Ohio
Denver, Colorado
Detroit, Michigan
*Grand Rapids, Michigan
Hartford, Connecticut
Honolulu, Hawaii
Houston, Texas
*Jacksonville, No. Carolina
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*Miami, Florida
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Orlando, Florida
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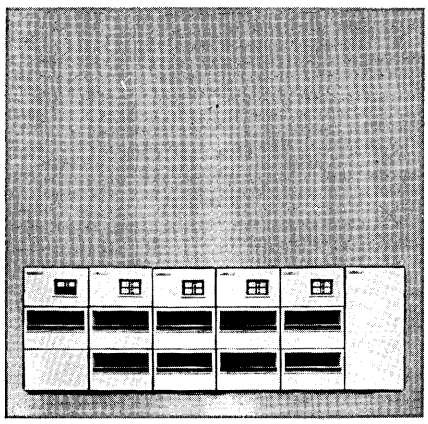
For complete information, addresses and phone numbers, please ask for Bulletin No. 130.

CalComp's CD 22/14 replacement for the IBM 2314 system. Each 2-high cabinet stores up to 58 million 8-bit bytes.



CIRCLE 66 ON READER CARD

and the state remained the same.

In the final analysis it will be up to the state legislature to act on the auditor's long list of recommendations. If nothing else comes out of this, it appears there will be some tightening of requirements and language in the awarding of Health Care Services subcontracts.

Agencies Don't Like Gov't. DP Management

A blistering attack on the federal adpe management program has been unleashed by members of an interagency advisory committee. The Office of Management and Budget (OMB), General Services Administration (GSA), and the National Bureau of Standards (NBS) "seem to have construed their authority and responsibilities ... quite narrowly ... and the result has been a lack of leadership and a drift in management," says the group's report.

It adds that: There is "no formal structure or method" requiring agencies to collaborate on development of new dp applications; "imaginative use of data processing ... has barely been touched," largely because "policy-level decision makers have not become sufficiently involved ... "; before the feds can reap really big benefits from system multisourcing, the federal standards effort will have to be vastly expanded; there is too much emphasis on immediate payoffs and the current budget cycle, and not enough on long-range development. "Thus we observe third generation adpe emulating second generation adpe working on first generation data systems."

The group "reluctantly reached the conclusion that no meaningful, coordinated data processing planning and systems development is being conducted in terms of the (federal) government as a whole. (The government) is not motivated, equipped or structured well for development of the most effective use of (dp systems), and none of the presently constituted government-wide adp entities have demonstrated either the necessary capacity or intention to lead the charge in this area, which represents about 70% of total adp costs."

The group recommends establishment of a presidential commission "to conduct a comprehensive review of adp in the federal government." It should look into such areas as management structures and attitudes; competence and availability of personnel; the need for standards; central adpe funding, procurement, and inventory management; centralized management of adpe and telecommunications resources; central information bases and distributive adp; individual privacy.

In the meantime, OMB should develop better adp management information, including criteria for evaluating system performance; investigate agency organization charts to see where changes could bring about better use of dp resources; decide what the most critical management problems and technological opportunities are and develop a five-year plan for solving the former and exploiting the latter; develop safeguards for insuring the privacy and physical security of automated data files.

OMB must also build a fire under the other two members of the federal adp management troika, the report adds. GSA should be directed to study central funding of "all adpe costs and central inventory management of adpe." Other problems requiring increased GSA attention, according to the report, are federal overdependence on suppliers for help in configuring systems and the use of long-term adpe rental contracts and long-range plans for reutilization and disposition of government-owned dpe. Advisory services provided by NBS to agency dpe users need to be improved, said the group. It also thought federal standards should be expanded "to encompass not only ... hardware ... and software but ... any aspect of adp and related information systems which must be standard if many agencies are best to collaborate, interact, and function jointly."

The report was prepared by members of an interagency committee on adpe, which includes representation from all the major users in the federal government. The task group that did the work comprised nine members, including one from the General Services Administration; the other two members of the troika weren't represented. *(Continued on page 93)*

Make the next step COM.

By going directly to microfilm, you can get your computer printout at a fraction of the paper cost. And at the same time speed distribution and reference.

And you don't have to make a big investment, either. Simply have a nearby COM service bureau equipped with a Kodak KOM-90 microfilmer do the job for you. They can convert your tape data to any one of several microforms—including microfiche. And they offer COMplete service—are backed by Kodak's national service organization, software programs, and information retrieval know-how.

For more information, contact your Kodak microfilm systems representative. Or write: Eastman Kodak Company, Business Systems Markets Division, Dept. DP-558, Rochester, N.Y. 14650.

Kodak Microfilm Systems

CIRCLE 64 ON READER CARD

Conversations with the officials on the Hill and in the Executive Branch who have policymaking responsibilities for federal dp activity suggest opposition to much of the report's recommendations.

Digital Scanning for OCR?

A solid-state optical scanning device which converts optical input *directly* into digital output has been patented by a 15-man firm that has devoted its four years of existence entirely to the new technology.

Optonetics, Inc., Teterboro, N.J., sees its Solidscan as a replacement for electron beam vacuum tubes now used in electro-optical applications such as OCR; the tubes produce analog output and are about the last vacuum tubes in general use, except for crt displays. Solidscan is now ready for marketing, and the vendor can quote firm prices with deliveries in 60-120 days. A typical unit that takes the form of a 2½-inch cube and provides 160,000 scan points at 400 points per linear inch sells for about $100 in quantities of "several hundred."

The firm says Solidscan provides the advantages of having an inherently digital nature, solid state stability, and high resolution. Although the firm claims its prices are competitive with vacuum tube devices, this was contradicted by a potential customer who said that Solidscan was presently too expensive, though he felt it was a good idea and Optonetics should be encouraged. At the same time, the company's sales pitch that Solidscan is more reliable than vacuum tubes would have to be demonstrated in actual use to satisfy this particular customer, who said present devices are also highly reliable.

CIRCLE 593 ON READER CARD

NEWS BRIEFS

Going, Going, Cancelled

The first order for a Japanese computer to be sold in the U.S. has now become the first order for a Japanese computer to be cancelled, but two other installations should be forthcoming. Squibb Beech-Nut Inc. had placed a conditional order for a 48K Facom (Fujitsu Automatic Computer) 230-25 in December but withdrew in March "because the capacity of the new machine exceeded ... current and projected requirements for the application considered." But meanwhile, Automation Sciences International Corp., marketers of the Facom line, announced receipt of a three-year lease order for a 230-25 from Demographic Systems Inc., and revealed that negotiations were in progress with Western Union Computer Utilities, Inc., also for a 25. At press time, a firm order was believed imminent. So it looks as if the Japanese will yet establish a beachhead.

Standards Oil the Networks

Two new standards have been submitted to ANSI's X3 for approval by X3K6, the Network-Oriented Project Management Systems task group. The first pertains to the "special vocabulary" for such network-oriented systems, and is subdivided into three segments: Abbreviations and Acronyms, Symbols, and Terms. The second draft standard is a set of network-oriented simulation terms for inclusion in the American National Information Processing Dictionary.

A further NOPMS effort is "in the area of formalizing networks in terms of graphic representation. In this instance, the purpose will be to provide a standard formalism for each of the major networking techniques; e.g., precedence diagrams or activity-on-arrow networks."

Datacraft to Harris-Intertype

Datacraft Corp., Florida manufacturer of 24-bit computers, has found $1.6 million to help its cash flow from Harris-Intertype, which eventually would gain a 61% interest in Datacraft under an agreement providing a $1.6 million loan secured by a debenture convertible into 800,000 shares of Datacraft common. Harris also has a five-year option to buy 550,000 shares of outstanding stock at a range of $5-9 a share over the life of the option. Much of the outstanding stock will come from Recognition Equipment, Inc.

Come Fly With Him

Jay Kleinbard of North American, Downey, Calif., is trying to get together a group of 50 computer commuters to fly to Ljubljana, Yugoslavia, for the IFIP Congress 71, Aug. 23-28. He's been quoted a round-trip price of $350 from Los Angeles by a European airline that will even make stops in Chicago and NYC to pick up enough passengers to make up the 50. Anyone interested can reach Kleinbard through P.O. Box 165, Beverly Hills, Calif.

SHORTLINES

The 10-year-old Society of Data Educators has launched a certified data educator program in which it will officially encourage use of the initials CDE (Certified Data Educator) by candidates who successfully complete three levels of examinations in data education, verify 100 hours of dp teaching experience, and are members of SDE, which requires a bachelor's degree. The CDE designation, says the society, "is intended to certify that the candidate is qualified to teach data processing at elementary, secondary, collegiate, or adult levels ... and to provide a badly needed national standard measure of competency" ... American Institute of Planners, based in Washington, D.C., has created an Information Systems Dept., which will elect its own officers annually and, in time, have its own bylaws ... Logicon, Torrance, Calif., software firm, received a $728,056 contract from the Naval Regional Procurement Office, Los Angeles, for continued work on the Navy's Warfare Analysis and Research System (WARS), a large computer-centered planning, training, and gaming system for which Logicon is doing software design and development and providing systems engineering support ... The U.S. Postal Service is continuing to automate its efforts, this time in the area of production of keys for postal lock boxes. The Service has installed a PDP-8 based system designed by Comstock & Westcott, Inc., Cambridge, Mass., which cuts, stamps, inspects, and packages the keys for mailing throughout the country ... When every day is payday, a computer comes in handy, and Nicholson Terminal & Dock Co., River Rouge, Mich., which loads, unloads, and repairs 400 ships yearly and pays its employees in cash every day, has

"And when did you become a Computer Expert, sweetheart?"

Look at the Datapoint 2200.
It ushers in the sensible age of computers.
She'll enter data directly from source documents.
She'll verify it on the CRT screen.
And it's transmitted with no other human involved.
(No mistakes either.) She doesn't need any other equipment.
It's a friendly terminal that talks to her. Guides her.
Walks her through the job. And without a peep or noise.
It's the first computer that doesn't add to office turmoil.

Some slightly technical information about the 2200:

1. It has a programmable memory of up to 8192—8 bit words.
2. It takes a library of basic systems created by CTC.
3. It enters data directly to tape, at the speed of light.
4. It works with any data code. ASCII, EBCDIC, BCD, etc.
5. Beautifully enough, no special training is required.
6. Sleek and handsome. (Wait till you see it!)
7. Self-contained unit. That means you lay out nothing for supplemental units or auxiliary power.

"On my lunch break."

Your secretary will learn just as fast.

(the people who took the terror out of computers)

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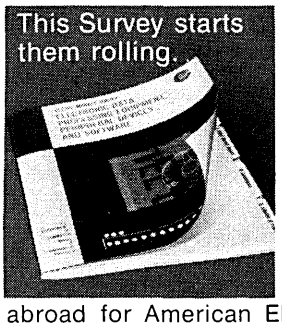
CIRCLE 45 ON READER CARD

We can get the wheels turning

to get you a piece of the $4 billion EDP market overseas.



When it comes to EDP equipment America is the world leader. Yet the time has never been better to cultivate new markets than right now.

Just look overseas!

Potential customers abound abroad for American EDP hardware, software, peripheral equipment.

A special market study—more than a year in the making—tells the whole story. It has been specially prepared by the U.S. Department of Commerce's Bureau of International Commerce for the computer industry as part of the Global Marketing Program.

It can tell you who's looking to buy what now and over the next five years in 25 countries around the world. For new installations. Expansions.

It can tell you what EDP products are most in demand. How to sell them most effectively.

The Bureau of International Commerce will help you in more ways than you can imagine... and so will Sea-Land, the international intermodal transportation company. Sea-Land can show you how containerization can put your EDP machinery and related equipment right on the doorsteps of overseas customers.

Write today on your business letterhead for your copy of the EDP Global Market Survey and find out how really easy it is to expand your marketing horizons. Copies may be obtained from your local U.S. Department of Commerce field office or from Sea-Land Service, Inc., Dept. A, P.O. Box 1050, Elizabeth, New Jersey, 07207.

CIRCLE 94 ON READER CARD

U.S. DEPARTMENT OF COMMERCE • BUREAU OF INTERNATIONAL COMMERCE — GO GLOBAL

SEA-LAND

Partners in expanding U.S. exports.

enlisted the aid of an IBM System/3 ... The Computer Professionals Against ABM, the ad hoc organization formed to oppose the Safeguard antiballistic missile system, has enlisted seven more supporters, including Dr. Herb Grosch of the National Bureau of Standards and Professor Robert W. Floyd of Stanford Univ. The group now numbers more than 500 members ... Time Zero Corp., Torrance, Calif., maker of data concentrators, front-end processors, and communications equipment, has formed a wholly owned subsidiary, Time Zero Communications Corp., to emphasize its new venture into data communications systems. Bob Hengen continues as president; R.R. Morgan becomes a vp.

NEW COMPANIES

A neurosurgeon in the computer business? Yep. He's Dr. Joseph M. Edelman, who developed a small computer-based system to streamline report preparation in his own practice and liked the result so much he formed **Edelman Systems, Inc.,** Baton Rouge, La., to develop and market small computer systems for group medical practices, legal firms, and small businesses. The systems are based on Digital Equipment Corp. PDP-8/I minicomputers ... Facilities management continues to attract newcomers. **Raam Information Services Corp.,** new New York City-based FM firm, says its sales already are running at $2.5 million annually ... Computer output microfilm facilities management services will be offered by **Computer Microfilm Systems,** organized in Glendale, Calif., to install COM units, assume complete management, financial and technical responsibility, and to deal directly with COM manufacturers ... **International Microfilmers, Inc.,** Hazleton, Pa., is providing microfilming, COM processing, and what it describes as "a unique method of combining microfilming organization with computer retrieval systems." ... The Plessey Co. Ltd. has formed **Plessey Communication Systems** in New York City to sell and rent its private automatic branch exchanges (PABX) and related telephone equipment ... **Marlennan Management Systems, Inc.,** Chicago, will offer management consulting services on computer operations and personnel ... Another new firm with personnel services is **The Corporate Resources Group,** San Francisco, which provides executive search, staffing, and recruitment counsel to the financial, technical, and edp community ... **Optical Entry Systems Corp.,** formed in Silver Spring, Md., as a subsidiary of Computer Entry Systems Corp., will specialize in an optical character recognition approach to data entry systems ... Energy Conversion Devices, Inc., Troy, Mich., formed a new subsidiary, **Ovonic Memories, Inc.,** to manufacture and market optical mass-memory systems using ovonic material as the storage medium.

MERGERS, ACQUISITIONS

Western Union Telegraph Co. acquired the **Teletypewriter Exchange Service (TWX)** from the Bell System and Independent phone companies. Western Union paid AT&T $83.4 million, half in promissory notes, and the Independents $5.5 million ... **Data Products Corp.,** Woodland Hills, Calif., peripherals manufacturer, acquired 100% ownership of **Core Memories, Inc.,** Mountain View, Calif., producer of ferrite cores, stacks, and complete memory systems ... **Information and Computing Centers Corp.** acquired all assets of **World Computer Systems Engineering Corp.** for stock. Both firms are in Dallas. ICCC makes power supplies, audio-frequency amplifiers, cathode ray tube monitors, and other subsystems; and WCSEC, a payroll information collection system and a computerized security against false entry system (ComSAFE) ... **Elkins Institute,** Dallas-headquartered computer education firm, purchased Houston's **Univac Education Institute** for cash and combined it with its Houston school ... **Comress, Inc.,** Rockville, Md., software firm, moved into the computer monitoring field with acquisition of the assets of **Computer and Programming Analysis, Inc.,** from lease Management and Financing Corp. of Philadelphia. ■

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When you need computer services, you want a company that will be around for awhile.

We've been around for 20 years. Now we're an independent company offering you this experience and dependability in a full range of services. Including time sales, facilities management, consulting, program services, training, and data base services.

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This card has an error keyed into it, and heaven only knows where it will end up. But if it gets as far as validation on your main computer, you know it will have to go all the way back to data preparation and start over.

Like passing go and *paying* $200.

The Entrex 480 is a key-disk data entry system that delivers an edited, verified, blocked, and labeled magnetic tape to your computer. Inside our "black box" is a computer with up to 65K bytes of core and 8 million bytes of disk. Outside are up to 64 DATA/SCOPE™ CRT keystations so simple to use an untrained operator can be productive in less than two hours.

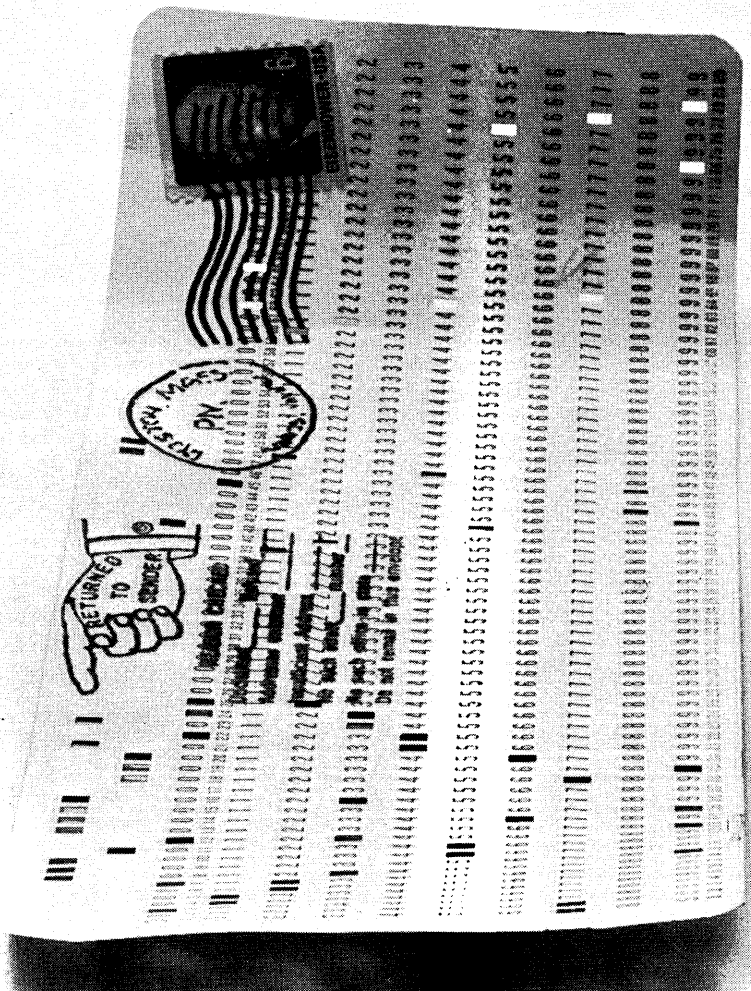
Not just blind entry, either. The DATA/SCOPE's display tells her what to enter in each field. It signals her errors, she corrects them then and there. Simple as we make it for the operator, there's even a HELP! button if she panics. Then the CRT tells her how to get back on the track. The completed entry—up to 400 characters on the scope at once—can be edited and verified quickly. Other records can be called back from the file for comparison.

The Entrex 480 output is a single compatible tape. None of your equipment, or people, or time is required to put the information in your required sequence and format, blocked, labeled, and ready for high speed processing.

Install an Entrex 480 system and you'll not again have to return undelivered data to its sender. Call or write for literature and/or a demonstration. Entrex, Inc., 113 Hartwell Ave., Lexington, Mass. 02173. (617) 862-7230.

ENTREX

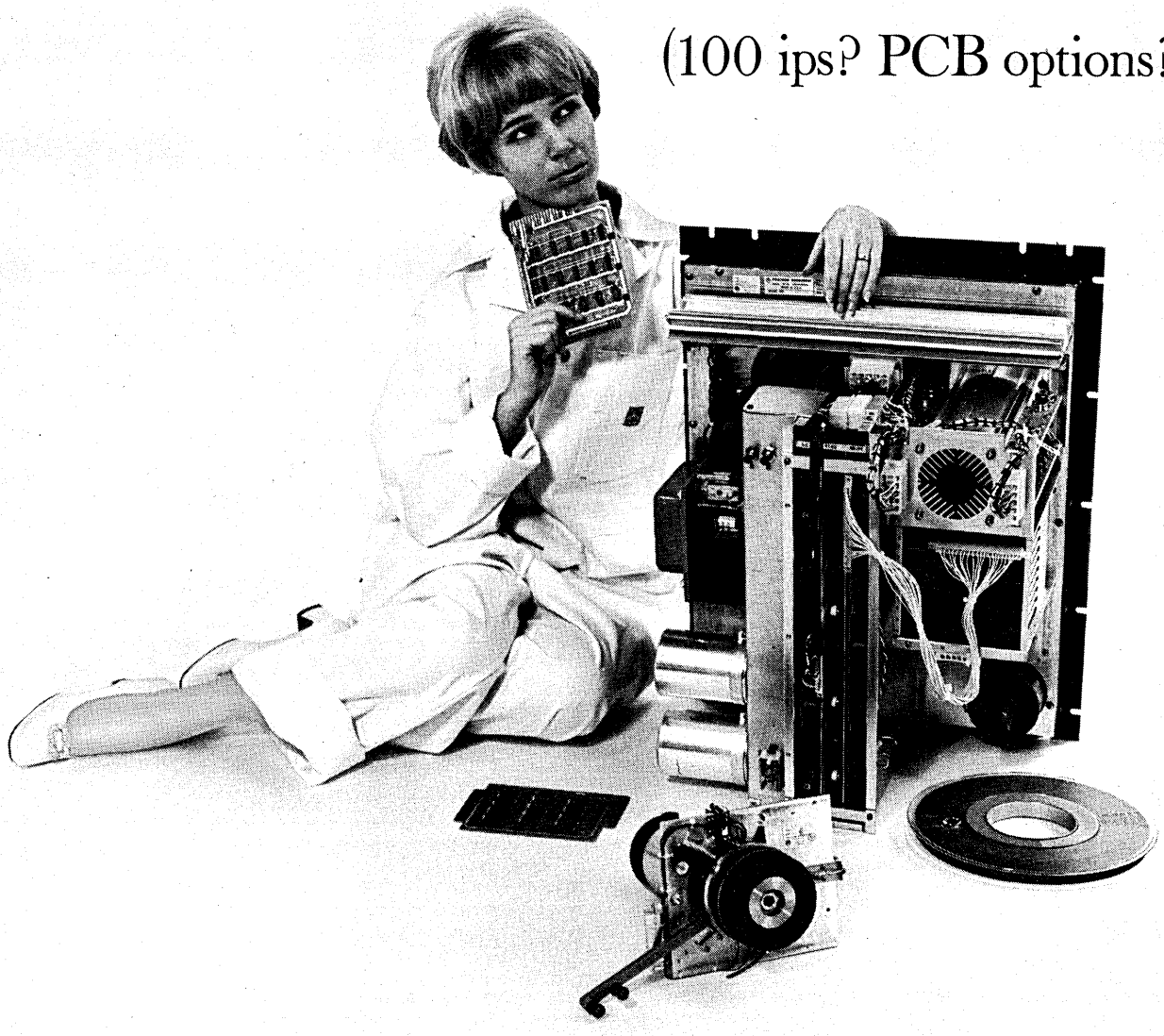
Return to sender



CIRCLE 48 ON READER CARD

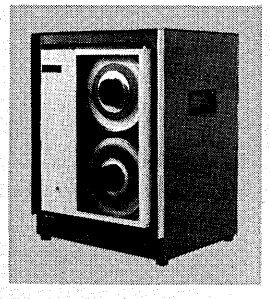
WHICH VERSION NOW, SUZY?

(100 ips? PCB options?)



"Mmmm . . . It's so hard to decide—the PI-1217/19 digital recorder has such possibilities! . . . 100 ips for special off-line applications . . . . . increment above 5,000 characters/second with zero data loss . . . modularity that means *real* flexibility, and low mean time to convert!

"And every version of this fantastic recorder is *reliable*—all tape-handling components are mounted on precision-ground surfaces. Our customers say the PI-1217/19's as compact and rugged as they come! Call me (just ask for Suzy) and I'll give you all the groovy details—and introduce you to 'Hap,' our product manager.



". . . Let's see now . . . PCB? . . . ('PCB'—I know what *that* means—'perfectly charming boards')."

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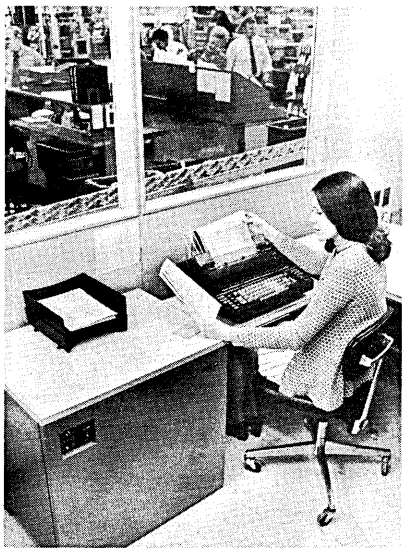
CIRCLE 26 ON READER CARD

Programmable Terminal



Configured around a modified version of the Selectric typewriter with adding machine number format superimposed on the keyboard, a storage disc providing 62,800 to 146,400 bytes of capacity, and communications capability, the 3735 programmable buffered terminal allows business documents to be prepared in a step-by-step fashion under program guidance. Assistance such as automatically incrementing purchase order numbers, vendor number verification, and even calculating totals when the quantities and unit prices are known, are examples of how it could be used in a manufacturing environment. Error lights and a locked-up keyboard are the operator's reward for mistaken entries.

The 3735 is programmed on 370 or most 360 models using macro-instructions under either OS or DOS. The compiled program is then transmitted to the 3735 for storage on its disc file. Selectable baud rates of 1200, 2000, or 2400 are possible when the terminal is not being utilized off-line as a standard Selectric. Transmission can also take place with the terminal unattended, and both EBCDIC and ASCII code can be accommodated.

Other features of the 3735 include diagnostic programs to help users determine the cause and location of any malfunction, and an optional data recorder for receiving or transmitting 96-column card data. Every time the terminal is turned on, it runs a diagnostic sequence on itself, verifying the condition of the disc, logic, and arithmetic units. Available during the second quarter of next year, the basic 3735 will rent for $330/month, or can be purchased for $13,200. Each additional 41,800 bytes of memory rents for $30/month. IBM CORP., White Plains, New York. For information:

CIRCLE 523 ON READER CARD

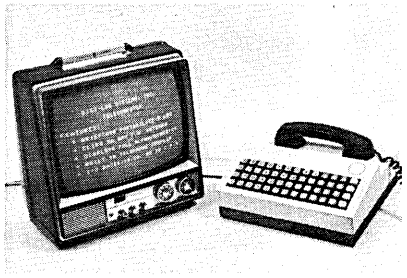
Tape Subsystem

Another alternative to IBM's recently announced 3803/3420 tape subsystems for 360/370 models is introduced with the TC 5805 controller and three tape drive models, the AT 3423, 3425, and 3427. The drives are direct replacements for the 3420 models 3, 5, and 7 that range in capabilities from 7-track, 556-bpi, 75-ips units transferring information at 120 KB up to 9-track, 1600-bpi, 200-ips units with 320KB transfer rates. Among the other general features are automatic threading, a motor-driven automatic latching hub, and single capstan design with in-column rewind.

The 5805 controller attaches to the drives through a radial cabling arrangement permitting individual tape units to be removed while the system is operating. Switching capability allows up to 4 controllers to access up to 16 tape drives. A TC 5805 controller and eight AT 3423 drives will rent for $3750/month, which is several hundred dollars under the current IBM rate. Initial installations are scheduled for the second quarter of next year. POTTER INSTRUMENT CO., INC., Melville, N.Y. For information:

CIRCLE 522 ON READER CARD

TV CRT



At $960, the TeleComputer display terminal is purported to be the lowest priced in its class. But you'll need your own tv to display output by a simple clip lead attached to the antenna. Up to a 64 alphanumeric character set is displayed on a 32-character by 8-line field. The keyboard comes with a built-in acoustic coupler or hardwired or direct access interfaces. Key configurations are Teletype or alphabetic. Codes available are ASCII or BCD, and printing is 10, 15, or 30 cps. Switch-selectable speeds are available optionally, as are additional pages of buffer storage. The keyboard unit weighs only 8½ lbs., making it easily portable in a briefcase. Prices are substantially reduced in quantity orders. Delivery requires 30-45 days ARO. DIGI-LOG SYSTEMS, INC., Conshohocken, Pa. For information:

CIRCLE 528 ON READER CARD

360/30 Upgrade

It is remarkable how few current 360/30 users are interested in trading the machine in for a newer model —but they would like some additional memory capacity, according to this manufacturer. So the CORPAK 30 is offered to replace original 360/30 core rations in increments of 32K bytes up to 96K. Users must retain at least 8K of the original IBM-supplied memory, however. IBM is rumored to have a similar package in the works for July announcement, so whatever software changes are required will be available. A 32K CORPAK 30 module of 1.5 usec core, including power supply, is priced at $41,704, or would lease for $960/month on a two-year contract. There is an extra installation charge for going above 64K and the work requires the computer be down approximately eight hours. Maintenance will be provided by Sorbus, Inc. INFORMATION CONTROL CORP., Los Angeles, Calif. For information:

CIRCLE 521 ON READER CARD

(Continued on page 102)

Performance Monitor

A complement to manual and printer computer performance monitors is the manufacturer's description of the first member of the CTA 7800 series of performance monitors with tape storage. The system is fully buffered, has 16 accumulators, and a performance diagnosis system for data reduction and compilation. The recording mode is 9-track IBM compatible. Computer system functions are measured by up to 32 inputs available simultaneously from single and quadruple probes. A 384 point logic patch panel allows multiple logical operations. Two hexadecimal decoders are also included in the patch.

The monitor unit with diagnostic package is designated the CPA 7816, and up to four of these units can be attached to one tape drive. A complete CPA 7800 analyzer is priced at $21,500, and the monitor unit alone lists for $14,950. The units can be rented. COMPUTER AND PROGRAMMING ANALYSIS INC., Wynnewood, Pa. For information:

CIRCLE 526 ON READER CARD

User-alterable ROM

EAROMS (Electronically Alterable Read-Only Memories) have been on the market for some time, but the OmniROM might be the first of a very significant product line. Basically a plated wire design expandable up to 4K 16-bit words, the contents of this EAROM can be modified by the user, in real-time, under keyboard or console control. This allows programs to be optimized and checked out, with the necessary changes to the storage readily accomplished. The only disadvantage of using such a memory would seem to be the depressing effect on soldering iron manufacturers. After the user is reasonably happy with the contents of the OmniROM, the write circuitry can be disabled—probably as a safeguard against accidents more than anything else.

Since the OmniROM interfaces to many current computers, including the CIP 2000 and Micro 800 from Cincinnati Milicron, the Data General minis, the Interdata models 2, 3, and 4 (and next month the DEC PDP-11 and 8/E, GRI 900 family, and units for the Modcomp), it could measurably alter the type of memory specified for those machines by the purchaser. The potential user will probably consider the EAROM for more applications, since it is now so much easier to alter the contents. Besides, it runs faster—at the basic clock rate of the host computer, down to 200 nsec. OmniROM contains its own power supply, as dependency on that of the host computer might cause too many compatibility problems.

The developers will sell the OmniROM either in single units or in quantity. For the time being, an "end user" in this context will probably be assembling a system for a potential customer. But perhaps the near future will bring plug-in modules that the true end user can play with and install himself. Prices in quantities of 100 are right around $2000 for the standard 1K x 16-bit. Single quantity pricing will approximately double that price. MEMORY SYSTEMS, INC., Hawthorne, Calif. For information:

CIRCLE 513 ON READER CARD

(Continued on page 105)

SJCC Booth 1425

YOU KEEP ORDERING. WE KEEP DELIVERING.

In early 1971 we started shipping Model 101 line printers to a few sophisticated users of peripheral devices. Now we are shipping many 101's to many sophisticated users. And for good reasons. The 101 is easy to build and maintain. It performs very reliably. Its matrix print quality is excellent, even on the fifth copy. It interfaces readily to almost any computer or terminal. And its low price is setting a new standard in the industry.

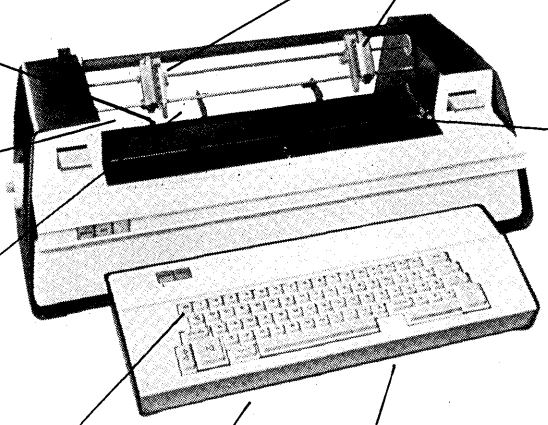
CENTRONICS

because you don't want to spend more than you have to.

Centronics Data Computer Corp., One Wall Street, Hudson, N.H. 03051
(603) 883-0111

CIRCLE 74 ON READER CARD

If you spec'd an I/O printer that would turn your 'mini' into a 'maxi' accounting system... it would look like this



Split Platen
Independent feed for simultaneously performing a multiplicity of accounting functions.

Removable Print Wheel
48 or 96 character, BCD or ASCII

Electric Line Finder (Optional)

Wide Carriage
Direct Tabbing in two directions (192 print positions) enables operator to simultaneously make entries on invoices, purchase journal and sales journal. A tremendous time-saver.

Front Form Feed
For easy inserton of ledger cards, invoices, passbooks, journal rolls and continuous forms.

Separate Numeric Keyboard
Faster entries with less chance of error and ease of operation.

Reliability
Few moving parts. Proven record. Ruggedized.

Speed
Twice as fast as an IBM Selectric I/O writer. Three times faster (30 cps) than TTY or any other low-cost printer on the market.

so, why bother?

Our Model 30 is the *only* printer that can economically satisfy *all* accounting applications. It's ready for fast delivery. With or without control electronics or companion keyboard. And, it costs less than other printers with less capabilities.

Sales and Service on OEM Products are available in: United Kingdom, Germany, France, Italy, Yugoslavia, Spain, Switzerland, Belgium, Holland, Luxemburg, Sweden, Australia, New Zealand, Japan, Canada, Mexico, Puerto Rico and the U.S.A.

See it at BOOTH 2315-17 — SJCC

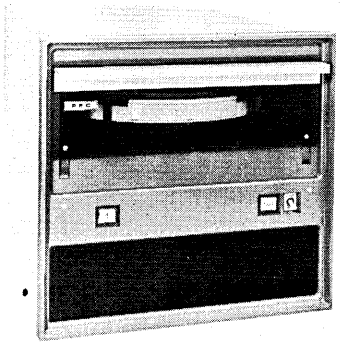
For more information call Frank Misiewicz OEM Products Division (201) 935-2200

LITTON ABS
automated business systems
600 WASHINGTON AVENUE, CARLSTADT, NEW JERSEY 07072

Litton

Disc Storage

It will be interesting to follow the course of this product line and see if the manufacturer can penetrate the competitive oem disc drive market as well as it did the tape drive market. All four drives in the 5000 series use the IBM 2315 type of disc cartridge, have an average access time of 60 msec, and mount into a standard 19-inch EIA rack.



The basic 5101 model has a recording density of 1100 bpi, giving a 12 million bit capacity, and a transfer rate of 720 KHZ. The 5201 doubles all of those figures when the density jumps to 2200 bpi. The 5121 and 5221 have dual discs, one removable (as in the 5101/5201). If 1100 bpi is specified, 24 million bits of storage and a 720 KHZ transfer rate is maximum on the 5121. The top-of-the-line 5221 records at 2200 bpi, holds up to 50 million bits, and has a transfer rate of 1.562 MHZ. The 5000 series is available 60 days ARO, and on order of 100 of the basic model disc drive would have a price tag of something under $2900 each. PERTEC CORP., Chatsworth, Calif. For information:

CIRCLE 515 ON READER CARD

Minicomputer

High-volume users and oem's might want to consider the Micro 820 minicomputer for I/O processing and data communications applications. The 820 architecture is basically byte-oriented, with 4 or 8K modules of 1.1 usec core accommodated up to a maximum of 32K. There are 102 operation codes in the cpu, including 16 control, 12 multibit arithmetic and logical shifts, 17 conditional jumps, 6 for I/O, 19 interregister, 8 stack control, 4 character/string manipulation, and 20 to reference memory.

Other features of the 820 include concurrent buffered I/O, direct memory access, and an expandable priority interrupt scheme. The standard software offered includes loaders, a tty debug and operating system, a two-pass assembler, text editor with diagnostics, and an optional BASIC interpreter. "Separate pricing" for this product means $4180 for the cpu, $150 for the control panel, and 4K of memory for $1860. End-user versions are also available. The Micro 820 is currently available 30 days ARO. MICRODATA CORP., Santa Ana, Calif. For information:

CIRCLE 518 ON READER CARD

(Continued on page 106)

Maxi/Mini Interface

One can think of the Interface Control Unit (IFCU) as a sort of back door front end. It allows the attachment of this manufacturer's 620/i, 622/i, or 620/f minicomputers (having at least 4K of memory and direct memory access) to the I/O channel of the 360, enabling the mini to perform such tasks as data storage, data acquisition, job stacking, and even some processing. Bi-directional communication between the 360 and the 62X should not be too much of a programming problem because the IFCU emulates the controller of an IBM 2803 tape subsystem, while the minicomputer responds to the tape drive commands.

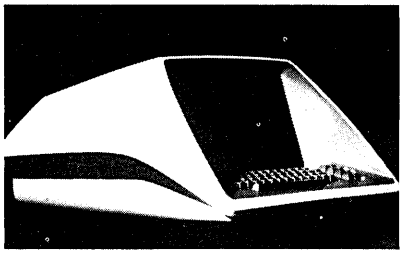
Some of the possibilities that come to mind for such a configuration include having the minicomputer acquire data off-line and then hand it over to the 360 for processing by putting the IFCU on-line. The data can be checked for accuracy, some preliminary data reduction performed, and the input sent to the 360 ready for number crunching.

Two components comprise the IFCU: An Electrical Interface Unit with IBM-compatible receivers and drivers to match the 62X and 360 logic levels, circuitry to permit 360 control of the 62X power, and the interface connectors; and the Interface Controller, which does byte/word conversion, generates parity, etc. The price of the IFCU, excluding the minicomputer and installation charge, is $10K. Delivery is 90 days ARO. VARIAN DATA MACHINES, Irvine, Calif. For information:

CIRCLE 519 ON READER CARD

Display Terminal

This display of the major minicomputer manufacturer's increasing diversification is actually its first terminal for use with other computer systems. To that end it is tty and ASCII compatible and has standard 110, 150 and 300 baud transmission rates with options for 600, 1200 and 2400 baud. The crt has a 12-inch display and the capacity for 20 lines of 72



characters each. Its character set is limited to 64 characters. Cursor address is featured and cursor movement is handled by designating X and Y coordinates. A video interface permits attachment of multiple television monitors and provides for mixing video and data display. Each terminal has its own controller and a 1440-character MOS buffer store. The DECterminal I has a 100-unit price of $1995. Deliveries will begin this summer. DIGITAL EQUIPMENT CORP., Maynard, Mass. For information:

CIRCLE 517 ON READER CARD

Controller/Computer

While this firm's PDP product line in the past has consisted of computers (PDP standing for Programmed Data Processor), the characteristics of the PDP-16 are such that it probably is closer to being a controller than a computer—as hazy as the line separating such products is. The new PDP member is oriented strictly to oem's. Lacking cabinetry, the PDP-16 is supplied as a collection of pc boards on a hardwired back panel with a power supply.

Perhaps the most significant aspect of the PDP-16 is the way it is built. A customer outlines his function needs using a set of five flowchart symbols—evoke, branch, merge, subroutine, and terminator. This "Chartware" is then submitted to DEC for processing on a PDP-10, which calculates the number of socket locations, pin assignments, bussing instructions, power requirement, and the price. It probably even calculates what word size would be most suitable for the target application, as the PDP-16 can be supplied with 8-, 12-, or 16-bit word lengths. It is an asynchronous machine with add times typically in the 400-500 nsec range. If required, memory rations consist of 1K bits of braided wire ROM and 16-512 words of scratchpad memory. A bidirectional bus permits peripheral devices to be used.

Applications for the PDP-16 range from assigning storage destination locations for a lumber yard conveyor to incorporation in a blood chemistry analyzer. Deliveries of the PDP-16 will commence in June, and the prices will range from $800-$3500 depending on quantity and on what the PDP-10 says is necessary for the target application. DIGITAL EQUIPMENT CORP., Maynard, Mass. For information:

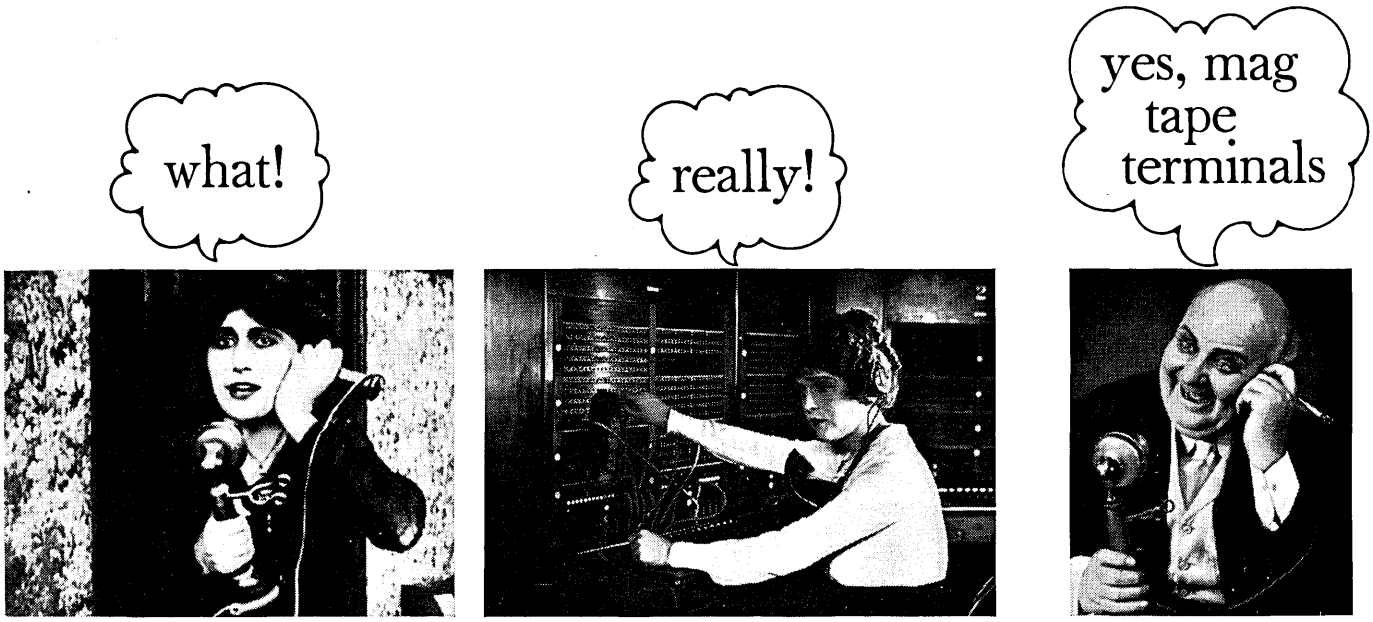
CIRCLE 516 ON READER CARD

Voice Terminal

The VCT-400 series of voice response terminals is available either as desktop units or in portable, battery-powered versions. The keyboard is available with up to 56 keys including alphanumerics and special functions. Transmission is by tones compatible with Bell 403 or 401 demodulators and the IBM 7770. Thus, the terminal can be used with any cpu equipped with any make voice response system. Options include cassette tape and a plastic insert key controller for security identification. Single quantity prices range from $248 to $350, depending on functions included. Delivery requires 60 days ARO. Maintenance shouldn't be a problem, as the units are all solid state, with no moving parts except the keys. Nevertheless, quantity purchasers will receive one back-up terminal free with each 40 terminals. MEDIA TECHNOLOGY, INC., Greensburg, Pa. For information:

CIRCLE 514 ON READER CARD

For additional new products being introduced this month, please refer to the SJCC Product Preview section starting on page 56 of this issue. ■

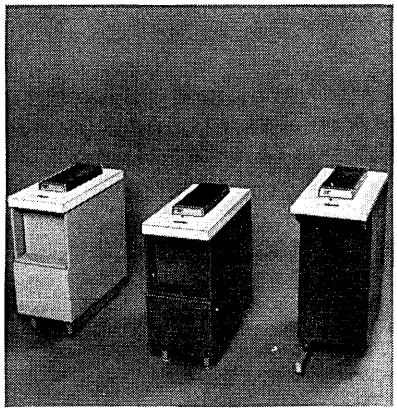


It's true.

After helping a jillion feet of paper tape wind and unwind its way through communications systems everywhere, Teletype announces the addition of magnetic tape data terminals.

There are some basic advantages in both mediums. But as you are well aware, the medium that's right for a system depends a lot on the application criteria.

The new magnetic tape data terminals have many operational features that make life less complicated for the operator.



New, modular line of Teletype® 4210 magnetic tape data terminals.

For example, take a look at the tape cartridge, which was specifically designed for reliability required for data transmission.

Its vital statistics are: 3″ x 3″ x 1″.

It contains 100 feet of ½″ precision magnetic tape.

It will hold 150,000 characters of data, recorded at a density of 125 characters per inch. The equivalent of a 1000 foot roll of paper tape.

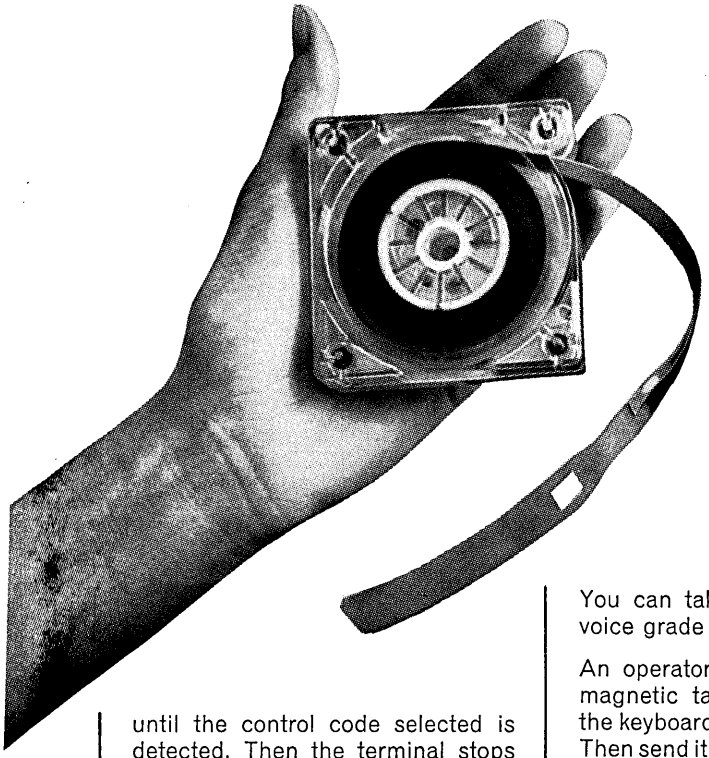
This means that your data is easier to store, easier to handle, easier to work with than ever before. And it's reusable.

Teletype is a trademark registered in the U.S. Pat. Office.

The units have a "fast access" switch which will move tape forward or reverse at a speed of 33 inches per second. A digit counter provides a reference point to help locate various areas of the tape.

Four ASCII control code characters can be recorded in the data format to aid character search operations. When the terminal's "search" button is pressed, tape moves at the rate of 400 characters per second until the control code selected is detected. Then the terminal stops the tape automatically.

A "single step" switch is also provided which enables you to move the tape forward or backward one character at a time. In editing or correcting tape, you can send a single character using this feature.



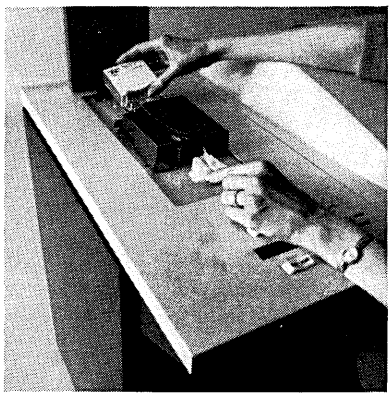
Also magnetic tape adds high speed on-line capability to low speed data terminals.

You can zip data along the line at up to 2400 words per minute. For example: Take a standard speed Teletype keyboard send-receive set, and a typical typist. Add a new magnetic tape unit to this combination and the on-line time savings can pay for the magnetic tape terminal in short order.

You can take better advantage of voice grade line speed capabilities.

An operator can prepare data for magnetic tape transmission using the keyboard terminal in local mode. Then send it on-line via the magnetic tape terminal up to 2400 words per minute.

These new modular magnetic tape data terminals offered by Teletype are perfectly compatible with model 33, model 35, model 37 and Inktronic® keyboard send-receive equipment.



Straight-through threading makes tape loading and unloading exceptionally easy.

They can send or receive at high or low speed. Or can be used independently as stand-alone terminals on-line.

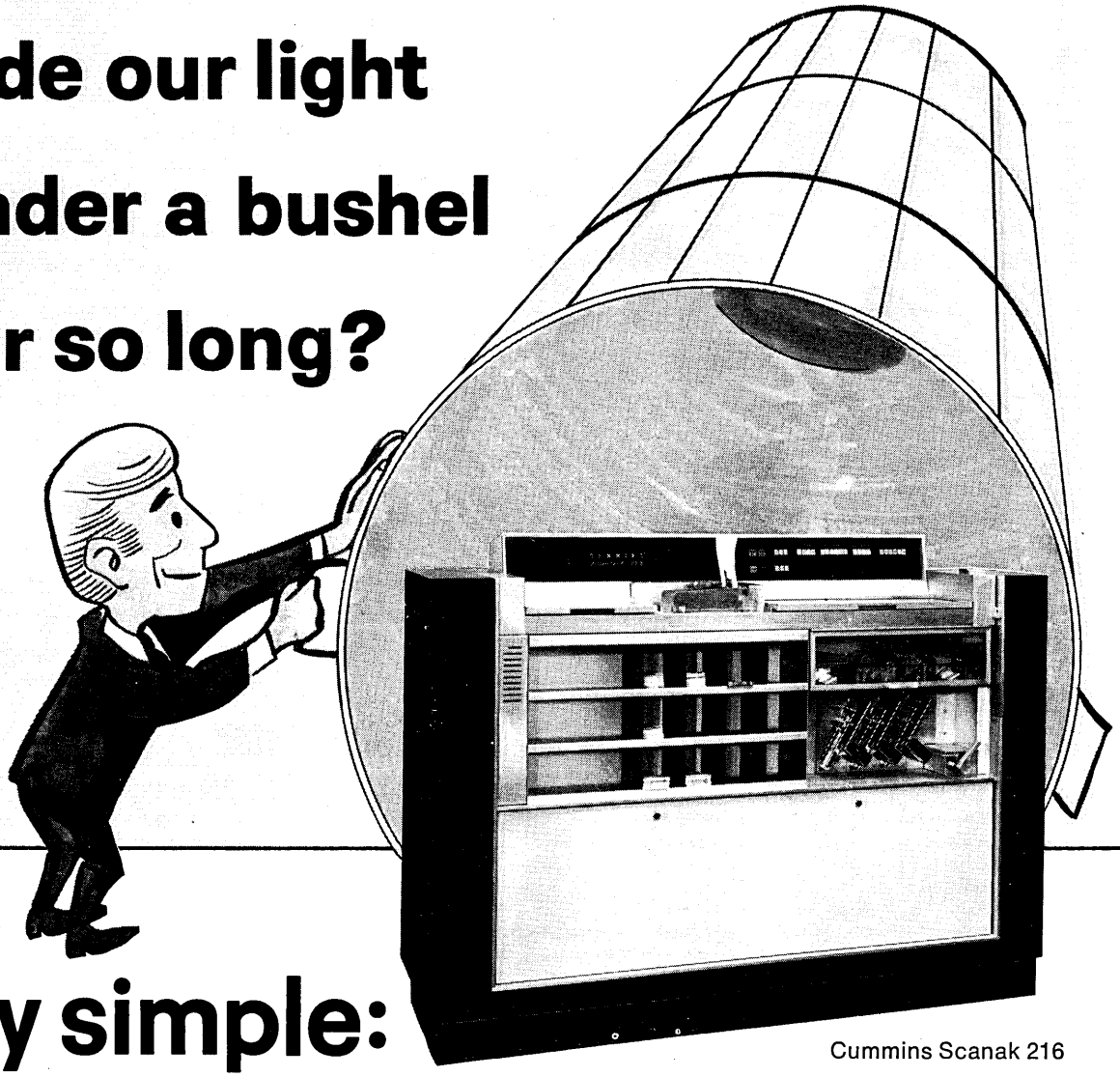
If you would like to know more about this new line of Teletype magnetic tape data terminals, please write Teletype Corporation, Dept 81-15, 5555 Touhy Avenue, Skokie, Illinois 60076.

Teletype 4210 magnetic tape data terminal with 37 keyboard send-receive set.

TELETYPE

machines that make data move

How did we manage to hide our light under a bushel for so long?



Cummins Scanak 216

Very simple:

While our competitors were talking to Security Analysts and selling stock, we were busy making 407 installations of our **Cummins SCANAK** Optical Scanners

Illustrated above is the Cummins Scanak 216, an input tool for off-line processing that outperforms more expensive OCR scanners in reliability, throughput, simplicity and flexibility. Faster installation, fewer rejects and misreads, elimination of keying errors, reduced labor, faster report preparation. The Cummins Scanak line also includes the Scanak 220 for converting information from original paper documents to punched cards, punched paper tape or magnetic tape...and the Scanak 229 high speed tag reader. The Cummins Scanaks cost less than $1,000 a month. No wonder we prefer talking to customers and prospective customers rather than to Security Analysts! We'd like to talk to you.

Write today for **Scanak** booklet with case histories

Let us send you a copy of our new illustrated Scanak brochure, with case histories of a broad spectrum of Scanak installations.

The Cummins Scanak 216

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CUMMINS-CHICAGO CORPORATION

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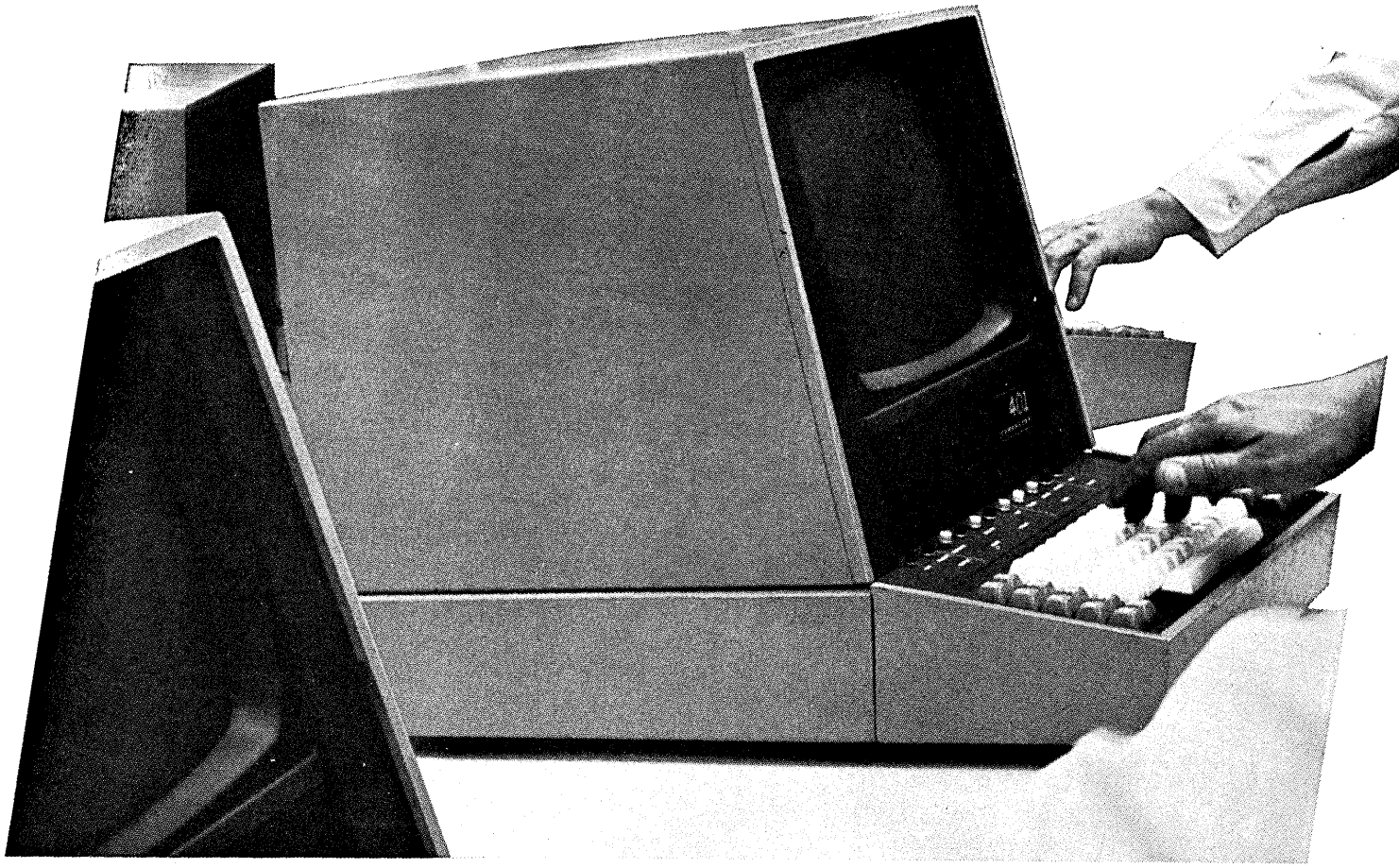
SINCE 1887



This is *not* a data display terminal

It's a complete input/output system.

We call it CONRACTOR. CONRACTOR is a new concept, designed specifically for the OEM market, which lets you mix modules until you match your customers' requirements at a cost lower than ever before possible. Your end user may need a stand-alone terminal on a dedicated line or a very sophisticated time-share cluster. More than likely, he'll need something in between. Regardless of requirements, CONRACTOR design permits an appropriate choice of terminal characteristics and equipment groupings at an economical cost. CONRACTOR reduces cable and installation costs significantly, also.

There are five basic modules—the video display, keyboard and unit controller, a serial distributor which expands the output of a data modem to eight ports, and a serial distributor expander which expands each of these ports. Plug in as many terminals as needed. Plug in a hard copy printer, dedicated or shared. Or bulk storage. As the requirements grow, simply add on what your customer needs. No more, no less. CONRACTOR solves your customers' application problems, minimizes your inventory holdings and saves you money.

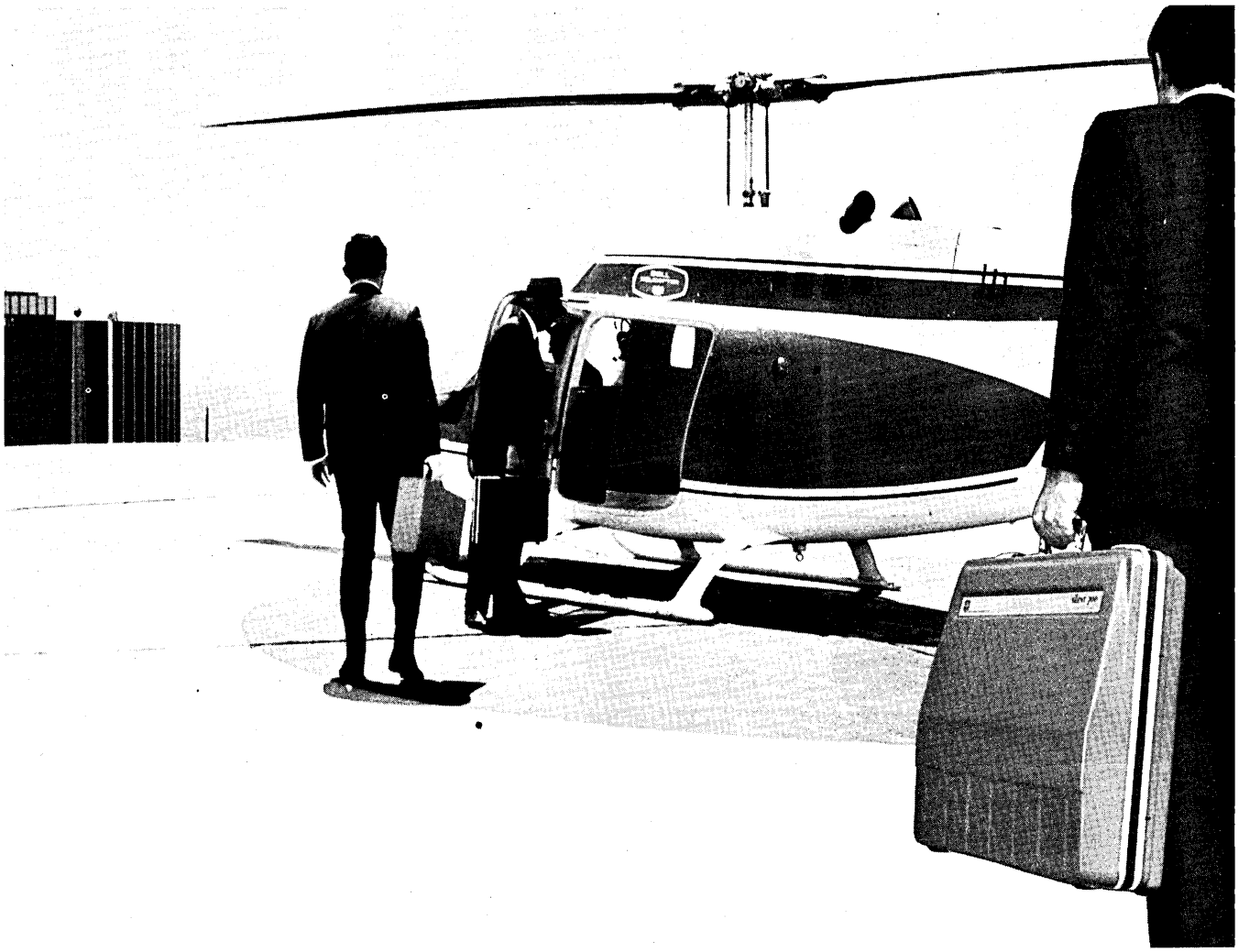
There's more. We make more professional CRT displays and terminals than anyone. You want ten a month, 1000 a month, we'll produce. No problems. Producing in volume for OEM's is nothing new, we've been doing it for over 21 years. We also make them better. CONRACTOR's list of features, options and applications is long. Write for it before you consider building your own I/O terminal or buying from someone else. Conrac Corporation. 600 North Rimsdale Avenue. Covina, California 91722. (213) 966-3511.

CONRAC CORPORATION

Booth 1513, SJCC

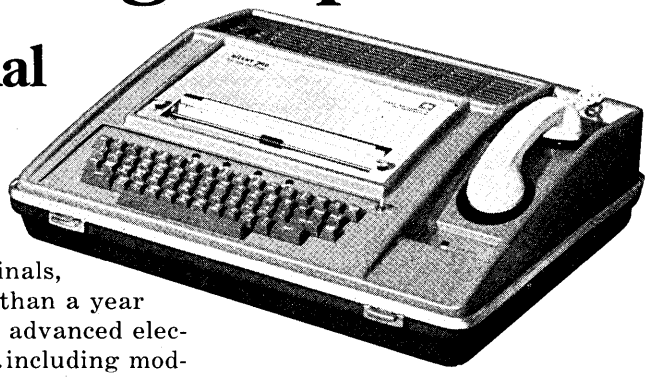
May 15, 1971

CIRCLE 70 ON READER CARD



Now, the "Silent 700*" goes portable:

The Electronic Data Terminal you can take with you.



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

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

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

Without noise.
Without impact.

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

They're available *now*. Portable or desktop.

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

*Trademark of Texas Instruments Incorporated

See it at SJCC Booth 1505

TEXAS INSTRUMENTS
INCORPORATED

Business Language

Most common commercial programming problems should be easily handled by FORCE, a compiler said to combine the ease of reading and writing COBOL and the matching and table handling logic of RPG, yet be almost as efficient and require only about 10% more core than BAL. The FORCE commands are closely akin to COBOL, while syntax is identical to BAL. A FORCE compilation produces a fully commented expanded assembly language listing, so that any FORCE programmer should be able to comprehend a program written by someone else within a few minutes.

Full compatibility is maintained with System/360 BAL, permitting the user to produce an expanded source deck with BAL coding inserted anywhere in the program, for assembly by any IBM level D and up assembler. FORCE produces a load-and-go object deck with automatic production of all job control cards necessary to test the program.

FORCE does have significant limitations; it doesn't support things like variable length records on tape, nor is it teleprocessing oriented. But for simpler jobs, it could cut programming time in half over a COBOL program. The price is $16,000 plus $50 per month for maintenance. It's the primary product of an eight-man firm founded in 1969. THE DATA FORCE, New York, N.Y. For information:

CIRCLE 505 ON READER CARD

Subroutine Library

LIBRARY 1 is a collection of scientific and statistical subroutines written in FORTRAN IV for OS and DOS 360 computers. Included in the first edition are programs dealing with analysis of experimental design data; basic statistics; differential equations (Quadrature and Differentiation); approximation and smoothing routines; statistical and mathematical special functions; regression analysis; linear programming; vector and matrix arithmetic; and a set of utility functions including special I/O routines, library maintenance and retrieval programs, and library testing programs. Implementation of forecasting, econometrics, polynomial, sampling, and transformation subroutines is scheduled for the near future.

The LIBRARY 1 subroutine package will rent for $70/month, $200/quarter, or $720/year. Subscribers may return the library within 30 days without charge. The pricing includes telephone consultation, maintenance, source code, later augmentations, updates, and a newsletter. Distribution will commence in August. INTERNATIONAL MATHEMATICAL & STATISTICAL LIBRARIES, INC., Houston, Texas. For information:

CIRCLE 504 ON READER CARD

Programming Language

A subset of the Dartmouth BASIC compiler is now available for this manufacturer's Century 100 computers in two versions. The first version of BASIC-1 dedicates the entire system to BASIC-1 and accommodates up to 15 data terminals. The required hardware configuration is 16K of memory, a communications multiplexor, and an asynchronous character adapter for each data line employed. It is priced at $9K, or can be rented for $310/month on a three-year license.

The second version of BASIC-1 requires 32K of memory and disc storage area to accommodate up to 10 data terminals while simultaneously allowing concurrent background processing using the B-1 executive operating system. The price of the dual installation is $10K; rental is $365/month on a three-year contract. NCR, Dayton, Ohio. For information:

CIRCLE 501 ON READER CARD

Cobol Cross Reference

The EXCHECK package provides cross-reference listing of source programs in ANSI COBOL, COBOL D, COBOL E, or COBOL F. A unique feature, according to the vendor, is that the cross references print on the same lines as the source statements. And an alphabetic reference to all data and paragraph names is printed. EXCHECK does not compile, but it turns out a temporary data set on disc which may be used as input to the COBOL compiler. Since EXCHECK generates the same line numbers as the compiler, the compiler's listing may be suppressed; the EXCHECK listing may then be used to correlate maps and diagnostics. It requires 16K core on any System/360 configuration with at least one disc. The price is $395. ARKAY COMPUTER APPLICATIONS, Lowell, Mass. For information:

CIRCLE 508 ON READER CARD

Fortran Resequencing

The NEAT program resequences all statement numbers within standard FORTRAN II or IV card decks to give a neat appearance to the final code and make it much easier to trace the flow of the program after a GO TO statement, for example. NEAT punches a new card deck complete with sequence numbers and identification as to the program or subroutine name in columns 73-80. It accepts cards punched on 026 or 029 keypunches and produces cards in 029 format. The program is written is 360 FORTRAN IV. The price of $500 includes a source deck, program listing, and user manual. Versions of NEAT for other hardware are subject to special price quotations. ENVIRONMENTAL COMPUTING, INC., Lowell, Mass. For information:

CIRCLE 506 ON READER CARD

Test Debugging

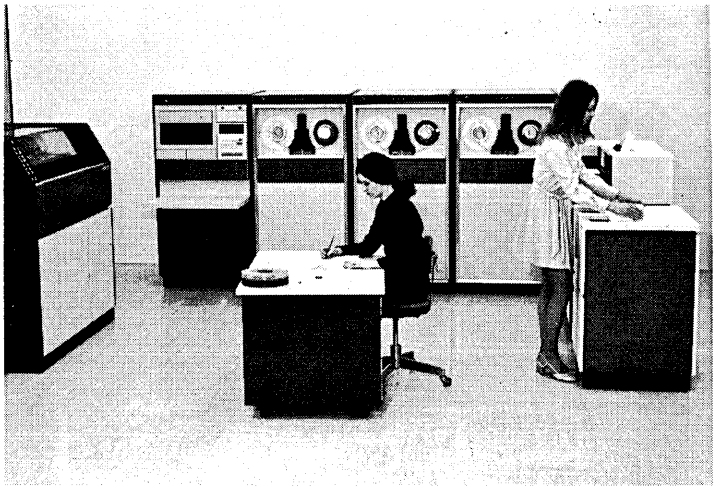
A $395 OS/360 debugging aid that uses the SPIE macro to detect and correct data exceptions during test is called, appropriately, 007. The programmer, rather than having a test end after one error, can use this utility routine to handle a specified number of errors, such as uninitialized counters, bad test input, and incorrect data definitions. It prints out all information on the error, such as the operation code, length code, A field, B field, and actual location of data causing the exception, as well as the new data changed by 007. Answering programmer objections to manipulation of any macros, the vendor says it will guarantee trouble-free operation by the "simple" 007. COMPUTER METHODS CORP., White Plains, N.Y. For information:

CIRCLE 510 ON READER CARD

(Continued on page 115)

SYSTEM 2400, Data-Converter Configuration

The 2400 turns cards, communications, paper tape, magnetic tape, and keyed data into cards, magnetic tape, paper tape, communications, and printed matter.



Set up as a Data-Converter, the Mohawk Data SYSTEM 2400 can go from any one medium to any medium or mediums your computer prefers. And it can handle any tape density or code in the bargain.

The real bargain, however, is all the things the SYSTEM 2400 can do for you. It will block, unblock, edit, reform, sort and merge all of your processed data. Capable of concurrent I/O operations, the MDS SYSTEM 2400 is also capable of satisfying all your utility needs off-line.

In its standard Data-Converter configuration, the 2400 has a 1250-lpm high speed printer. So you can convert main frame output into usable form without having to spend vast quantities of on-line main frame time. Yet rentals of the 2400 start as low as $600.

The 2400. It's our new generation of peripheral control, timed to meet the newest generation of computer equipment.

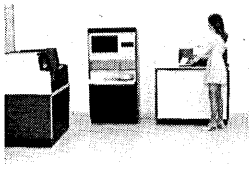
Truly, peripherals have come of age. Mohawk Data 2400.

Data-Satellite Configuration

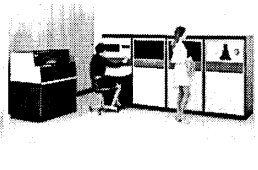
Data-Editor Configuration

Data-Printer Configuration

Data-Communicator Configuration



Data-Sorter/Collator Configuration



Mohawk Data Sciences Corp.
Herkimer, New York

MDS®

Minicomputer Commo

The Telecommunications Programming System lets 16-bit minicomputers interface with and serve as front-end processors for System/360 and 370 cpu's. It consists of three modules: a communications processor program that resides in the minicomputer and permits it to emulate a 2701, 2702 or 2703, or serve as a front-end processor; a 360- or 370-resident communications access method which can replace BTAM, QTAM, and TCAM for nonemulatory preprocessor applications; and a communications program generator that permits the user to create new communications processor programs on his 360 or 370 without writing assembly language code for the minicomputer—the user develops, assembles, and loads on the mainframe.

Core requirements for the minicomputer are about 8K on most models for the communications processor program, and 9K on the 360/370 for the access method. The communications program generator requires a 100K partition and operates under OS/MFT or /MVT; it can be modified for DOS. Price range is $50-70,000 for most installations. PHI COMPUTER SERVICES, INC., Arlington, Mass. For information:

CIRCLE 503 ON READER CARD

PL/I Programming Aid

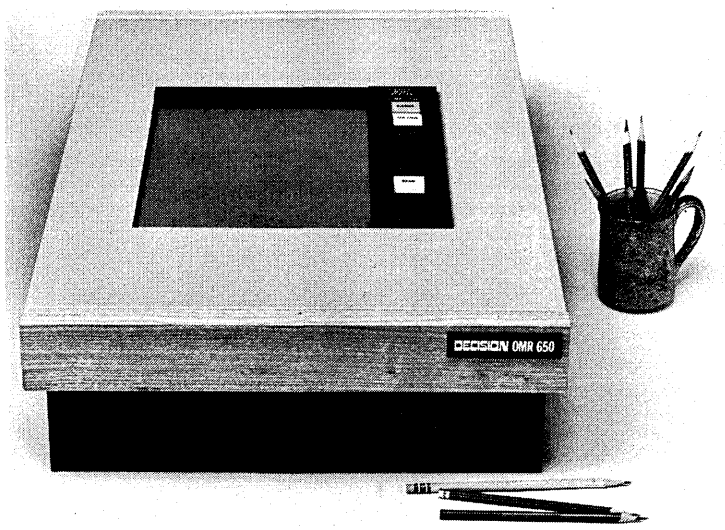
NEATER 2 contains a number of features that seem to make it a desirable program acquisition for installations running PL/I. Basically it is referred to as a reformatter, changing the arrangement of the source coding, which may be in a free-form format, without changing the content. But additional features check for logic errors, and an option called USAGE inserts statements to tally the number of execution cycles required by the user's program, thus helping him possibly to better optimize its performance. This range of capabilities suggests that NEATER 2 is really a precompiler—though not a replacement for the preprocessor stage of the PL/I compiler.

The logical structure of the source program is listed in the indentation pattern of its output. This might be a very great documentation aid. Nonessential blanks are removed, and diagnostic statements are included to explain unsuccessful runs. This stage of NEATER 2 is said to run 3-6 times faster than the PL/I compiler, which should make it a money- and time-saving tool. Additionally, NEATER 2 scans the entire source deck regardless of whether fatal errors are present. A number of parameters control formatting, sequence numbers, PUNCH/NOPUNCH, and other specifications. Approximately 60K bytes of memory are required for NEATER 2, and the price for commercial institutions is $1K. Academic institutions can obtain the program for $200. CHEMISTRY DEPT., KANSAS STATE UNIV., Manhattan, Kansas. For information:

CIRCLE 509 ON READER CARD

(Continued on page 117)

Mark this ad!



Are you interested in a low cost Optical Mark Reader...

That...

	yes	no
▶ reads marks, Hollerith image, and handprint numerics?	☐	☐
▶ reads forms from card size up to 8½ x 11 sheets?	☐	☐
▶ reads IBM 1230, Digitek, and Motorola forms?	☐	☐
▶ reads up to 4,000 marks on an 8½ x 11 sheet?	☐	☐
▶ may be used as a remote terminal or on-line to any c.p.u.?	☐	☐
▶ has computer interfaces and teleprocessing software available?	☐	☐

If you are... return this ad for scanning on the OMR 650.
It is the *yes* answer to your data entry questions.

☐ Send us more information.
☐ Call us.

NAME _____ PHONE _____

COMPANY _____

ADDRESS _____

CITY/STATE _____ ZIP _____

DECISION

DECISION INCORPORATED 5601 COLLEGE AVE. OAKLAND CA. 94618 415/654-8626

APT Processing

APT processing on Honeywell H-316 or XDS Sigma 2 computers having at least 8K of memory is possible using Interactive APT. Among the features of the program are full three-axis contouring capability and standard APT-compatible center-line data; full on-line interactive parts program editing capability; expanded motion, pocket and part surface commands; postprocessors written in FORTRAN IV; and a design said to ease expansion into direct numerical control. The price of $12K includes installation, manuals, and free maintenance for one year. An IBM 1130 version of Interactive APT is near completion but no price is available as yet. INTERMOD, Long Beach, Calif. For information:

CIRCLE 502 ON READER CARD

IMS Reporting

A special version of the CULPRIT output processor called IMS-CULPRIT allows the IMS and/or Data Language 1 user to efficiently produce summary reports from DL1 files in a batch environment. It will extract and produce up to eight reports in a single scan of the data base. IMS-CULPRIT is written in assembly language and requires 80K bytes on 360/40 or larger cpu's. Purchase is $20K, or a three-year lease runs $15K. IMS-CULPRIT can also be rented for $500/month for three years. Installation, training, documentation, warranty, and maintenance are provided. CULLINANE CORP., Boston, Mass. For information:

CIRCLE 512 ON READER CARD

Utilization Reporting

A computer utilization reporting system for IBM DOS POWER users accesses all the POWER-generated data elements and provides additional control fields of its own. It offers greater flexibility by allowing custom formats to be catalogued within the system. Detail and summary reports are produced, as well as totals and subtotals, and it provides the ability to weight the hourly usage figures by shift or priority, and to produce billing or in-house memorandum figures. The system is written in COBOL and requires about 44K bytes of memory. The price is $950. COMPUTER GENERAL CORP., McLean, Va. For information:

CIRCLE 507 ON READER CARD

Report Generator

The Dummy II report program generator is a BAL program written for the 360/25 and up, DOS or OS, and Spectra 70/45 and up under TDOS. It includes a report writer, test tape creator, load and go operation, card, tape, or disc input and output plus print output, sequential and indexed sequential files, arithmetic capability, data and bit manipulation facilities, etc. Core requirements begin at 32K for 2,000 tape positions. The price is $5500. COMPUTER SYSTEMS & EDUCATION CORP., East Hartford, Conn. For information:

CIRCLE 511 ON READER CARD ■

Hardcopy for your data terminals?

Now it's an open-and-shut case:

If you're an OEM with a system that generates data for people, we'd like to show you an alternative to the now-you-see-it, now-you-don't of CRT displays and the noisy, expensive bulk of teletype:

The Litton Datalog MC-100 Non-impact Strip Printer.

Light, rugged and reliable, the Litton MC-100 is as much at home in a briefcase (that's it on your left) or a squad car as it is in a department store or even tomorrow's living room. At under $200 in your kind of quantities, it's ideal for ticketing, reservations, inventory control, credit verification or mobile communication systems.

It weighs a scant pound-and-a-half and measures 6½″ x 6½″ x 2½″, with optional mounting configurations available. Fully DTL/TTL-compatible, the MC-100 is easily interfaced to your computer or telecom lines. Printout at 10-65 cps is on easy to handle ⅝″-wide paper that comes in a fumble-proof, instant-load cassette. Throw-away cassettes are only $1.00, fully-loaded with 350′ of paper.

And because the MC-100 uses the unique Litton non-impact printing process, operation is totally silent, there's only one moving part, and we offer what may be the world's only 3-year warranty.

So if you've turned thumbs-down on hardcopy (or had to go with teletype), call one of the numbers below today. We've got a very convincing case.

Datalog Division, Litton Industries, 1770 Walt Whitman Road, Melville, New York 11746.

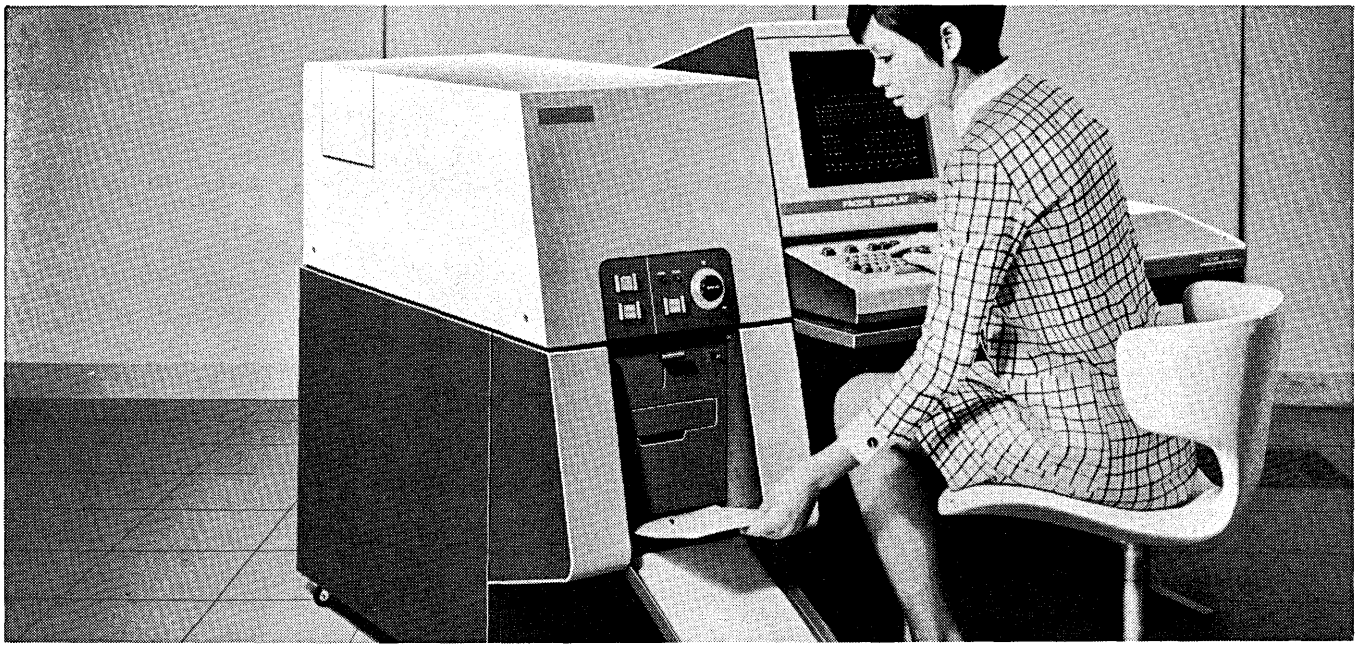
DATALOG DIVISION
LITTON INDUSTRIES

For a Free Demonstration, Call Now:
Western Region .....(213) 986-7350
Mid-Western Region .(303) 771-2010
Central Region .....(312) 297-3138
Eastern Region .....(516) 694-8325

Announcing the birth of a beautiful slave

FACOM 6541A, the entirely new CRT printer that delivers hardcopy alphanumerics and graphics in seconds.

Take a close look at the '71 SJCC.



It works for any CRT display. Without programming, without interface. Because it directly utilizes X, Y and Z signals of the master display. Behind the beauty stands the world's first electrostatic deflection system which features very wide frequency bands and a newly developed slave CRT with fine resolution and high brightness.

In other words, it's compatible with all CRT display units and oscilloscopes, regardless of scanning method, speed, size, or kind of phosphor. And it's fast. Works at a speed of 7500 characters a minute, or 8 seconds per sheet. Just push the button and you'll get up to 10 clean electrophotograph copies automatically. Without waiting.

Why not take a close look at the '71 SJCC EXHIBITION. At the booth 1622 & 1624 our engineers will be on hand to discuss about your particular hardcopy requirements.

FUJITSU LIMITED
Communications and Electronics
Marunouchi, Tokyo, Japan

MAIN PRODUCTS ☐ Telephone Exchange Equipment ☐ Carrier Transmission Equipment ☐ Radio Communication Equipment ☐ Space Electronics Systems ☐ Auto Radios & Car Stereos (TEN) ☐ Electronic Computers & Peripheral Equipment (FACOM) ☐ Telegraph & Data Communication Equipment ☐ Numerical Control Equipment (FANUC) ☐ Remote Control & Telemetering Equipment ☐ Electronic Components

LITERATURE

Data Transmission

This 12-page brochure describes the type 25B data transmission system which provides speeds from 75 to 600 bps on a standard voice-grade telephone circuit, describing it as "one of the world's most versatile data, telegraph, and telemetry transmission systems." LENKURT ELECTRIC CO., San Carlos, Calif. For copy:

CIRCLE 531 ON READER CARD

Eleven Modems

Eight-page catalog of data communication products includes descriptions and technical specifications on 11 different modems operating at speeds from 300-1 million bps. Also included are multiplexors, transmission test equipment, and specialized modems for oem users. INTERNATIONAL COMMUNICATIONS CORP., Miami, Fla. For copy:

CIRCLE 532 ON READER CARD

In the Family

This 112-page brochure contains specifications for more than 150 circuit functions for what the vendor describes as "the broadest TTL family in the industry." It includes design information about logic, memory, and interface circuits in standard, low-power, and high-speed ranges. FAIRCHILD SEMICONDUCTOR, Mountain View, Calif. For copy:

CIRCLE 533 ON READER CARD

Real-Time Peripherals

Sixteen-page technical brochure describing the RTP 7400 series of real-time peripheral devices comes with a companion piece, an eight-page price list. The series includes low-level analog input systems containing transformer-coupled low-level multiplexors, high-level analog input systems, d/a output systems, sample and hold d/a output systems, and a variety of digital I/O systems. COMPUTER PRODUCTS, Ft. Lauderdale, Fla. For copy:

CIRCLE 534 ON READER CARD

Census Data

Enumeration district and city block group data appearing in the first count of the 1970 census of population and housing was aggregated by a special computer program into census tracts for this 24 page catalog which, its publishers say, will enable census users to obtain basic census tract information without waiting for the second and subsequent counts of the census. NATIONAL PLANNING DATA CORP., Rochester, N.Y. For copy:

CIRCLE 535 ON READER CARD

T-S Phone Book

The "Time-Sharing Phone Book" has been called the first published national inventory of the data communications telephone facilities of remote-access computing services. More than 1,000 local data dial-up points are listed by city and state, plus the IN-WATS coverage of the companies which provide such toll-free data access. The spiral-bound book sells for $10. TIME-SHARING ENTERPRISES, INC., University City Science Center Building One, 3401 Market St., Philadelphia, Pa.

In Living Color

A digital picture analysis system designated System 800 is described as enabling "the unique marriage of digital computers to color television," in a four-page technical publication. A photo of the two-unit, desk-sized system is featured on the cover. The technical text describes such performance features as: high-speed arithmetic for picture processing; high-speed, high-capacity disc for picture storing; digital-analog interactive processing; and full-color television-compatible display. SPATIAL DATA SYSTEMS, INC., Goleta, Calif. For copy:

CIRCLE 536 ON READER CARD

Buffer Stores

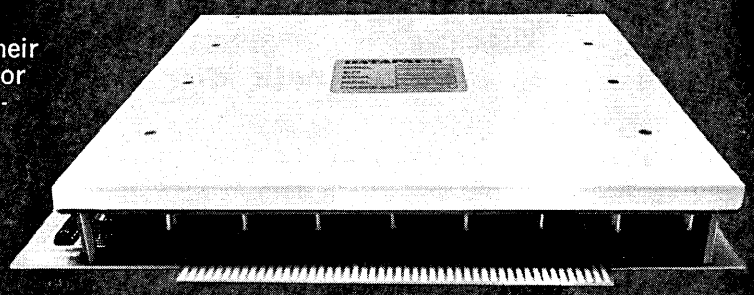
Twelve-page brochure describes what the vendor claims is a new approach to buffer storage. The booklet uses photos and diagrams to show how the new units operate and to demonstrate how they can increase the efficiency of data communications systems. WILTEK, INC., Wilton, Conn. For copy:

CIRCLE 537 ON READER CARD

(Continued on page 123)

DATAPAC BUILDS AND SELLS MORE ROMS FOR MORE APPLICATIONS THAN ANYONE ELSE IN THE WORLD

Datapac Read-Only Memory Systems are unique in their design to let you easily change individual bits, words or an entire memory in the field. Datapac ROMs are available in a wide choice of models, sizes and configurations. Capacities from 1K to 1 Megabit. Word lengths to 80 bits. Speeds as fast as 200 Nsec. Cycle and 75 Nsec. Access. Off the shelf delivery—50,000 MTBF. Mil Spec compatible. And 1.5c per bit. Write today for our FREE brochure containing the complete Datapac story.



"#1 in the field"

DATAPAC INCORPORATED

3839 S. Main St., Santa Ana, Calif. 92702, Tel. (714) 546-7781

CIRCLE 65 ON READER CARD

Venture Capital Guide

"A Guide to Venture Capital Financing" was published to "help young companies and young businessmen understand how to approach the financial community." Its section headings include: What is Venture Capital; Sources of Venture Capital; How to Find Venture Capital; What Qualifies as an Attractive Venture to the Investor; What the Investor Requires to Make an Investment Decision; When to Seek Initial Financing; Legal Considerations and Requirements in a New Financing; How to Market the Venture to the Investment Community; and, The Venture Brochure: Eight Essential Components. AMERICAN SCIENCE ASSOCIATES, New York, N.Y. For copy:

CIRCLE 538 ON READER CARD

Computers in Japan

Latest in an annual series, the "Computer White Paper" is an English-language report on the state of the computer industry in Japan. It covers developments through 1969 and early '70, and includes data on users and vendors, as well as governmental activities. User sites are surveyed to show configuration sizes, personnel and salary practices, training programs, and communications usage. Educational activities at secondary schools and colleges are also traced. The 106-page volume is priced at $8, sans postage. COMPUTER AGE CO. LTD., Kasumigaseki Bldg., P.O. Box 122, 3-2-5, Kasumigaseki, Toyko, Japan.

Computer ECG Analysis

Brochure describes a service offering computer analysis of electrocardiograms to physicians and hospitals throughout the country on a 24-hour-a-day basis. The analysis includes measurement of all pertinent ECG amplitudes and durations, characterization of the wave forms from each of the 12 leads of the scalar electrocardiogram, calculation of such factors as rate and electrical axis, and production of an interpretation of the status of the electrical function of the heart based upon these parameters. TELEMED CORP., Schiller Park, Ill. For copy:

CIRCLE 539 ON READER CARD ■

Fact:

Only a Transitel Communicator can be made to talk at half speed... to get you through under bad line conditions (even at 3600 bps).

Just flip our half-speed switch.
It's like turning off the weather.

Under normal line conditions, the Transitel Data Communications Terminal (7 or 9 channel tape models) transmits 1200* or 3600 bps over Direct Distance lines. Transmission is error-free and without loss thanks to character, format and parity error detection, as well as odd-even record check.

But what happens under storm conditions? Or any other noise-on-the-line conditions. Just flip the exclusive half-speed switch. Instantly the Transitel Data Communications Terminal slows to a more intelligible 600 (or 2400) bps. Which, with Transitel error checks, assures clear, correct communication.

*1600 bps on private lines also available.

Easiest all the way. Basically an expanded Transitel Key-to-tape Data Station, the Data Communications Terminal can be quickly learned by any office clerk. It offers the proven advantages of English display and easier error recovery for simplest possible operation.

Uninterrupted transmission is facilitated by 10½" tape reels with 2400-foot capacity. And transmission is fast with the Transitel Terminal's large 240 character memory.

Grows with your needs. You can quickly increase the capabilities of a Data Communications Terminal with addition of a Transitel Buffered Data Line Printer. The latter produces reports at remote locations after data has been transmitted from the computer site. An optional 133-character memory allows transmission and printing of most tapes without modification.

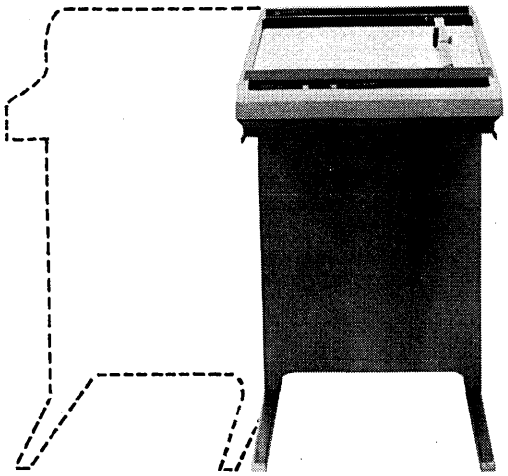
Also available from the expanding line of Transitel products: a low cost character printer, compatable with its high-speed counterpart; a card-to-tape transcriber with blocking capabilities; and an input proof adder for batch totals.

Whatever the case, you'll find a Transitel Data Communications Terminal the most efficient of all. Under any line conditions. With any operator you choose. Additional facts in the new Transitel line brochure. Free on request.

equipment that's nice to people– plus service to keep it that way.

TRANSITEL®
COMPUTER SUPPORT SYSTEMS

DIVISION OF SANGAMO ELECTRIC COMPANY
P.O. Box 7255, Park Hill Station, Denver, Colorado 80207 ☐ PHONE (303) 399-2263



Picture your terminal (even if it's IBM) with our $3,300 graphic plotter.

At last, everybody can see their time-share data plotted in smooth, clear graphs. Hewlett-Packard's Model 7200 Graphic Plotter will add a new visual dimension to any terminal in the business. Now, even if you're partial to IBM's 2741, you can have instant graphic solutions to every type of engineering or mathematical problem.

There's no special operation or programming knowledge needed. You control the program. Plot numerical data in points, lines, curves, circles, ellipses, bar graphs or pie charts. Or, manipulate and expand computer data and plot in finished graphic form. You get smooth lines—not the staircase drawn by the incremental recorder.

Use the HP 7200 simultaneously with your time-share terminal or silence the terminal and use the plotter alone. Because it goes to work when the data comes in, there's no time lag.

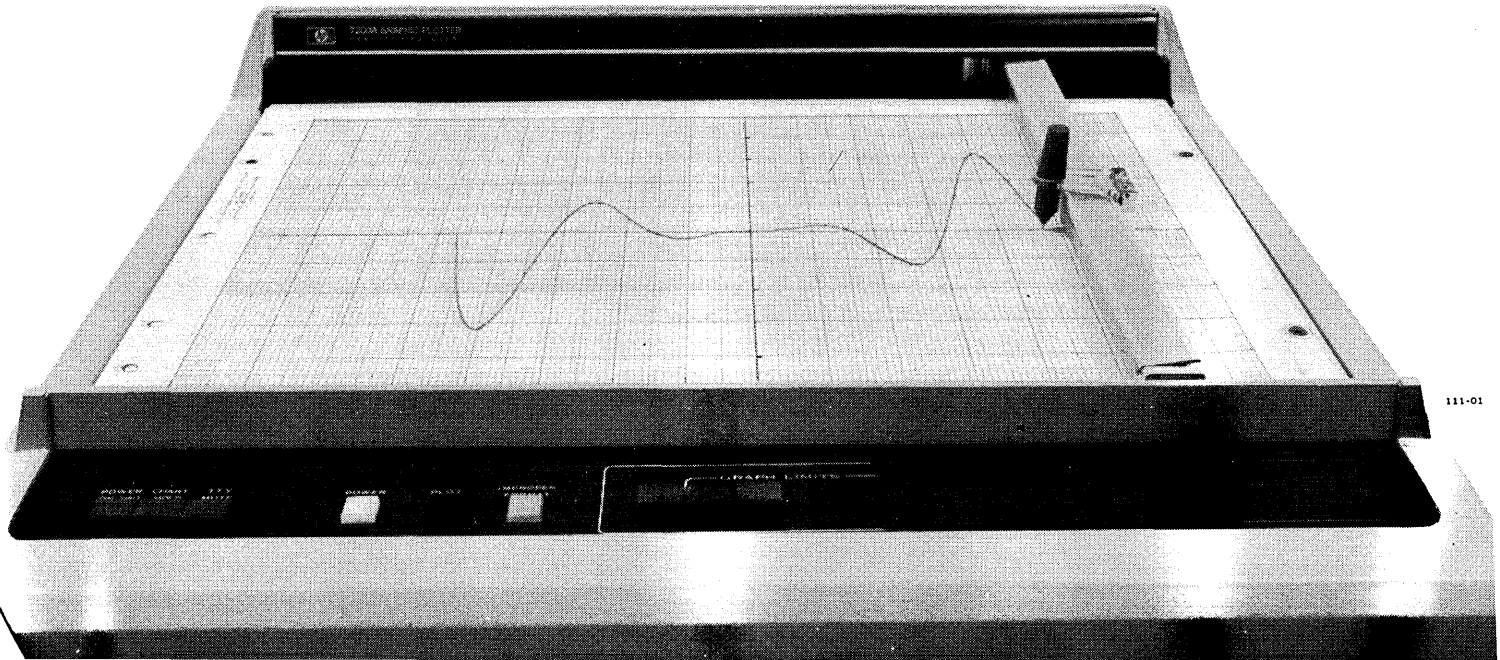
Simple manual controls allow you to set the graph limits to fit any pre-printed grid. HP's Autogrip electrostatic holddown firmly grips any graph paper up to 11x17 inches.

You can arrange to add a graphic plotter to your existing time-share terminal by contacting Hewlett-Packard. Buy it at $3,300. Rent it. Lease it. Or lease to buy.

We can match a 7200 with any EIA ASCII terminal in the business . . . or even IBM's 2741. So now, everybody can be the arty type. For details, contact Hewlett-Packard, Palo Alto, California 94304; Europe: 1217 Meyrin-Geneva, Switzerland.

HEWLETT hp PACKARD

CIRCLE 87 ON READER CARD



111-01

Fortune's 494 unfortunates

Everybody in Fortune's 500 could use one of Information International's FR 80s but only a favored few have gotten the word.

We wonder how the other 494 are making it.

All of you have big computers. Most of you have some sort of microfilm facility. But what you need is the perfect interface between the two: the FR 80. No ordinary graphic COM recorder, the FR 80 is a high speed digital computer integrated with the world's most precise electro-optical imaging. The highest resolution, flexibility, accuracy and quality available. It accepts any kind of digital format, and without tying up precious mainframe time, converts it to pictorial information, displays it, and records it on microfilm.

494 APPLICATIONS. Talk applications, and you must talk resolution. Begin with positional addressability of one point in 16,384. That means 100 line pairs per millimeter on 105mm microfiche, and up to 80 line pairs per millimeter (additional cost option) on 35mm aperture cards.

The FR 80 is the only COM system currently meeting standards for PCMI® ultrafiche masters, and also the micropublishing standards of a major computer company.

What does such resolution mean? Well, for some it means higher quality masters for printing or micropublishing. For others, greater condensation of computer output—more data per page. To the world's largest COM service bureau, it means generating a complete, up-to-date record of the price fluctuations of every stock on the New York and American Exchanges. Complex, detailed; but Information International's FR 80 has the resolution to execute these plots six pages per frame!

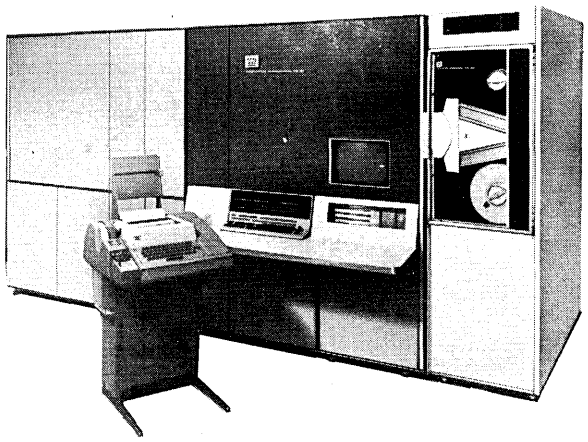
But, whether physics, finance or inventory control, it comes down to this: doing what previously couldn't be done, saving film, saving pages of plots, saving money. We can scarcely guess what it means to you. But 494 of you do have the need. You tell us.

WE LIKE YOUR COMPUTER. The FR 80 works with any large computer. No adjustments necessary. If you want to use the FR 80 as a super line printer, it has the software to print six or eight pages on a frame. 64 character sizes, 128+ different characters, 8 character weights. Untold format flexibility.

Your needs may include animation. Or color. For a small additional cost, you can have graphs and charts in color. You may want to generate PC boards, PERT charts, parts catalogs, logic diagrams or schematics. The FR 80's accuracy, flexibility and plot capability makes it a universal graphic medium.

AN INVITATION. Come see the FR 80 for yourself, and bring your favorite tape along. Simply call us to arrange a demonstration, or stop by our display at the NMA convention. (We'll be in booth numbers 1687-89/1798-1800.) And while you're there you'll meet the new **COMp 80;** it does everything the FR 80 does but specializes in high speed electronic typesetting and composition. We know that when you see the FR 80 in action you won't settle for anything less.

After all, you're one of Fortune's favorites too.



INFORMATION INTERNATIONAL®
12435 West Olympic Boulevard, Los Angeles, California 90064

CIRCLE 24 ON READER CARD

How to save your paycheck from you.

It's great to have a pocket full of paycheck. But temptation being what it is, things happen to the part of it you intended to save. It disappears.

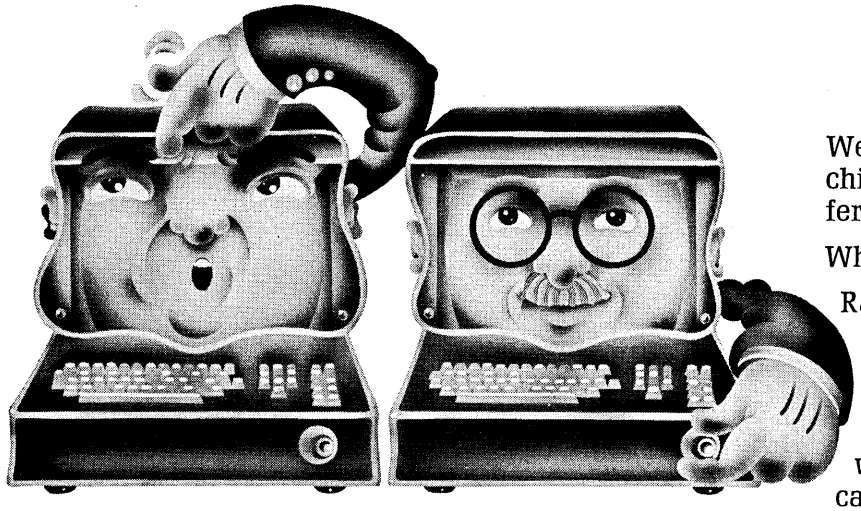
That's why the Payroll Savings Plan for U.S. Savings Bonds works so well. It gets to your money before you do. You just decide how much you want to save out of each paycheck and it's taken out automatically. And painlessly.

And now there's a bonus interest rate on all U.S. Savings Bonds—for E Bonds, 5½% when held to maturity of 5 years 10 months (4% the first year). That extra ½%, payable as a bonus at maturity, applies to all Bonds issued since June 1, 1970... with a comparable improvement for all older Bonds.

You work for your money. Let the Payroll Savings Plan make sure some of it works for you.

...a message from Xerox Corporation in behalf of the 1971 Payroll Savings Plan.

Why settle for a boob tube when you can get one with a brain?



Conventional display terminals are fine for certain jobs. But some people want a terminal that can adapt to change. Or tackle a lot of different jobs, even do some thinking on its own. So we developed one—a display terminal with a built-in computer.

It's small, but it's plenty powerful. It's also versatile: to change the project, change the program. This resident computer gives the terminal user its undivided attention, instantly and always. Of course, when access to vast, central data banks is called for, our terminal, like all the others, is perfectly capable of acting as an electronic window... it's intelligent, but not proud.

We'll tell you more about our new brainchild at the Spring Joint Computer Conference. Look us up, we'd like to meet you.

Who are "we"?

Raytheon Data Systems Company. We're new, but we have some distinguished ancestors. Raytheon Data Systems Company has fused Raytheon's Computer and Teleprocessing activities with our expertise in telecommunications. The result is an entirely new company—with decades of experience.

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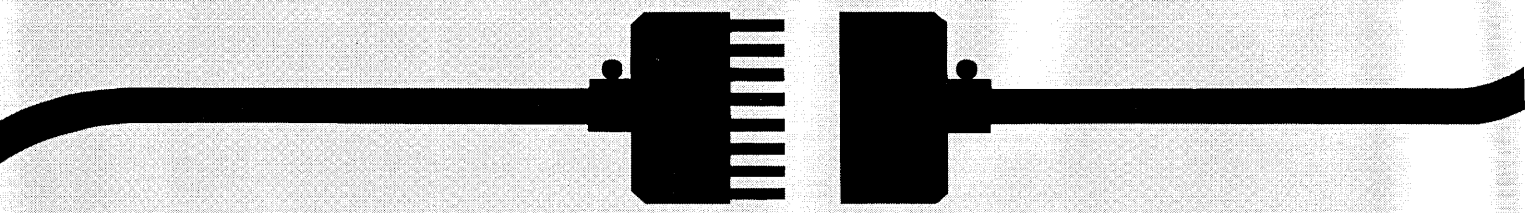

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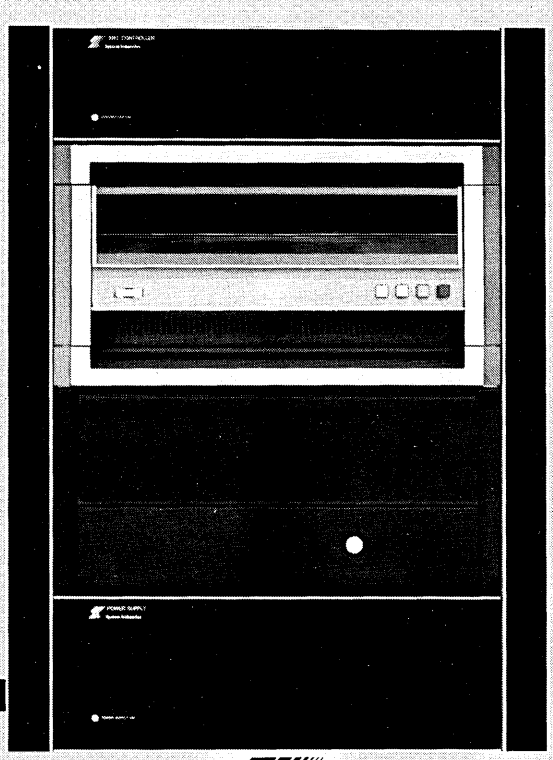

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CIRCLE 34 ON READER CARD

DOD AND JCS CLASH OVER WIMMIX PLANNING

Full development (but not full implementation) of a Machine-Independent Data Management System (MIDMS) by the Defense Intelligence Agency has been okayed by DOD Comptroller Bob Moot, despite JCS efforts to half the project (April 15, p. 83). Non-IBM'ers contending for the WIMMIX buy applauded Moot's actions, since---if MIDMS works---it could mean that the WIMMIX buy will be awarded to multiple suppliers. This would give the non-IBM'ers a better chance. But subsequently, Deputy Defense Secretary Packard announced that 31 "second standard" installations consisting of 360/40-G core cpu's or larger, can be upgraded instead of being replaced. This decision, besides helping IBM hang onto the 31 sites, also increases the appeal of NIPS, one of several Data Management Systems being evaluated for WIMMIX. NIPS is IBM-dependent, so if it's selected, Armonk will gain leverage in competing for the non-second standard sites.

CPU DEAL UNDER NEW EXIMBANK PROGRAM

Honeywell has sold a GE615, valued at $1.175 million, to a Finnish customer, with financial help from the Export-Import Bank and a French bank. This is the first deal consummated under Exim's new cooperative financing facility program. Several similar computer deals are now in the works. Meanwhile the Senate passed a bill (S.581) that would allow Eximbank to finance U.S. exports to Eastern Europe (with presidential approval). The vote on this proposal is expected to be close in the House.

DO AS I SAY BUT...

We hear Cong. Jack Brooks has written Attorney General Mitchell complaining that Justice has acquired nothing but IBM since 1963. GSA officials are probably chortling; a few months ago, they were accused of discouraging competitive computer procurements by--the Justice Dept.

CAPITOL BRIEFS

FCC has okayed Western Union's plan to build a hybrid digital-analog microwave link between Atlanta and Cincinnati. But WU must go back to the commission before offering new services...United Telephone, GT&E, Western Union, and ITT are protesting FCC's recent decision on carrier-owned dp affiliates (April 15, p. 83); meanwhile, the commission has agreed to hold a hearing on a related issue, Bunker Ramo's unfair competition allegations against Western Union... Illinois Bell has withdrawn a 600% rate increase, directed primarily at dp service bureaus, from a pending rate case. But the company probably will try again. The rates were embodied in a new information service access line (ISAL) schedule...Legislation to extend the Government Procurement Commission for another year is being pushed by House GovOps Committee chairman Chet Holifield (D-Calif.)...S.1469, which would tighten control over use of gov't. production equipment by private contractors, has been introduced by Sen. William Proxmire (D-Wis.).

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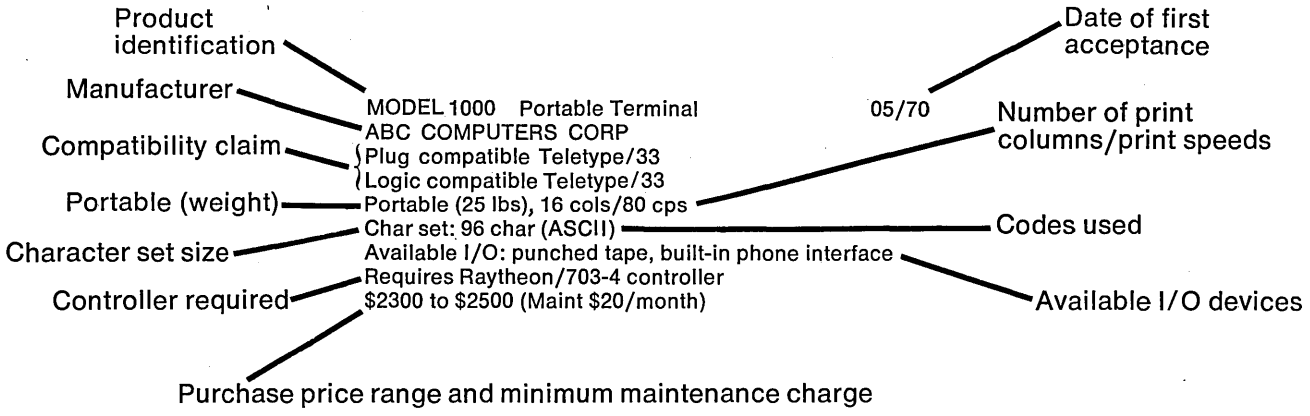

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PEOPLE

Datran (Data Transmission Co.) must raise close to $400 million to build a data transmission network which it hopes to have functioning by 1974. One of the men who will play a key role in raising the money is **Harry G. Bowles,** a former Burroughs financial man who joined Datran this spring when the company still was awaiting a go-ahead from the FCC to build the network in competition with AT&T, Western Union, and other established carriers. Bowles retired in February as senior vp-finance with Burroughs in Detroit where he had held financial and administrative posts for 41 years. Bowles will join Datran's 100-man staff in Vienna, Va., where the subsidiary of University Computing Co. maintains its headquarters. But he'll also have an office in New York City, close to the money markets Datran will need to pluck if its network idea is to work. . . . In San Diego, meanwhile, Cubic Corp. announced the appointment of **William J. Johnston** to vp-finance with Process Consulting and Computing, Inc., a Cubic service bureau subsidiary.

Richard Kelly, a man who likes to buy ailing companies and turn them around, moved into the computer industry in March with purchase of a majority interest in Scientific Control Corp., Dallas (April 1, p. 52), and found last month he was in with both

J. Landon H. Bowles

feet. Kelly took over reins of the company as resident chairman of the board in the wake of the resignation of **John Boness** as president. Boness left to become vice president, Computer Services for Braniff Air Lines.

Three new vice presidential posts have been created by Logic Corp., a small Cherry Hill, N.J., specialist in large key-to-disc systems. The former directors of marketing and engineering, **Lewis A. Barr** and **Joseph Mowery,** both two-year veterans of the firm, are now vp's of their respective sectors, while **William E. Fahy, Jr.,** a CPA hired a year ago as controller, is now vp-finance.

James N. Landon, who headed up marketing programs for RCA's Computer Systems Div. before it was incorporated into the new Data Processing Div., is now directing RCA marketing and field engineering operations in Canada as vp/gm of Computer Systems, RCA Ltd., Canada . . . **John R. Martin** is the new director of information services in the corporate systems division of Montgomery Ward & Co. He moved to corporate headquarters in Chicago from Baltimore where he was Ward's eastern regional systems manager . . . **Edward J. Roberts,** a former management consultant, joined Zenith Radio Corp., Chicago, as manager of information systems . . . Joy Manufacturing Co., Pittsburgh, named **Robert E. Higgs** director of data processing. Higgs had been manager of data processing and customer service for RCA's electronic components division . . . **Emanuel J. Kissner,** new director of management systems for Lenox Hill Hospital, New York City, has been assigned the job of expanding the hospital's dp systems into the areas of patient care and information systems. He formerly was data processing consultant for Computer Specifics Corp. where he was responsible for the development of edp and associated training programs for the disadvantaged . . . **Sigmond Hartmann,** a senior manager in the Electronic Systems Div. of TRW Systems, was promoted to become vice president and assistant general manager of TRW Data Systems . . . **Thomas A. Cleary** was named director, business administration for Information Storage Systems, Cupertino, Calif., peripherals manufacturer. He moved up from the position of manager, marketing administration . . . **John E. Fitzgerald** was named to the newly created position of vp-administration of Elgin National Data Services, Inc. He had been manager of systems for Reingold Breweries, Inc. . . . Assuming another newly created post was **Mrs. Dagnija D. Lacis,** named manager, scientific programming, in the Management Systems Development Dept. of Burroughs' Business Machines Group. She was project leader, mathematical programming. ■

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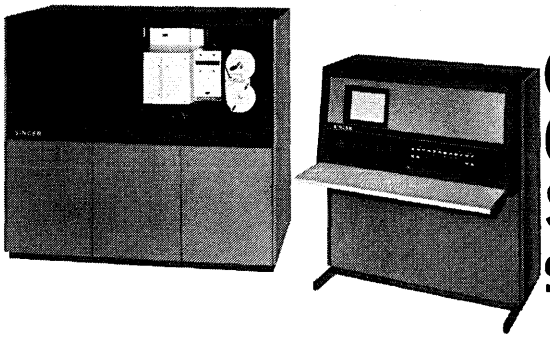

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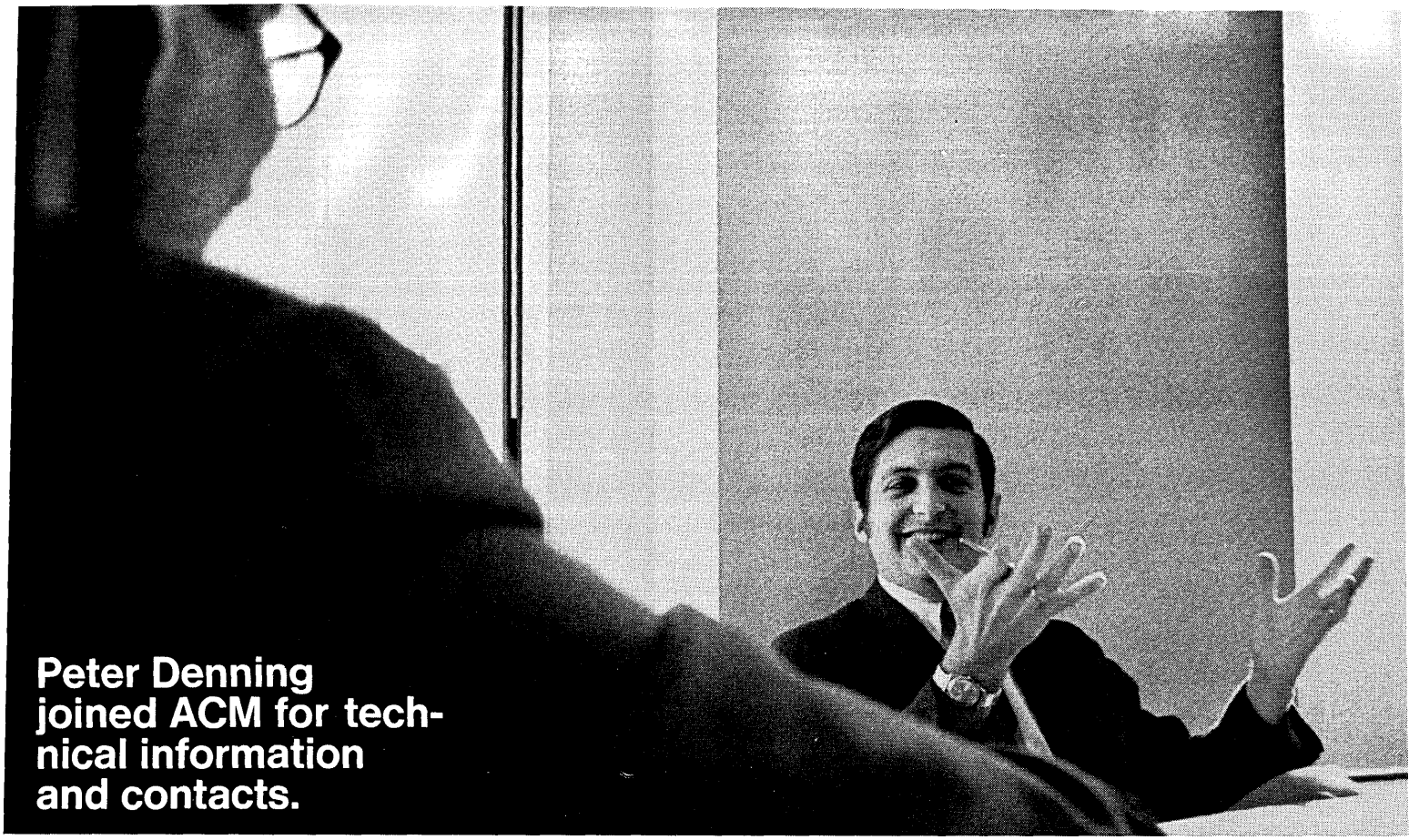

Peter Denning joined ACM for technical information and contacts.

Now he's involving other members in everything from microprogramming to data banks and privacy.

Peter Denning, 29, is an Assistant Professor of Electrical Engineering at Princeton. He's also an ACM member and chairman of our committee on special interest groups and committees (SIGs/SICs). He wasn't always as active in ACM.

"I joined in 1965 while working on my thesis," says Peter. "Mainly for technical material and a chance to meet other computer professionals. In 1968, I was asked to edit the Operating Systems (SIGOPS) newsletter. I got involved and quickly took on more responsibility. After two leadership positions, I ran for SIG/SIC chairman.

"Special interest groups are what ACM is all about," says Peter. "We've got 27 now, from microprogramming techniques to the impact of computers on society. One out of three ACM members belong to at least one group. I want this share to grow.

"Now I can do something about it. Like help restructure the whole SIG/SIC operation. Some groups may have to be split up, to cover less ground. Others need stronger leadership. A few we should have don't even exist yet, like performance evaluation and computer architecture."

Peter Denning is involved in ACM, the oldest and most respected association in the computer field. He's advancing his career. Sharing his ideas. And making a contribution to the computer profession.

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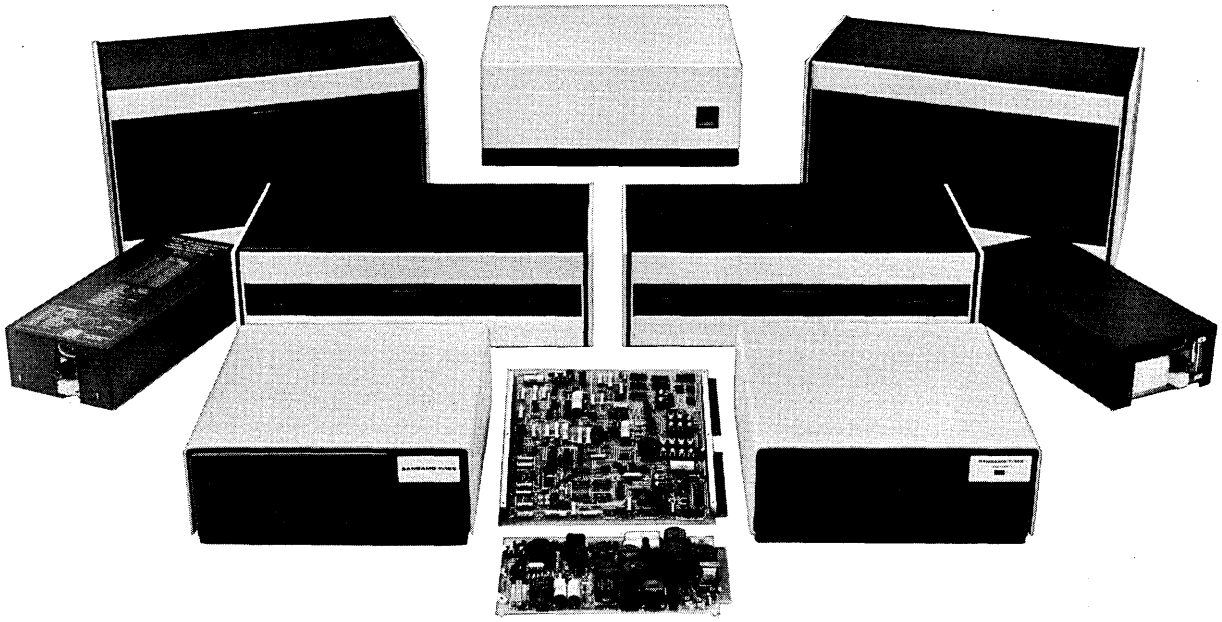

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BOOKS

***Teleprocessing Network Organization*, by James T. Martin, Prentice-Hall, Inc., Englewood Cliffs, N. J., 1970, $12.50.**

This is the third of a trilogy of books supporting the same author's *Design of Real-Time Computer Systems* (1967). Like the latter, and like its two other companion volumes, it is an accurate, complete compendium of information. The present volume is devoted to the equipment and techniques of teleprocessing, with particular emphasis on terminals, control of terminals, line characteristics and network concepts.

It should be noted that the viewpoint of the book is that of the system designer, rather than of the programmer. It begins by describing various types of communications links—an awesome task for the 25 or so pages the discussion fills, but well-done—then proceeds to describe codes, transmission modes, and transmission errors. The central portion of the book is devoted to the organization and control of communications lines. Descriptions of hardware, including terminals and intermediate devices such as controllers and concentrators,

follow. The final chapters deal with over-all considerations of computer-based communications systems. It is a thoughtfully-organized book, one that leads well from relatively simple to very complex concepts.

Anyone who becomes involved in the design and implementation of a network of teleprocessing equipment will necessarily go quickly beyond the material Martin has provided, but the book is a valuable primer. It is the only source known to this reviewer that draws together so many elements pertinent to working with computer/communications systems, and that explains them so lucidly. It is a highly recommended first exposure to the field.

—Richard H. Hill

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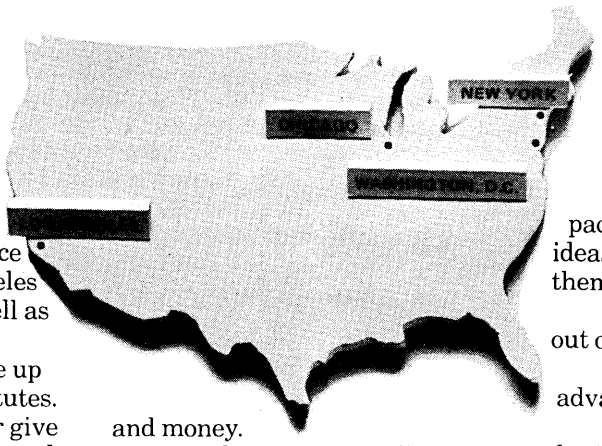

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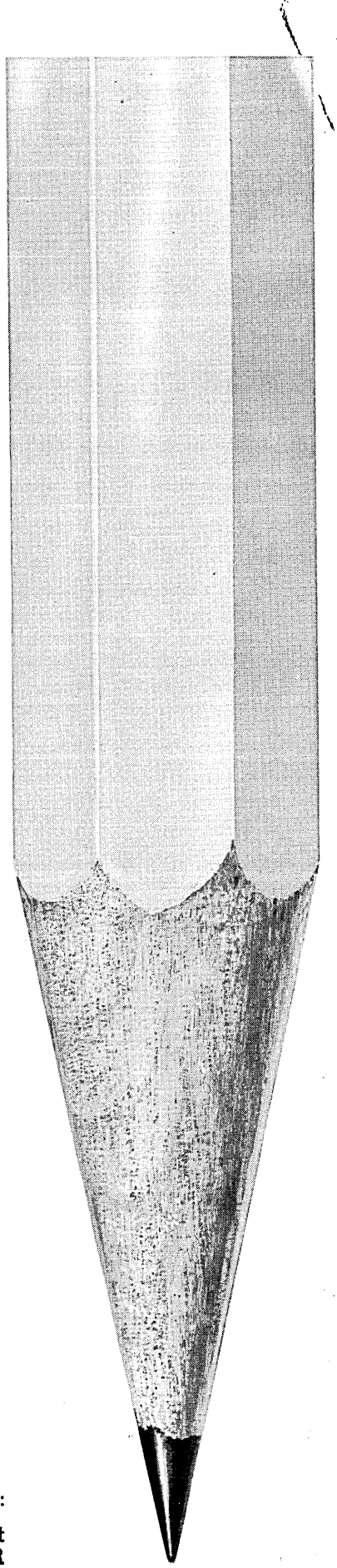

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CIRCLE 303 ON READER CARD

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THE FORUM

Of Vice and Virtue

The article "The Myriad Virtues of Text Compaction" (Dec. 1, page 36) has so many virtues that it may be the act of a pedant to point out its defects. Perhaps by first recounting these virtues, one can avoid giving the impression that one is merely carping.

The method described works. It produces an impressive saving. It is employed in a useful application. Best of all, one does not discover, at the end of the article, that the system will go on-line in late 1972, if only someone would write the program.

The vices of the paper are two. First, the idea is not "unique." Second, the specific method used is not the most efficient, by a non-negligible amount, granting a modern computer and the general conditions of the application. It turns out that these two points overlap in the discussion which follows.

It might be better to abandon the term "compaction" in this context. "Compression" is the word used in the body of the article, as well as by other authors. "Compaction" is applied by Knuth[1] to garbage collection, and is used in that sense by Haddon and Waite[2] also.

The idea of alphabets which include single symbols for two letter combinations (digraphs) is quite old in cryptography. Although in greater part the driving force is increased security, the need for economy in composition or transmission of a message was always recognized. For example, d'Agapeyeff[3] exhibits a so-called Solomon's Alphabet, in which several digraphs are included. Napoleon's Petit Chiffre, set forth in the same work, uses code symbols in the form of two or three digits. Interestingly, single letters are sometimes represented by three digits, while digraphs are sometimes represented by two. Unfortunately, this system does not decompose uniquely. A German army cipher described in the book includes both digraphs and complete words. This type of cipher falls into the class of nomenclators, discussed in detail by Kahn[4]. More mundanely, in telegraph practice, commercial code books invariably include a large number of groups which stand for digraphs and even larger combinations of letters. These groups, which sometimes are collected into a separate appendix for convenience in enciphering, are used to reduce the cost of spelling out proper names or other words not found in the vocabulary covered by the book. Needless to say, all groups in the code book are of the same length.

The ASCII and EBCDIC codes are specially designed for accurate transmission of information from one place to another over commercial circuits. For this reason a distinctively coded block of binary groups (characters) was set aside for control of communications. Among these were some characters which had both information and control characteristics, e.g., NAK and EOT. Even then, it was not possible to use all combinations, and the suggestion to employ unused groups for local purposes was made both explicitly and implicitly, e.g., by IBM[5,6] and Morenoff and McLean[7].

Taking advantage of the mismatch between number of binary groups made available by using a certain number of bits, and the number of characters in a basic alphabet, has been suggested by Belevitch[8], Fraser[9], and Bemer[10].

More important than the foregoing history is the question of efficiency. I will show that, in a major subset of the total code described, a far better selection of candidate digraphs exists than that chosen. Then I will briefly describe one procedure for setting up such a subset, and how it would be used on input and output.

The subset of digraphs as described consists of the letters AEIOUNT as initials of digraphs and the alphabet without JKQXYZ as terminals. In addition, the word spacer was admissible either as initial or terminal. This gave a total of 168 digraphs. If word spacer is not counted, the number of digraphs becomes 140.

In a sample of 50,000 letters of English, the 140 digraphs above mentioned accounted for 52.4% of the text. The 140 most frequent digraphs in the sample accounted for 80.1% of the text.

The reason is easy to see. Many of the 140 permitted combinations are rare in English. Who has ever seen an aardvark skiing in a vacuum? On the other hand, RE, ST, VE, and SE are excluded. Yet these four digraphs constitute about 5.3% of the sample.

Digraphs which included word spacer as an element were not taken into account in the above sample of 50,000. However, from considering a count made on 10,000 words of English text, it would appear that:

1. If word spacer was used as part of a digraph in the preceding word, a word can start with a permitted digraph only 41% of the time, since that represents the combined frequencies of AEIOUNT as initials.
2. The set AEIOUNT occur as terminals of words 44% of the time. This means that 56% of the time, the terminal letter of a word cannot form a digraph with the word

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1. D. Knuth, **Art of Programming,** Addison-Wesley, 1968, Vol. 1, p. 421.
2. B. K. Haddon and W. M. Waite, **The Computer Journal,** Vol. 10, No. 2, p. 162, Aug. 1967.
3. Alexander d'Agapeyeff, **Codes and Ciphers,** Oxford University Press, 1939, p. 37 and p. 48.
4. D. Kahn, **The Code Breakers,** Macmillan 1967.
5. IBM System/360 System Summary, Form A-22-6810-9 (1968), p. 9.
6. IBM System/360 Principles of Operation, Form A-22-6821-7 (1968), Appendix F 150.3.
7. E. Morenoff and J. B. McLean, "A Code for Non-numeric Information Processing Applications on On-line Systems," **Comm. of ACM,** Vol. 10, No. 1, Jan. 1967, p. 19.
8. V. Belevitch, **Langage des Machines et Langage Humain,** Collection Lebègue et Nationale, 1956, Ch. II.
9. A. G. Fraser, "Data Compression and Automatic Programming," **The Computer Journal,** Vol. 10, No. 10, Aug. 1967, p. 165.
10. R. W. Bemer, **Comm. of ACM,** Vol. 3, No. 9, Sept. 1960, p. 530.

spacer.

In a nutshell, the probability of a letter occurring at any particular point in English text is not independent of the identity of the letter which has preceded it, and therefore the frequency of a digraph is not the product of the frequencies of its components.

What the digraphic frequencies are will often vary with the nature of the text. It is likely that the distributions for literary, telegraphic, scientific, and military text differ significantly from one another.

The best set of digraphs to use is that composed of the 168 most frequent ones in a sample of the text which it is desired to compress. To find these does not take, or make, an excellent thesis (unless in a school very hard up for degree candidates). It takes a Fortran program which uses the first and second letters of each digraph to locate an element of a, say, 27 by 27 array into which a count of one will be added. Afterwards, the elements of the array are sorted into order of size. To save array space (although why bother?) in cases where the text elements do not form a dense set, the distribution routine should be preceded by a table look-up to "compact" the space of text elements. Distributions of this kind can be used in several ways. The one on which I have last worked used a data base of United States place names, in the work on code content for mechanical sorting of letters, performed by the Institute of Defense Analyses for the Post Office Department.

It is usually worthwhile to make simple analyses of text such as the ones for text compression, because the surprises which turn up are really the information one is looking for. There is no reason to expect a general rule to be discovered, and therefore each problem should be examined for its individual characteristics of text peculiarities, size of date base, computer restrictions, nature of storage, of search, etc.

In the case of data like that in the article under discussion, ordinarily the text which is finally copied out is first located by working with descriptors or with words in the title of the text. The text itself is often not searched. If these assumptions are correct, the problem is that common one where quite elaborate input and output procedures are admissible because input/output is not the big drain on system time.

Table look-up would seem to be the way to translate, both going in and coming out. Plainly, the internal code can be so constructed that the value of a character as a binary number indicates whether it is a digraph or a single letter. Input preparation would always be by taking two letters at a time, since the pair is odds on a digraph in the table.

If more than one kind of text is included in the data base, it may very well pay to have a separate table for each variety of text, with suitable indication in storage as to which table is applicable to the item to be read out.

—Arnold I. Dumey

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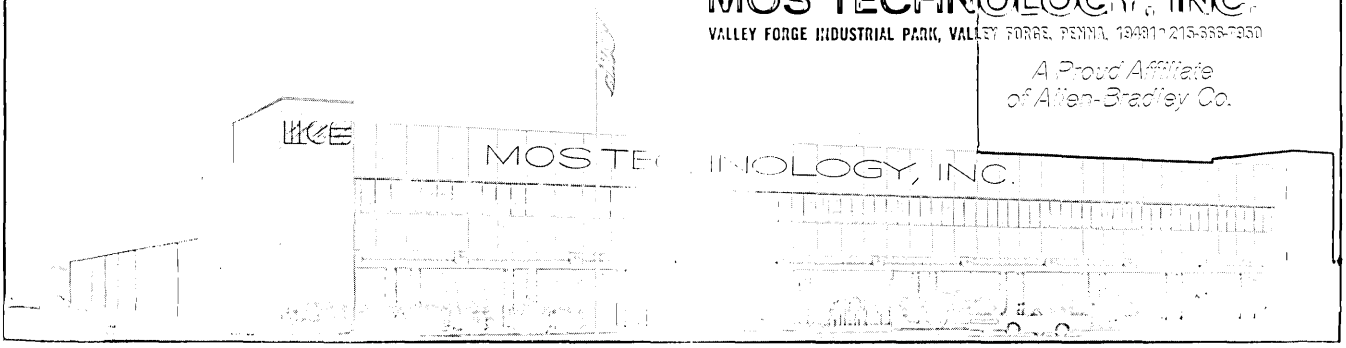

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