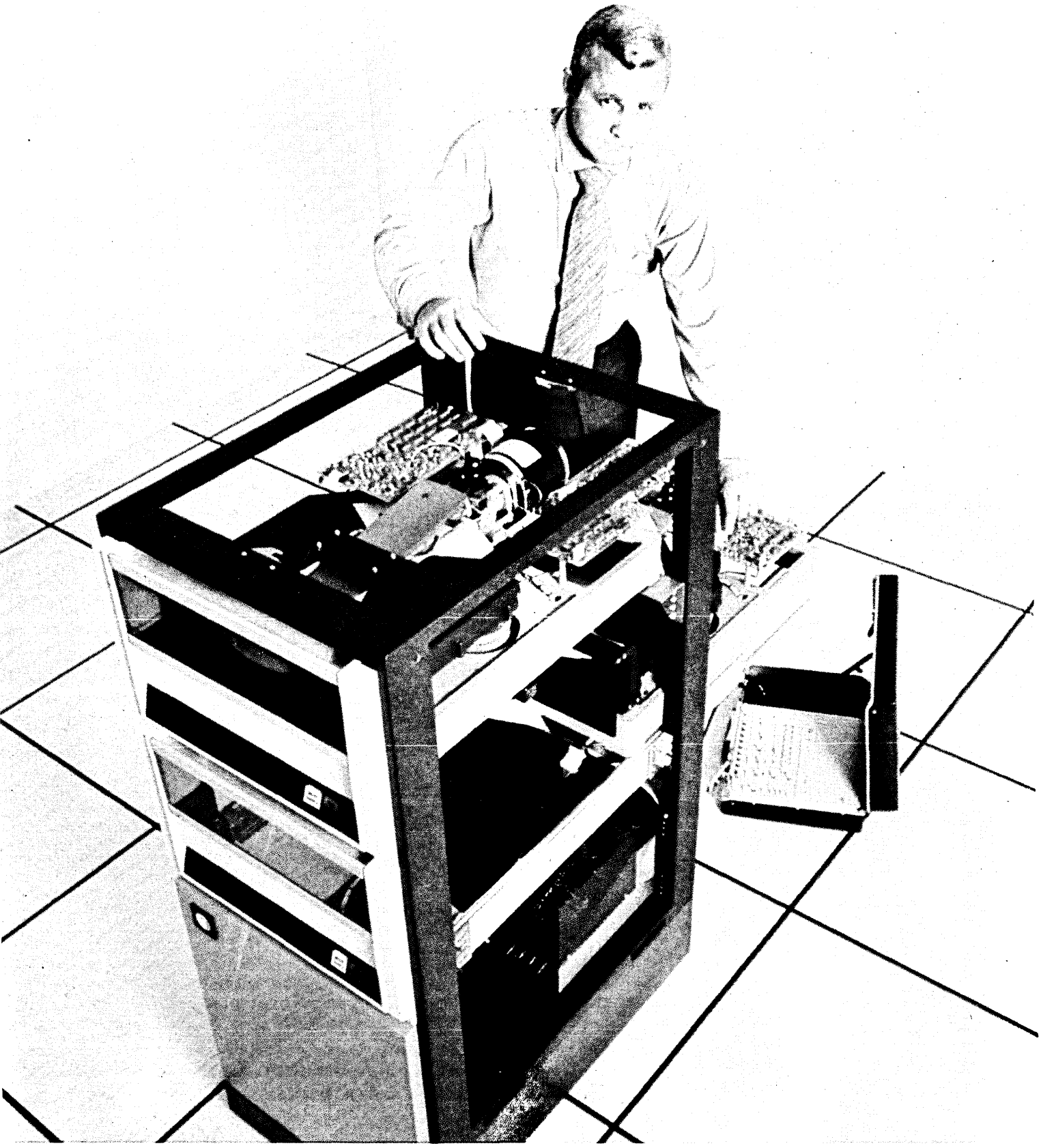
DATAMATION®

70

December 15

measurement:
theory and
practice



Anatomy of the Caelus® Disk Cartridge Drive

The facts are these: this high density disk drive provides the lowest bit cost in the country. Available in single or dual configuration with 22 or 44 megabit capacity. Random access heads. Both disks are removable. Rack mountable in your cabinet or ours, with ease of access for maintenance. Single power supply. The disk cartridges, drives and test units are made by Caelus, which says it all for quality and performance.

CÆLUS® MEMORIES, INC. P.O. Box 6297, San Jose, California 95133. Telephone (408) 298-7080

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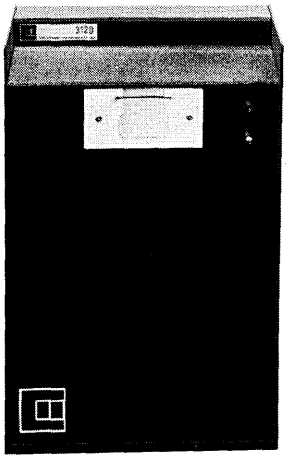
Tell a friend about Colorado Instruments.

Better yet-send us his name. We'll send him complete literature and tell him ourselves.

We're the best in source data collection systems, although most of your friends probably don't know we exist. We've been "off in a corner" perfecting!

But we've proven ourselves to a number of the country's leading companies.* By solving some problems in simple ways that would intrigue you. So we're ready to widen our circle—show a lot more people how we can fill the gap between them and their computers.

Our systems are uniquely designed for speed, accuracy and reliability. They collect data directly from its source—the man on the job—and transmit it to the computer. On-line. Or off-line.



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By eliminating the need for keypunching, record keeping and pad-in-hand inventories, they eliminate man-hours. Increase accuracy. Decrease costs.

They are simply designed. And easily operated. Modularly designed. And easily adapted.

Here, we can only touch upon a few of the advantages of our brand of source data collection. At your convenience we'll demonstrate them all.

So you can tell a friend about Colorado Instruments.

You can tell him how we've helped others solve their problems. With time and attendance recording. With production reporting. With inventory control and materials ordering. With purchasing and receiving.

More important, you can tell him how we can help him!

*Names available upon request

Filling the gap between people and computers.

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CI-342

LINE PRINTER.
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The Centronics Model 101.
It's economical because of the matrix printing and simple design.
It's practical because of the multiple copies,easy interface and communications options.
Just look at the Model 101 as something that acts like a line printer and costs like a teleprinter.
Centronics Data Computer Corp., Hudson, N.H. 03051

centronics

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

FJCC Booth
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CIRCLE 68 ON READER CARD

DATAMATION 70®

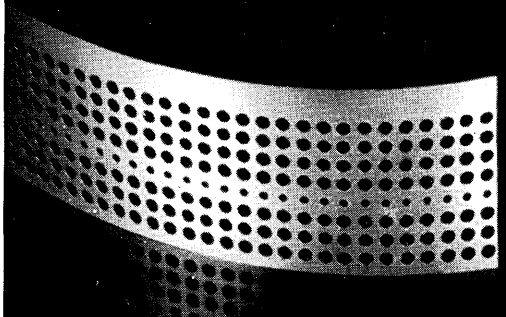
DEC. 15, 1970
volume 16 number 17

arvey

the no-fail nc tape

guaranteed

trouble free



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arvey corporation

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DATAMATION®

DECEMBER 15, 1970

volume 16 number 17

This issue 112,099 copies

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ROBERT B. FOREST

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CIRCLE 10 ON READER CARD

You can get faster response time out of a 360 by adding more and more memory.

And you can get warts from frogs.

Terminal-oriented 360's have a habit of getting slower as you add more terminals. Adding core doesn't seem to help. Pretty soon you're waiting 30 seconds for answers.

There's a way out. It's called ENVIRON/1.

ENVIRON/1 is a 4thware operating system that can process most real-time applications with a CPU and a core one-size smaller than normally required. And you'll be looking at the data in 2 seconds, not 30.

You can program ENVIRON/1 in either Assembly or COBOL languages. It takes just a week to learn how. And, you can operate under DOS or OS/360 with any System/360 from a Model 25 with a 32K partition, to a Model 195 with thousands of terminals.

If you'd like to get your terminal system out of the dark ages and see the response time you were promised, contact us.

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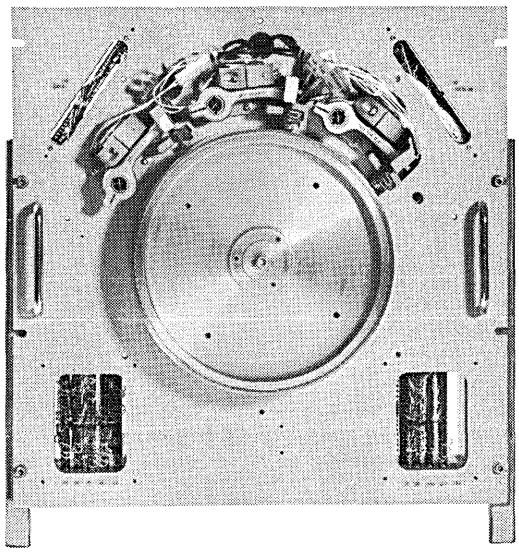
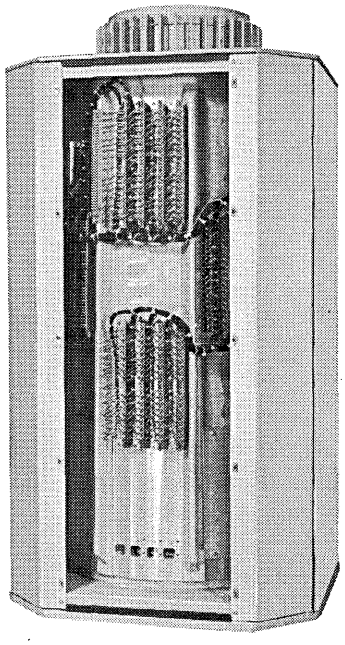
1970: A Bryant and remember al

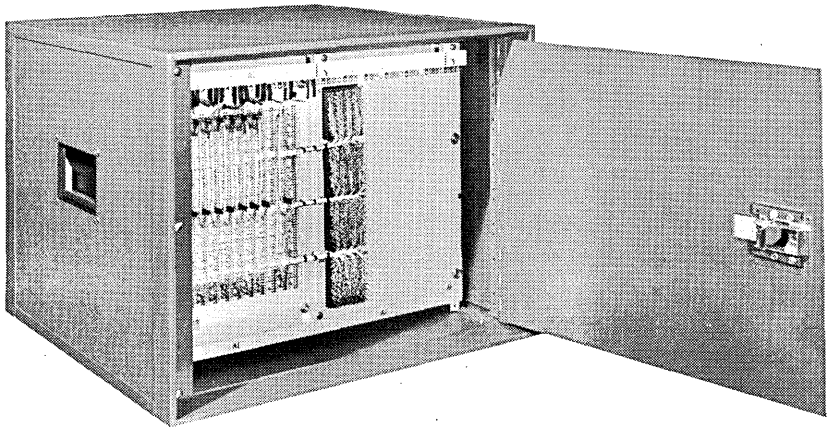
The CLC-1 Drum. A genius that never forgets.



The AB Drum Series. For plug-in growth potential. This is the 18″ model. We also have a 10″ one. They're both great.



The 720 Mini-Controller. The Napoleon of the computer industry. (Can interface with anything shown here.)



year to remember
I remember and rei

We want to be thought of and remembered as the largest independent manufacturer of magnetic memory drums, disc files and complete memory systems in the world.

Well, you don't get there by sitting on your hands.

You do it by using your head. Thinking ahead. And you introduce new products.

So we did all that. All in 1970.

A new drum. Our CLC-1. With 50% more storage. In the same space as the old one.

A new disc storage drive. Our 1100. That ought to go for $25,000. But sells for a lot less.

A new mini-controller. That thinks big. Our 720. Big enough to handle as many as eight of anything shown here. And instantly compatible with your mini-computer.

A new CD Drum. That remembers twice as much as it used to.

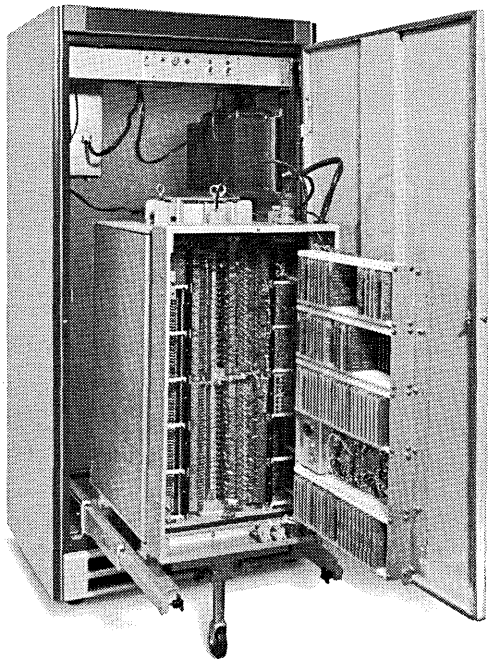
A new AB Drum series. In 10″ and 18″ models. With plug-in growth potential.

1970. A year to remember, indeed.

In fact, the only thing that could make you forget 1970—is what we're doing for 1971.

BRYANT
COMPUTER PRODUCTS

The 1100 Disc Storage Drive. You get everything the IBM 2311 has. Except that you get it for a lot less.



The CD Drum Series. Shown here, the 10″ model. It remembers twice as much as it used to. You should see its big brother.

A UNIT OF
XLO®
EX-CELL-O CORPORATION

CIRCLE 51 ON READER CARD

If our new alphanumeric digital printer didn't work, neither would thousands of Friden calculators.

But of course Friden* calculators do work. Including the thousands of electronic printing models we've sold for the past 4 years.

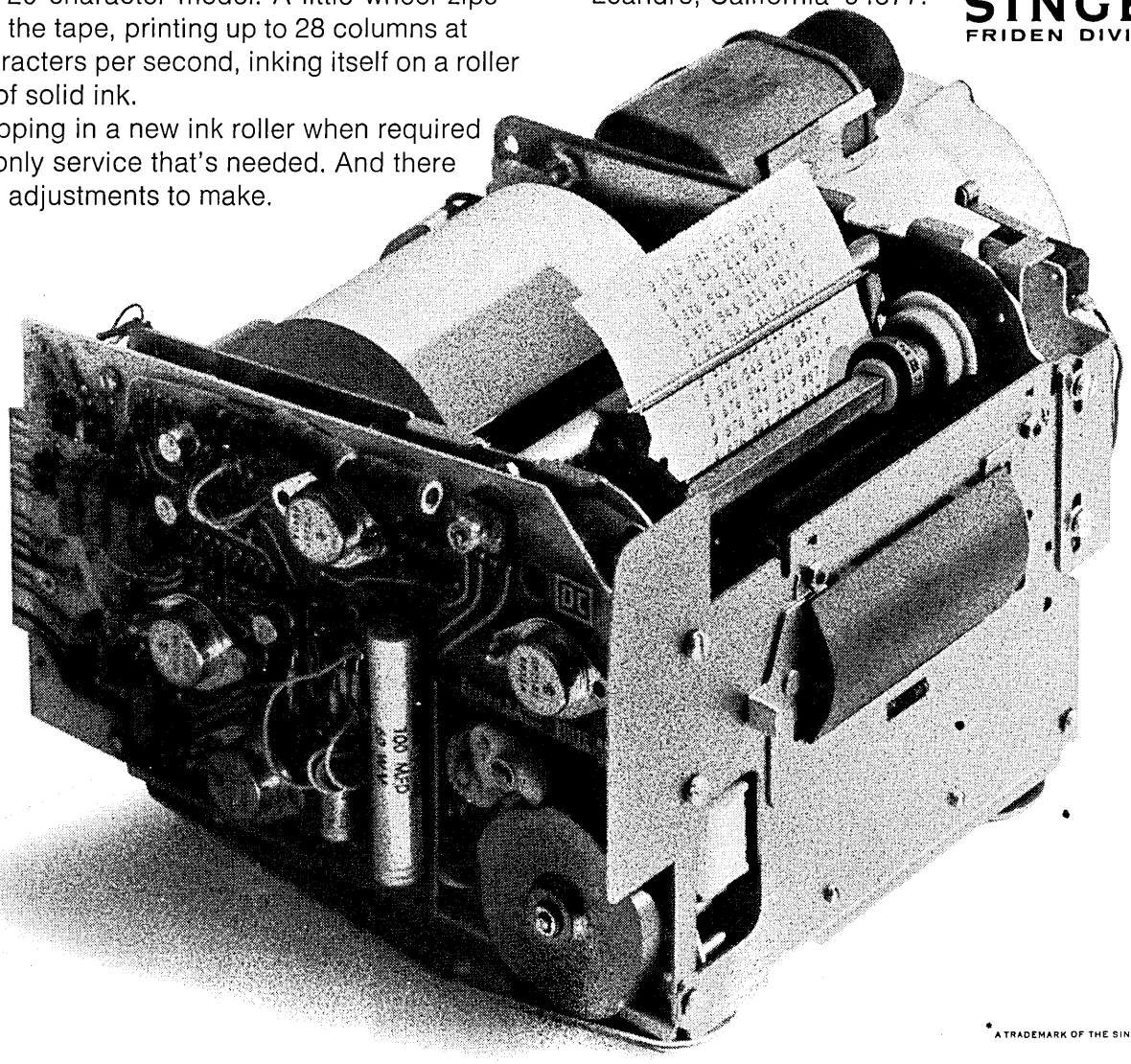
With this ad, we're introducing 30-character and 40-character alphanumeric printers, both of which work exactly the same as the standard Friden 20-character model. A little wheel zips across the tape, printing up to 28 columns at 46 characters per second, inking itself on a roller made of solid ink.

Popping in a new ink roller when required is the only service that's needed. And there are no adjustments to make.

It's a printer you can count on. Ask anybody who owns one of our calculators.

And if you'd like complete information on all three Friden digital printers, ask Mr. Gary Dotzler, Sales Manager, OEM Products, Friden Division, The Singer Company, San Leandro, California 94577.

SINGER
FRIDEN DIVISION



*A TRADEMARK OF THE SINGER COMPANY

LETTERS

Two-day weak work

Sir:
In the article "Golden Rule Days" (Oct. 1, p. 42) the equation given for success by the "We've Got a Formula" school:

$$\text{Attitude} \left(\frac{\text{Aptitude} + \text{Placeability}}{\text{Investment of Time and Energy}} \right) = \text{Success}$$

indicates that the less time and energy spent, the greater one's chances for success. Wouldn't it be nice!
JUDITH PARKER
Long Beach, California

Bellringer

Sir:
Mr. Nelson's article "Campus Computers: Target for Militants and Almost Anyone Else" (Oct. 15, p. 37) touched me as deeply as any article I can remember. It rings like a bell with a warning that the outside world, to which computer personnel may isolate themselves from time to time, is about to attack as it has attacked so many other disciplines recently.

As a graduate student who depends on the campus computer to complete my doctorate, to which I have devoted five years of my life, a bomb in the computer center is a very sobering thought. I have forwarded Mr. Nelson's article to the head of the computer center and to the president of the school.

Let's see more articles interfacing computers with our new social times.
JOSEPH J. SEIDLER
Georgia Tech
Atlanta, Georgia

Come to your census

Sir:
Mr. Rappeport's comments (Sept. 15, p. 13) on my letter about the Census missed the point, as usual. The social consciousness of the administration of the Census and the confidential nature of information "related to any specific respondent" is not *presently* at issue.

My concern, and maybe that of other "amateur civil libertarians" is with the fact that we are *required by law* to provide the Census information, to fold the form as directed, and to write only in the specified boxes. If we cede, today, to the government, the right to make us criminals for doodling in the margins, what sort of precedent are we setting for tomorrow?
JAMES V. DOODY, JR.
Amherst, New York

Crackers

Sir:
Pearce Wright's "Technology Gaposis" in the Sept. 15 issue of "Editor's Readout" reads, in part:

". . . plus Italy, the Netherlands, and Benelux. These countries were . . ."

I'm curious: precisely what sort of animal does Mr. Wright think Benelux is?
GEORGE A. THOMAS
Pittsford, New York

Mr. Wright should not have used Netherlands with the redundant Benelux. He was wroghng.

Plugging along

Sir:
Thank you for listing the Telex products in your survey on plug-to-plug compatible peripherals (Oct. 15). As will quite often happen, errors do creep in. We'd like your readers to note that our Telex 4800 series of IBM-compatible magnetic tape units have both phase encoding (PE) and non-return-to-zero (NRZ) encoding features. And they have read-backward capability as well.
G. HARRY ASHBRIDGE
Telex Computer Products
Tulsa, Oklahoma

Don't take the stand

Sir:
Your otherwise fine article in the Oct. 15 issue concerning the ACM's current activities titled "Smith at ACM: More Members and a Code" deserves some correction.

You state that before a Code of Ethics can be accepted, "the association would have to change its constitution from a society devoted to advancing computer science to one also taking political and social stands." My proposal expands the purposes of ACM to allow adoption of a Code of Ethics. It is not intended to also include taking political and social stands.

A question of importance, voted on by the entire ACM membership, clearly indicates the membership's desire that ACM not take such stands. The constitutional changes proposed would expand ACM's purposes to a concern for the integrity and competence in the practice of the arts and sciences of information processing. This change will not extend ACM's purposes outside of its areas of competence to take political and social stands which would be amateur at best and not appropriate for a professional society.

It should also be noted that ACM has a new chairman of the Professional Standards and Practices Committee, Mr. Roger Mills of TRW, who will be championing these causes with my wholehearted support.
DONN B. PARKER
Stanford Research Institute
Menlo Park, California

He's DeFiore-ous

Sir:
It is understandable that Mr. Maurer is under pressure for tenure at his university, but the way to obtain it is certainly not by publishing information that is technically incorrect and emotionally immature (Dec. 1, p. 9). The fact that he still fails to understand associative memories is evident by his letter. For example, although for m bits there are $N=2^m$ combinations, n is not necessarily related to N. In some cases, if m is the key (number of bits), N is not even an upper bound for n when multiple responses are allowed. In other words, in such cases m is not always greater than log n. As another example, Mr. Maurer states "there are sorting methods which take nk steps where k is the length of the key." It is true that k could be set equal to m, but this does not imply that $k = f(m)$. And in most cases when associative memories are used it is not so. Furthermore, Mr. Maurer is apparently confused between associative software implemented on con-

A dirty tape can put a computer down.

Depressing. Dirty tape causes data dropouts. And dropouts cost you money. That's a bad scene.

RCA Computer Tape helps keep computers up.

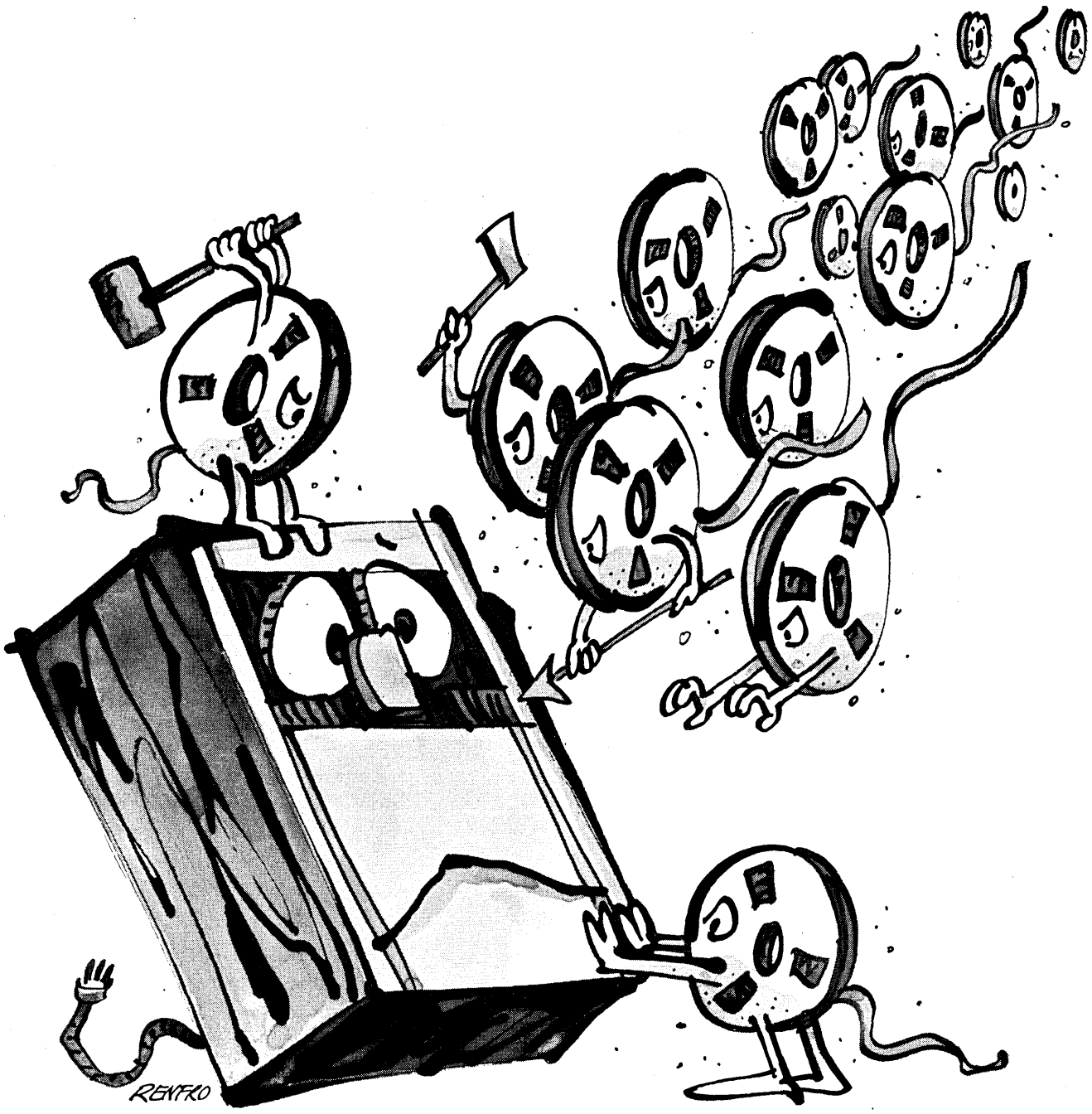
It's a special formulation that starts cleaner. Every inch of every reel is tested and certified in the cleanest of white-room conditions. (No statistical testing for us.) And it stays cleaner, longer.

Result? Fewer dropouts, more efficient computing.

Show your computer what a good scene really is. Write RCA Magnetic Products, 201 E. 50th St., New York 10022.

Our tape makes it.

RCA Computer Tape



CIRCLE 69 ON READER CARD

ventional computers and software for hardware associative processors. Software for associative processors is still very much lacking, while associative processors do exist.
CASPER DEFIORE
Rome, New York

Sawaya goes

Sir:
In the Letters section of your Oct. 1 issue, reader Selma L. Sawaya points out the fact that two spelling inconsistencies appear on p. 17 of the previous issue. . . .

So far, it appears that you have managed to reverse the page number digits, and halve the error rate—if you will check p. 71 of the Oct. 1 issue, you will find the word "primarily" rendered as "promarily" . . .

That's progress—keep up the good work!
CHRISTOPHER B. KILGOUR
Phoenix, Arizona

We're all for prigress.

Gal poll

Sir:
Regarding the letter in your Sept. 15 issue (p. 11) from the distaff data processors protesting the poor taste of the ad in the June issue, we have one word of comment: DITTO.
ANN CHRISTY
CANDY DENT
CAROL JOBE
JO STEVENS
JEAN WILKINS
LYN WONINK
Data Processing Section
Employment Security Commission
Phoenix, Arizona

Matrix is for kids

Sir:
Aside from switching figures 1 and 2 in Mr. DeMaagd's Oct. 15 article on "Matrix Management," DATAMATION made one major mistake: printing the article in the first place. Matrix or task team management seems, according to the article, merely new in description and definition. Organizations facing new tasks (projects) on a regular basis have long been forced to be this flexible. Small organizations (e.g., consulting companies) could not survive without it. What is new, the name?

Perhaps Mr. DeMaagd should get in touch with the Industrial College of the Armed Forces where they are using matrix management in a way that does have a new flavor. They are operating within the severe constraints forced on them by the structure of military rank, yet there is more novelty in the way they are organized than in anything Mr. DeMaagd describes. If he is an expert in matrix management, isn't it too bad that we couldn't learn anything new from him?
LEWIS B. HAYES
U.S. Army Management School
Fort Belvoir, Virginia

Mr. DeMaagd replies: In reply to Mr. Hayes' criticisms, I will only note the following:

1. True, the illustrations above figures number 1 and 2 have been reversed.
2. What is unique about the article is not matrix management as a new concept, but its application in a data processing setting. Hopefully its presentation as one of the alternatives will give data processing system managers additional insights into their organizational relationships.
3. We would be happy to hear about any new approaches to matrix management that have been developed.

Intermixed up

Sir:
Peripherals General, Inc., was part of a survey in Mr. Cecil R. Frost's article, "IBM Plug-to-Plug Peripheral Devices," which appeared in your Oct. 15 issue.

After the description of our Model 733 Disc Storage Drive on p. 30, the "COMMENTS" column stated: "Cannot mix 733s and IBM 2312s." This statement is untrue. Our Model 733 *can be intermixed* on the same system with IBM 2312 drives.

We would appreciate your rectifying this error.
JAMES E. LINNELL
Peripherals General, Inc.
Cherry Hill, New Jersey

Base power

Sir:
You may by this time be aware of the inadvertent reversal of the figures illustrating functional and project organizational structures in Gerald DeMaagd's "Matrix Management" article of Oct. 15. In reality, the first figure depicts a project arrangement while the second, on p. 48, presents a functional structure.

The author justly points out that a "special set of leadership responses" are required from a task team manager in the "markedly different" matrix organizatonal structure. A manager's success and value is measured by his ability to generate among the members of the group a resultant strength of motivation for the achievement of team objectives. It is significant to note, however, that the manager of a matrix organizational group endowed with legitimate authority and powers of reward and punishment need *not* emerge as the leader of the team. Referent power, i.e., personal liking and respect between leader and follower, and expert power, i.e., professional knowledge and competence of the leader, neither readily conferred by the larger organizational entity, yet both sufficiently important to be able to substitute for other bases of power, are not only more readily accepted by, but available to all members of the organizational unit.

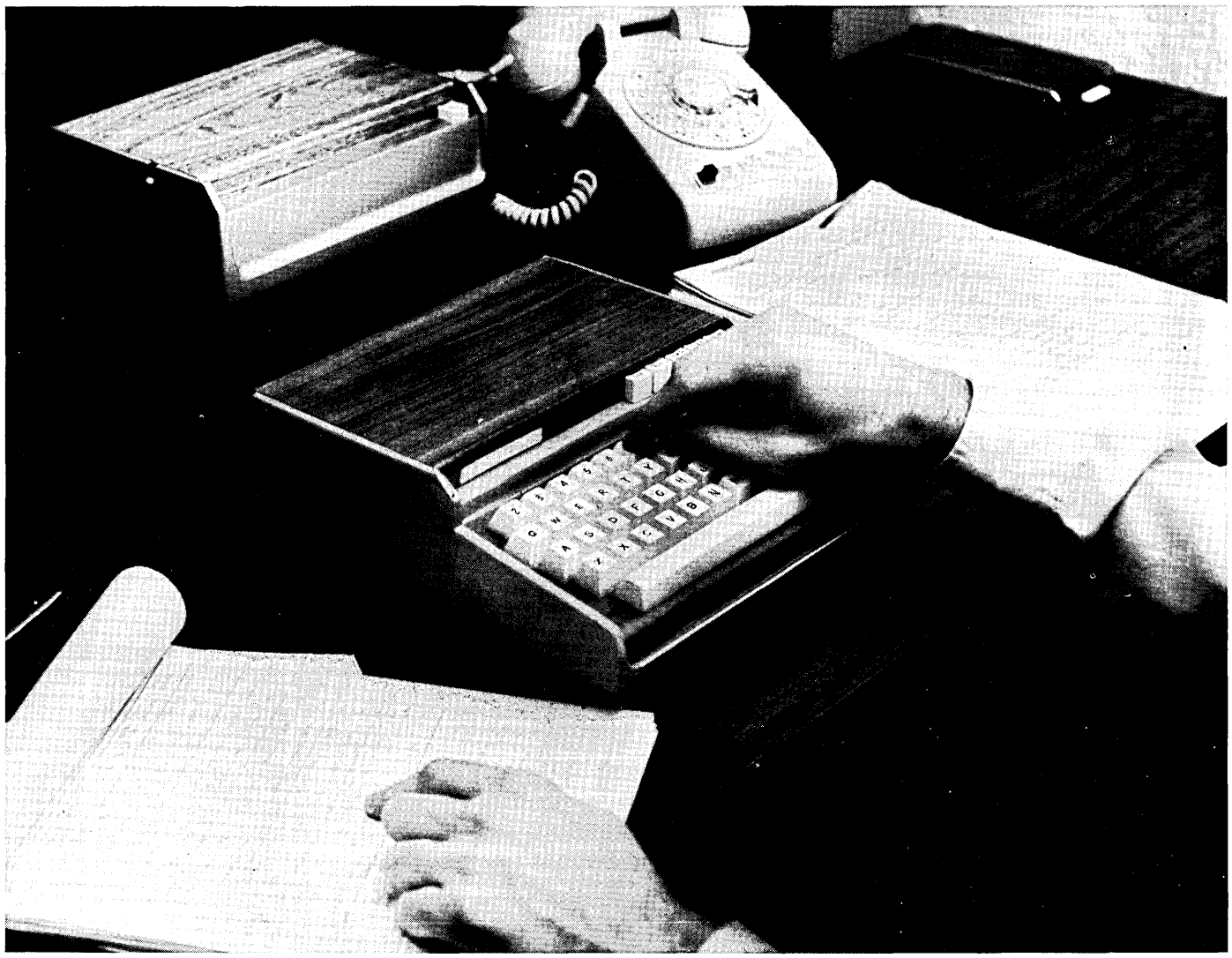
While at formation all members of a task team are created equal, due to varied traits of strength and intelligence they do not, however, during the life span of the group remain that way. Feasibly, a group participant other than the manager may psychologically outpace the others.
ANDREI GLASBERG
Kenosha, Wisconsin

Adverse Anthony

Sir:
Things are not quite as simple as Anthony Amort thinks (Oct. 15, p. 11).

Whenever performing hexadecimal arithmetic I enunciate able, baker, charley, etc., because the other way I frequently find myself saying A and writing 8. Apparently, my internal computer has a look-ahead feature, which assumes that the sound A will be followed by T, since no other number starts with this sound.

Reprogramming this internal computer can be done only heuristically; i.e., with lots and lots of practice. But since I have more important problems to worry about I stick with able, baker, charley, and the rest of them.
WALTER J. SAMEK
Windsor, Connecticut ■



keyed for success

Introducing MSI's Source 2002 Portable Alphanumeric Terminal. All eight pounds of it.

Designed for use at the source data entry location, the Source 2002 is low cost, lightweight, and self-powered. It simplifies and speeds recording and transmitting of aplhanumeric data, relieves "in-put bottlenecks," and eliminates slow, costly intermediate data preparation steps---such as key-punching, key-taping, and transcribing. Computer files can thus be updated, and reports printed in minutes or hours, instead of days or weeks.

Smaller than an office typewriter, the 2002's simplified controls make it easier to use. Data is entered on the alphanumeric keyboard, recorded on a magnetic tape cassette, and transmitted at 40 or 60 characters per second over common voice-grade telephone lines direct to the receiver. Off-line transmission provides greater flexibility at less cost.

Completely portable, the 2002 operates on its own self-contained, re-chargeable batteries, or may be plugged into any wall outlet. Options include attache case model; strip printer; two-way communications; separate ten-key adder keyboard; and on-line capability.

If your problem is fast, accurate, low cost alphanumeric data recording and transmission, MSI Data Corporation has an eight-pound solution.

Gentlemen: I am interested in learning more about MSI's Source 2002.

Name _____

Address _____

City _____

State _____ Zip _____

Company _____

MSI™ DATA CORPORATION

Department D12
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Montclair, Calif. 91763
(714) 626-2451

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We took a hard look at the needs of the OEM market before we designed the MODEL ONE.

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We knew performance was vital, so we designed it with the specifications you need. Like:

49 instructions, 8 and 16 bits long, with conditional skips and 1 to 2 usec execution time

8 hardware priority interrupt lines

4 usec interrupt response

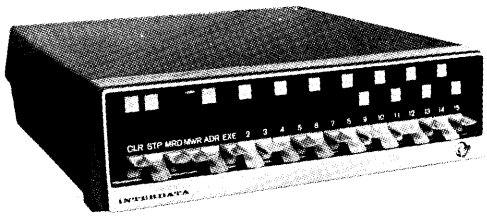
Direct Memory Access

Read Only Memory Modules

Pulsed or request response I/O

As well as a complete set of peripherals, including a dual tape cassette, mini disc, I/O modules and a digital multiplexor to handle thousands of inputs and outputs.

If you're looking hard at control computers, take a hard look at us, we're in volume production right now. Interdata, 2 Crescent Place, Oceanport, N.J. 07757, 201-229-4040.



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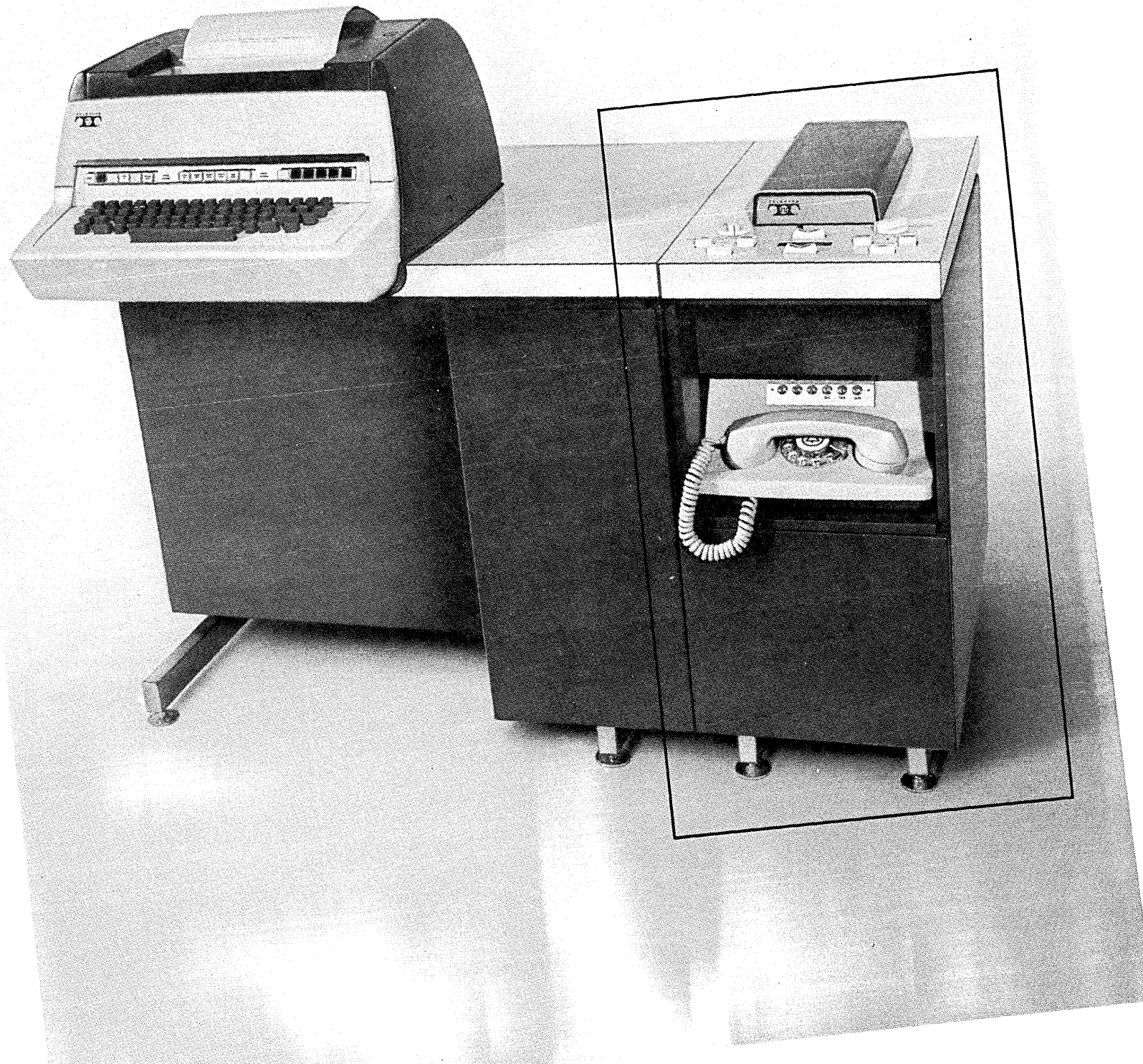
The Forthcoming Generation—*Now!*

CIRCLE 71 ON READER CARD



If your office needs to take or send information up to 1200 words per minute, we have a way.

Our Dataspeed® Magnetic Tape Terminal.

It bridges the gap between low-speed keyboard preparation and high-speed on-line data transmission.

At the same time it reduces the cost of data transmission over regular telephone lines.

The data that is sent and received is recorded on a compact cartridge that has a capacity for 150,000 characters. And the tape is reusable once the information on it is no longer needed.

Besides communicating at high speeds, the terminal has a Forward/Reverse mechanism that can search for specific data on the tape at a rate of 4,000 characters per second.

And time-consuming correction procedures are cut to a minimum since individual lines or characters can be easily located and corrected within a message.

The terminal can be adjusted to answer calls automatically, too. Transmission can be sent and received over regular telephone lines (Data-Phone® service) or private line service.

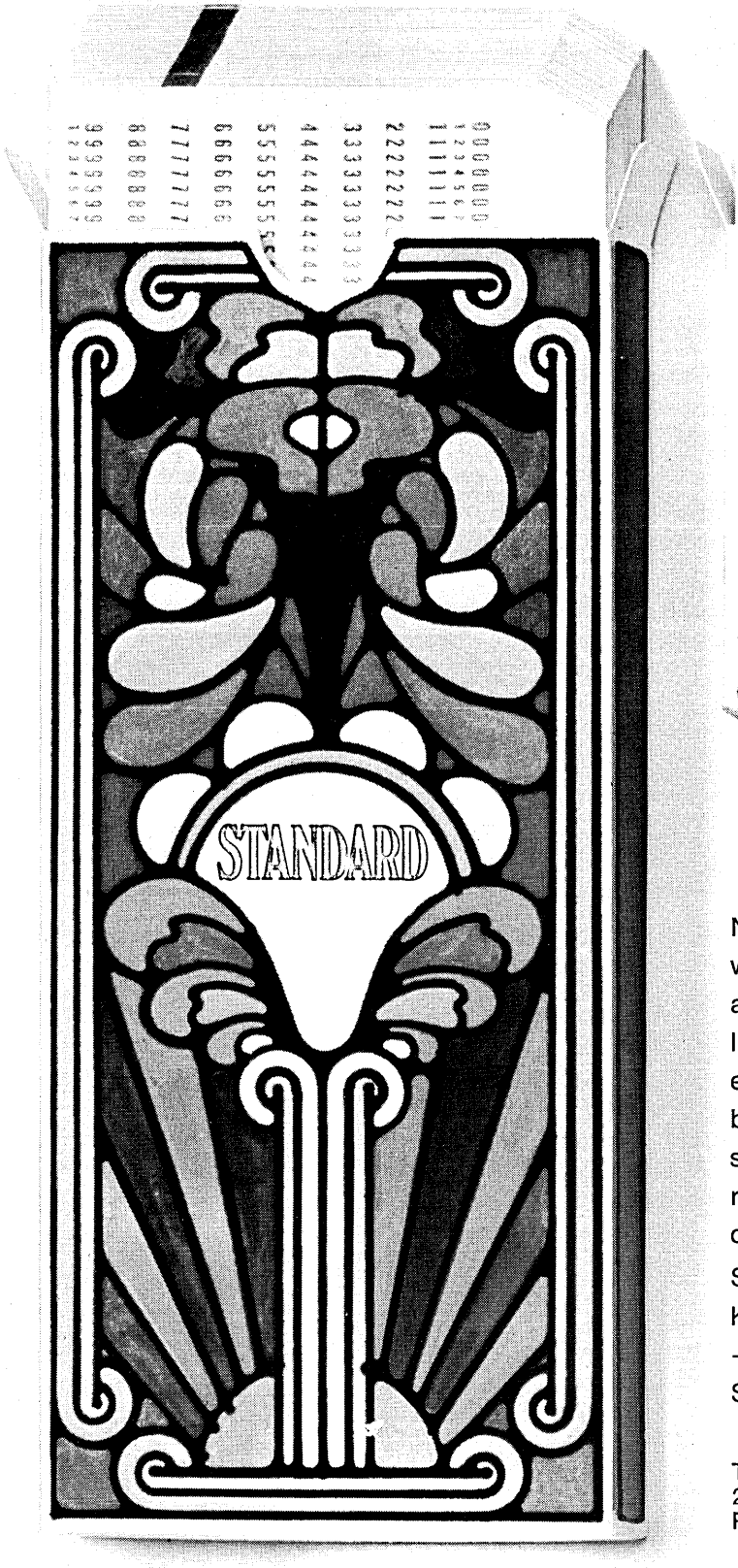
Often at low-cost after-hour rates.

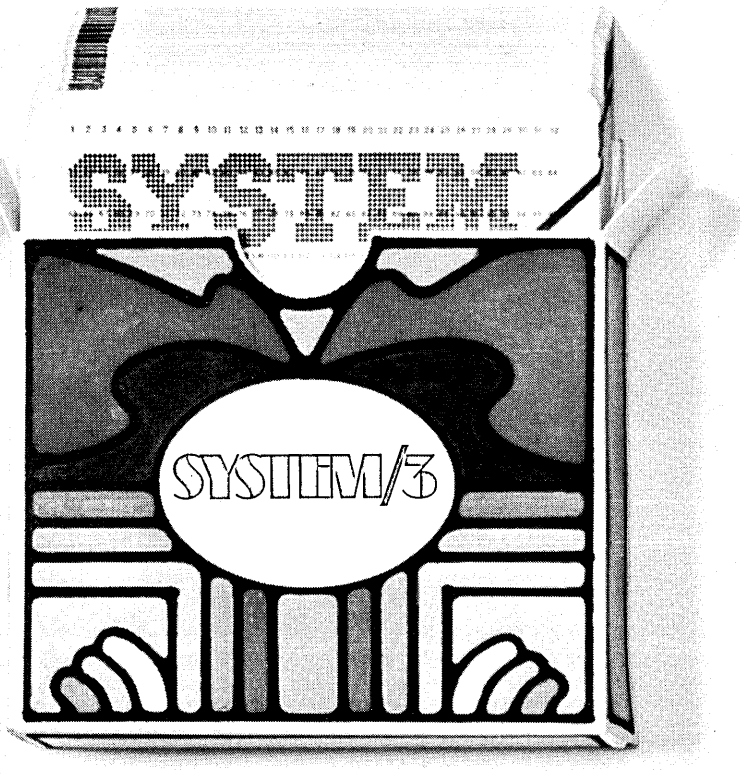
Call your local Bell Company Communications Consultant for information on how our Magnetic Tape Terminal can be implemented within your existing system without major redesign.

The American Telephone and Telegraph Company and your local Bell Company keep working to improve telephone communications.

This time by helping you communicate at speeds up to 1200 words per minute.

WE DON'T CARE
WHICH DECK YOU USE





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CIRCLE 53 ON READER CARD

LOOK AHEAD

AFIPS OK'S PROFESSIONAL CERTIFICATION STUDIES

AFIPS is still "studying" how and when it can implement a national program to certify computer professionals, although one has been offered to its executive committee for implementation in January of '72. During its meeting last month at the FJCC in Houston, the committee approved the plan but rejected the implementation date. At issue is the question of who should be certified—everyone, or only those performing work related to the well-being or safety of the public.

RCA FIGURES TO FIGURE

RCA doesn't claim overall dominance among the dwarfs, but it says it was close to tops in domestic shipments in 1970, with over 7% of the total. Computer chiefs there are happy with their $100-plus million in orders for the new series. One-third of that is new accounts, and 85% of those are IBM replacements; RCA is negotiating several guaranteed conversion contracts, with 360/DOS users among them.

Virtual memory systems (models 3 and 7) account for 40% of the new series' sales, and in '71, when RCA says it will capture at least 7½% of the market, virtual systems will account for 30-35%. Depending on how you look at it, RCA should have 2-3 years to market virtual systems without the competition—or blessing—of IBM, which has fluctuating plans for VM.

CSC DELAYING SPENDING ON INFONET PROJECT

Computer Sciences Corp. has yet to acquire the six Univac 1108s it said it would buy this year to keep the buildup of its Information Network (Infonet) time-sharing network on schedule. The company has promised Infonet will be operating profitably in Feb., 1972. Probable cause of the delay: CSC's difficulties in working out a $30-million refinancing package with a group of banks. It had expected the plan to be completed in late August. The plan also would have converted a $17.5 million short-term note to Bank of America into long term; but it's learned the bank has been renewing the note on a month-to-month basis until CSC got the new financing.

WIMMIX AGAIN STIRS BATTLE OVER IBM USE

A hot fight is raging behind the scenes at DOD regarding definition of the Wimmix second standard. Reportedly, DDR&E wants Deputy Defense Secretary Packard to explicitly list the second standard sites and forbid replacement of the related 360s with 370s on a sole-source basis. Non-IBMers say these curbs don't go far enough. They fear that a number of access protection features called for in the Wimmix update spec will be added to existing IBM systems on a sole-source contract basis. Such a contract, by repaying IBM's development costs, would enable Armonk to reduce the price of its Wimmix bid. Non-IBMers would be at a disadvantage, since their bid prices will have to reflect the cost of developing security protection software.

Non-IBMers see another erosion of their competitive position in current Army-Navy plans to purchase leased 360/30s and 40s being used at intelligence sites. They argue that, under the rules, purchases are OK only when buying is the most cost-effective option. Since these sites will have to

interface with the Wimmix system, the critics say, it's impossible, now, to determine whether purchase is really best. Conceivably, if a non-IBMer wins the Wimmix buy, it will be more cost-effective to replace the intelligence systems with non-IBM gear.

TIME-SHARING: ITN EXITS AND MATRIX MOVES IN

Losing up to $450K a month at one point this summer, two-year-old International Telecomputer Network, Inc., of Bethesda, Md., closed down in November and returned its two GE 615s to Honeywell Information Systems. Picking up ITN's 100 customers and thus getting into the time-sharing business in 11 states, is Matrix Corp., the GE 635-based El Segundo, Calif., service bureau. ITN's monthly revenues were about $50K at the time of the arrangement. Matrix, itself in serious financial difficulties this summer and fall, apparently has reached an arrangement with creditors and, we hear, may even be operating in the black as the year closes.

HONEYWELL AIMS BIG SELL AT GE CUSTOMERS

Large system sales to GE customers may have dried up considerably because of the uncertainty caused by the merger with Honeywell, but HISI is now reported to be selling aggressively to the once-hesitant GE customers. Meanwhile, sales of HISI's new model 115 are high: Honeywell has received more than 400 orders for the small system and is installing them within 90 days. Furthermore, the 115s are selling in larger configurations than expected—about $3K monthly rental on the average.

CIPHER DATA IN BLACK, THINKS IT'S BEAUTIFUL

Another company effecting a turnaround toward profit during the current, unwelcome recession is Cipher Data Products, San Diego-based manufacturer of mag tape drives and cassette recorders, whose sales have reached $1½ million this year, with expectations of $2½ million in 1971. Under new president Bill Otterson, former marketing vp at Standard Computer, the two-year-old firm has gone into the black by trimming 40% of personnel, eliminating all personal secretary and trainee positions, and even taking the Bigelow off Otterson's office floor.

The firm will introduce a two-track read-after-write cassette recorder this month and will use new capital supplied by Sutter Hill Ventures, San Francisco, to expand its IBM-compatible line of 7- and 9-track recorders and read-only models for COM.

RUMORS AND RAW RANDOM DATA

Despite the fact that IBM has had a rough sales year (August and September were the worst months ever), the 370 sales are ahead of forecast, whatever that was. Since the salesmen generally don't expect to meet quota for 1970 anyway, they are deferring taking commission credit for some orders until '71 -- although the customer is being put on the delivery schedule now...Univac is studying emulation of IBM systems on its new 1110 "very hard," but we're not likely to see anything in 1971...The Computer Peripheral Manufacturers Association has seven new members lined up, but Richard Caveney, its new full-time general, isn't saying what the total is. The association's big draw is its plan to battle IBM efforts to unplug the compatibles...Philips NV has a line of four computers under development going from the smallest mini to a medium-scale, general-purpose system.

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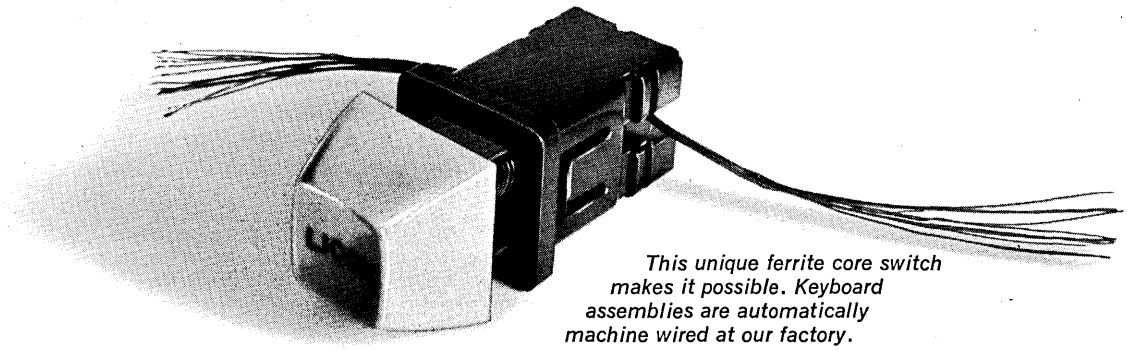

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CIRCLE 24 ON READER CARD

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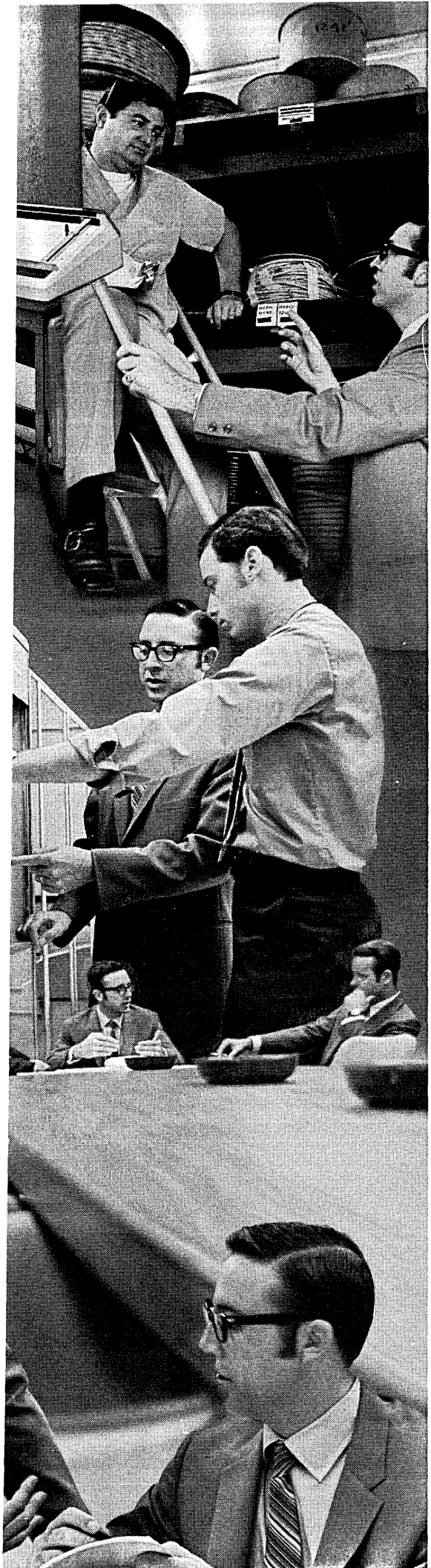

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DIGITAL COMPUTERS

CIRCLE 22 ON READER CARD

What's REALLY going on in all those slim, trim boxes?

Needed: A Measure

Civilization did not begin in earnest until man invented a measuring stick. In order to make progress, man has needed measures of what he is doing. These have ranged from the woodsman's blaze on trees as he went through the forest in order to know where he's been, to simple measuring sticks, to the compass to point his way generally through the unknown, to Johansen blocks for precise mechanical measurements, and to atomic clocks for the most precise measurement of time.

Man's measures have started from a vague understanding that there is some important effect around him that needs to be characterized in order for him to do something more effectively. Simple measures are a big help at first—the length of the king's foot, or a crude compass to point the general direction.

Numbers have to be used even with these crude measures to make them meaningful. No matter the absolute length of the king's foot; as long as it stays the same, everyone can use multiples of it.

The problem with computers today is the primeval problem of recognizing their important characteristics which can be represented numerically. Real progress in the computer art can only be made when it is known what it is that is significant about computer behavior, numbers assigned to these effects, and progress measured using these numbers.

Computer design is in the stage of the early forest dwellers; distance through the forest can be measured by the length of the king's foot—namely, clock speed of the computer. Clock speed measures a specific machine's progress compared to itself—the faster its own clock (or foot), the faster it goes (through the forest). But what characterizes this forest, and where is it?

The problem is how to analyze and predict the work that a computer will be able to do. Typical questions posed are:

How many terminals doing what kind of work and providing what response time with specified work loads can a computer handle?

How big a computer is required to handle any specified work load?

What is the extra cost and small-problem performance degradation introduced by an exchange in an internal exchange-oriented system?

How can more work per day be performed by an existing computer and its available crew of programmers and operators?

Today, the answers to such questions range from guesses ("Ask the salesman"), to simple inferences ("What's its add time?"), to simulations and finally benchmarks. The only way to answer these questions is to program the problems of interest and run them. Such exhaustive benchmarks are expensive and time consuming and they provide little real knowledge that's extrapolatable to other computers or different problems.

The basic need is for a "Theory of Computer Performance." In order to develop such a theory, two kinds of information are needed: Knowledge about the structure of programs during execution, and knowledge about the response of computers to these program structures.

Today, the desire for and the knowledge necessary to develop such a theory are, at best, only rudimentary. Especially lacking is knowledge about the structure of programs.

The need for a theory of computer performance is substantial. A sizable commercial industry has been built around machines which do useful work; but not only is the performance of these machines not predictable, there exist proofs that imply that some kinds of today's conventional prediction techniques are doomed to failure. Strachey[1] published a simple proof in 1965 which established that it is not possible to write a program to examine another program and tell, in every case, whether this latter program will terminate when it is run. If one cannot tell whether a program will terminate, how can one write a simulator to predict the performance of that program?

Strachey's proof is simple and interesting:

"Suppose T[R] is a Boolean function taking a routine (or program) R with no formal or free vari-

1. Strachey, C., "An Impossible Program" (Letter to the Editor), **Computer Journal**, Vol. 7, No. 4, p. 313, Jan. 1965.

ables as its argument and that for all R, T[R] = True if R terminates if run and that T[R] = False if R does not terminate. Consider the routine P defined as follows:

```
rec routine P
    § L: if T[P] go to L
         Return §
```

If T[P] = True, the routine P will loop, and it will only terminate if T[P] = False. In each case T[P] has exactly the wrong value, and this contradiction shows that the function T cannot exist."

A basic approach to avoid writing programs to analyze program performance might be to identify the information work that is done by a program as an integral part of a careful study of performance measures. The proposed theory of computer performance might then be based on how effective various program structures are in performing information work.

Today, lacking a theory of computer performance, the four parameters that are generally found useful in analyzing computer performance are capacity, throughput, raw speed, and ease of use.

Capacity is the total information work executable per unit with a balanced work load. A balanced work load is that set of tasks which fully utilize all of the separately accessible resources of a computer system. Such a work load might be imaginary.

...some kinds of today's conventional prediction techniques are doomed to failure.

Throughput is the number of useful jobs run per unit time. It might be considered to be the double integral:

$$\int\int (\text{Ease of Use})\ (\%\ \text{Capacity Used})\ d\ (\text{job})\ dt$$

Raw speed is the actual speed of performance of any part of a computer; clock speeds, add rates, memory speeds are typical examples.

Ease of use is the parameter that describes:

1. The effort and time required to prepare a problem for solution by a computer, and
2. The effort required to operate the computer and its peripherals.

These four performance parameters are used in four different ways which form the four classes of measures: design measures, purchasing-sales measures, configuration measures, and operating measures.

Class I—Design Measures are needed by system and subsystem designers to evaluate the trade-offs involved in choosing one structure from the many different structures possible.

Meaningful design measures generally do not exist. Creation of design measures needs to be done in parallel with the conception of new designs. Most system designs are sold and accepted based on the convictions and "powerful intuitions" of their inventors. But the performance inadequacies that have been discovered after major systems have been sold and installed should lead to the conclusion that design measures are needed covering all four performance parameters.

Class II—Purchasing-Sales Measures have been developed and used widely. Customers and salesmen have found they need quantitative measures for comparative selection and competitive sales. Present methods represent the best attempts to characterize and compare systems in a commercial ("non-scientific") sense. Adams' charts, instruction mixes, and benchmarks are the techniques used for these measures. These techniques represent three levels of escalating effort to relate raw speed to throughput. Ease of use is usually considered in existing evaluations as a feature which might be available from certain vendors. Capacity is difficult to predict.

Class III—Configuration Measures are typical of those needed by users in deciding how many of what are actually required to do their job once they have decided on a given system.

Class IV—Operating Measures are those needed by the computer center manager who has an existing set of hardware and software, and who needs to optimize his system's performance against a known work load. Hardware monitors have been proposed and used in this area; software monitors and statistical studies are being run; and progress is being made in developing performance sensitivity criteria.

The first serious attempt to provide a formal basis for comparing computers was a listing of the various characteristics of every computer published by Adams Associates. This listing has been called an Adams chart; it is still published by Keydata and typifies a good simple portrayal of the classical features of computers manufactured worldwide.

The limitation of Adams' charts is the inference that performance can be meaningfully predicted from these classic features. It has been well established that the use of the raw speed parameters of clock speed, arithmetic speed, memory speed, word size, or I/O rate can be misleading in predicting comparative performance between different systems. Over the years, many people have taken different combinations of these classic features and have used these combinations as figures of merit to infer performance measures.

Any listing of simple features fails to incorporate the differences that each system designer included to make his system better. The power of each instruction set combined with each system's architecture is not indicated; the effectivity of system software is not considered; and factors for evaluating multipro-

for Measure

by R. R. Johnson

gramming or multiprocessing capability are absent.

The first serious attempt to provide a better indicator of computer performance than Adams' charts was the Auerbach Reports. They list the actual performance of computer systems on a set of standard small problems. Each problem is programmed by an expert on that machine for a variety of standard configurations of memory and peripheral equipment. The Auerbach Reports show the amount of memory required, the amount of code, and good detail.

The limitation of Auerbach analyses is the implication that performance of these standard problems is indicative of performance of the actual problems of a real user, and that small-problem performance is indicative of large system capacity or large-problem performance.

All instruction mixes, of which the Auerbach standard problems are certainly one of the best documented and most widely used examples, suffer from the limitation that the actual mix in use may or may not correspond to that of the "standard" mix. Further, none of the instruction mixes yet devised provide a reliable indication of full load behavior of computer systems. This is an especially important shortcoming when attempting to predict the performance of multiprogramming or multiprocessing systems. The full load performance of such systems does not appear to be proportional to its small-problem performance.

Simple instruction mixes, such as the Gibson mix, have been widely used over the years because they are simple, easy to use, and offer the statistical comfort that if it is risky to deduce a performance measure from one simple parameter, then it is less risky to imply performance from a set of simple parameters.

The time required for a given computer to execute each instruction is multiplied by the weighting function considered typical of data processing, and a total

. . . none of the instruction mixes yet devised provide a reliable indication of full load behavior . . .

computed, which is the weighted Gibson instruction time. Machine performances are then usually listed with the reciprocal of this number: the number of weighted instructions per second.

A more sophisticated version of the instruction mix approach to the analysis of system performance uses "kernels." A kernel is a complete nucleus problem; meaningful kernel problems are selected according to the type of application of interest. The execution time of a set of such nucleus problems is assumed indicative of the system's execution of the whole application. Typical kernels are inverting a matrix, evaluating a polynomial, calculating a social security tax, or formatting a line of print. When kernels are programmed by experts on their respective machines and the actual software of that system is used, the results can be good indicators of that small-problem behavior of that system.

The only reliable and accurate measurement technique that has been developed to completely analyze system performance is to actually code and run complete programs selected from those that are to be run in the actual application. Such selected programs are called "benchmarks." As long as benchmarks are run in the large and small mixes expected in the actual operation, a good indication can be obtained of both the large and small problem behavior of that system.

The limitation of the benchmark approach is that it is useful primarily as a Class II (Purchasing-Sales) measure for marketing purposes. It takes a large effort to program benchmarks and to prepare realistic data. Benchmark performance can be misleading in terms of the capacity of a system unless complete benchmarks are selected to place a capacity load on that

Benchmark performance can be misleading in terms of the capacity of a system . . .

system. Performance predictions for other problems not benchmarked can be risky extrapolations.

Next, the three principal techniques that use computers for studying system performance are simulation, monitoring, and analysis.

Simulation is a powerful tool applicable to the study of alternative paper designs and/or actual systems. It involves building information models of the system structures to be studied, and then exercising these models with assumed models of programs and data. The models and the programs used to exercise them can be written using any programming technique, but the most effective programming technique is to use one of the simulation languages developed for various specific purposes. Typical languages are SIMSCRIPT, GPSS, and SIMULA.

One of the commercial simulation tools developed for performance evaluation is SCERT. This is a modeling and simulation tool accompanied by a large library of factors describing most production computers. SCERT, developed by Comress Inc., appears to provide good results for serial system architecture when the programs to be run are carefully formulated for each computer studied. It is not yet demonstrated accurate for system architectures employing dynamic resource allocation for concurrent processing, such as used in B5500.

Simulation provides insights, the accuracy of which improves as one's understanding of the actual process and structure to be modeled improves. The validity of any simulation is determined by how characteristically accurate the data and the model are of the real system and its actual application. Unfortunately, most simulation results do not lend themselves to parametric study for optimization by analytical means. Test cases and trends generally have to be determined by repeated runs through the model.

Simulation is a powerful, useful, used, and dangerous tool. The danger resides in overconfidence in the representativeness of the method. The results of simulation are very sensitive to the assumptions used to approximate the model and the data to exercise the model. Small omissions or distortions in either can

produce large discrepancies between performance of the model and that of the real system. The limitations of simulation are primarily the difficulty of determining validity of the model and of the data. A secondary limitation is the large effort, cost, and time required to build adequately detailed models, to collect representative data, and then to run a sufficient number of trials with this data.

Monitoring is the second area of computer aided measurement methods. It is the collection of the statistics and actual performance parameters of an operating, live system. Monitors are built within programs and within systems, and they are also built externally by separate monitoring software or hardware.

One problem with monitoring is in collecting data representative of the dynamic performance of the system such that it is typical of the full range of the intended usage of the system. This collection of performance data needs to be done without disturbing the performance of the system being monitored, which is difficult. Another problem is assimilating and interpreting the results. It is easy to collect massive amounts of confusing data unless one establishes monitoring experiments with clear hypotheses in mind.

An interesting graphical monitor is described by Stang and Southgate.[2] They have used a multichannel strip chart recorder to collect a history of dynamic usage factors of subsystem elements over a wide variety of operations. This appears to be a simple and effective way to detect and to convey what has happened inside the complex structure of a modern computer system.

It is easy to collect massive amounts of confusing data unless one establishes monitoring experiments with clear hypotheses in mind.

The graphic display monitor developed for Multics is a second kind of monitor intended to give a current snapshot picture of the system's performance and some historical or collected averages.[3] Most large systems today provide a plan to provide at least part of this kind of capability to the operator for observing the instantaneous status of his system. Typical items monitored are core utilization, channel and paging traffic, and various user statistics. Typically displayable are this dynamic raw data and the running results of statistical analyses in both alphanumeric and graphic form.

Analysis is the term used here for computer aided studies of system performance in which an analysis is made of the actual performance of systems in operation. This analysis is to determine, for example, individual instruction usage, overlap and blocking among subsystems, utilization of subsystems, traffic patterns between subsystems, data structures, and record activity. Obtaining this information requires careful use of both hardware and software monitors.

Finally, *numerical scoring methods* are used to weight selected computer and application parameters and compute figures of merit. This method is of primary value as a Class II—Sales Measure used to aid an individual selecting a computer.

One figure of merit, and a good base of historical data on 225 computers and an interesting method of trend calculations is presented by Knight.[4,5] His figure of merit for computer power (P) is based on memory available (M), the internal operating time in microseconds required to perform 10^6 operations (t_c), and the non-overlapped I/O time in microseconds for 10^6 operations ($t_{I/O}$). Thus his figure of merit for computer power is:

$$P = \frac{M}{t_c + t_{I/O}} \times 10^{12}$$

Using this measure, Knight concluded that: (1) Grosch's law was statistically valid for the 225 computers introduced in 1944 to 1962 and continued to hold for the 93 computers introduced in 1963 to 1967, and (2) performance per dollar increased 81% per year for scientific computation and 87% per year for commercial computation between 1950 and 1962. For 1963 through 1966, scientific performance per dollar rose at 115% per year and commercial at 160% per year.

A different figure of merit has been proposed by L. G. Roberts and described at the Advanced Research Projects Agency in 1969. This can be called Roberts' Linear Hypothesis. Roberts' study was based on benchmark programs run on a variety of systems. He proposed a simple measure that correlated well with his benchmark results: Throughput to be measured by megabits/sec (MBS) flowing into the cpu's. For conventional machines, MBS is their instruction rate times their data word length. For an ensemble of 29 computers, throughput was exactly proportional to cost. Thus Roberts came to the conclusion that there is a *linear* optimal relationship between throughput and cost at any given time.

A generalized form for numerical scoring for using many different decision criteria and applications to evaluate several different computers is called an "evaluation data matrix." This matrix is used to list the several performance parameters used as decision criteria along one axis, and different applications along a second axis. The performance for each of the several different computers is shown along the third axis. Relative values or weights can be assigned to each application and decision criterion to reach a final figure of merit.

Moving on now from physical measurement methods, three forms of analysis applied to the study of computer throughput are: statistical analysis, graphical analysis, and algorithmic analysis.

Statistical analysis is the theoretical study of the performance of computers modeled by mathematically tractable equations and subjected to statistically defined workloads. Graphical analysis is the study of

2. Stang, Harold, & Southgate, Peter, "Performance Evaluation of Third Generation Computing Systems," **Datamation**, Vol. 15, pp. 181-190, Nov. 1969.
3. Grochow, J., "Measuring & Monitoring a Multiple Access Computer System," **Proc. FJCC**, pp. 379-386, 1969.
4. Knight, Kenneth E., "Changes in Computer Performance," **Datamation**, Vol. 12, pp. 40-49, 54, Sept. 1966.
5. Knight, Kenneth E., "Evolving Computer Performance 1963-67," **Datamation**, Vol. 14, pp. 31-35, Jan. 1968.

computer performance where a graph is used to represent sequences of computer operations while executing programs. Algorithmic analysis is the study of the performance of computers modeled by mathematically tractable equations and subjected to algorithmically defined workloads.

Statistical analysis. A substantial amount of research is being applied in this direction. A good example of the method and of the kind of conclusions which can be drawn from this statistical approach is the study of Coffman et al.[6] Two kinds of computer structures are analyzed, a pure time-sharing system and a round-robin system. These two structures are each subjected to an input workload with a stream of new tasks each defined to start at a statistically defined rate (a Poisson input distribution). The time taken by the computer to do each new task is also defined to have a Poisson distribution. The throughput of each of the two classes of computer structures is then derived to obtain the statistical distributions of the waiting times required for the input workloads to be processed.

The time-sharing model shares its fixed capacity equally among all tasks arriving in the input stream. There is no waiting line, with each new task arriving receiving continuous service from the processor at an instantaneous rate proportional to the inverse of the number of tasks present at that time.

The round-robin model allocates its fixed capacity to each task in the ordered queue for a fixed service time quantum (q). Tasks remaining unfinished after q seconds are returned to the end of the queue for future servicing.

Some of the conclusions drawn by the authors from their analyses were:

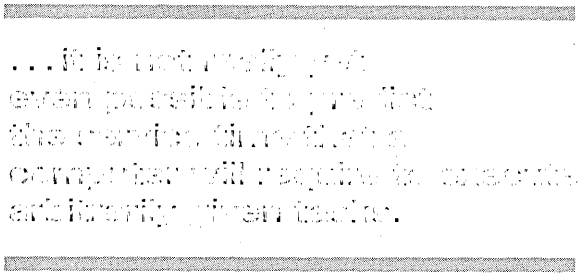
1. The mean waiting time in the time-sharing model varies linearly with the service time per task.
2. Mean waiting times for the time-sharing model are less than for the round-robin model whenever the service time per task is less than the mean arrival rate.
3. The variance of waiting times in the time-sharing model is potentially very much larger than in the round-robin model.

The importance of this analytical method is that parametric studies may be made to determine the importance of and relationships between the variables. Limitations include the facts that the workloads might not be the exponential functions assumed to facilitate the analysis, and that it is not really yet even possible to predict the service time that a computer will require to execute arbitrarily given tasks.

Graphical analysis. Throughput analyses can be made by decomposing the set of programs to be run concurrently on a computer into those programs segments which first can be processed sequentially, and then secondly arranging those segments with other segments which can be processed concurrently. The basic type of model of this set of computational tasks is a *directed graph* in which vertices represent computational tasks, and directed arcs represent logical interconnection (data dependency or data transmission) between vertices.

Another way to think of this is for an arc to represent a condition or state of the computer (determined by its present data) and for a vertex to represent the transition between conditions. This transition is typically a computational task. Transitions (vertices) are controlled by their input conditions (arcs) and produce new output conditions (arcs).

Two types of input control for transitions (vertices) are generally considered: *conjunctive* in which



all input conditions must be satisfied, and *disjunctive* in which any one of its input conditions will initiate the transition.

Similarly, transition output types generally studied are conjunctive and disjunctive. Conjunctive outputs occur simultaneously, and disjunctive output conditions occur exclusively based on conditional or branching decisions made at the transition vertex.

The purpose of these graphs is to facilitate, first, the calculation of the execution time of the program(s) modeled; and second, to facilitate restructuring of the program(s) to improve execution speeds. Martin and Estrin[7] provide an excellent summary of graph theory and its application to throughput analyses.

An example of the use of directed graphs to represent the behavior of automata is given by Petri.[8] Petri's study calls these graphs "Transition Networks" and employs them to describe a wide variety of processes.

Traversing the Petri net generates a history of event occurrences and system conditions. This dynamic history can be depicted by an "occurrence graph" which shows the sequence of events and conditions encountered.

The term "occurrence graph" and the technology of use and interpretation of these graphs in conjunction with Petri nets is given by Anatol Holt.[9]

Any Petri net can describe a wide variety of other systems. The relationships between the conditions which can occur simultaneously will differ with the interpretation of the system. This ability of a Petri net to depict concurrent conditions is important. The occurrence graph record is ambiguous about the relative time order of events which are not ordered occurrences as derived from the Petri net. Each possible sequence of events yields a different condition sequence history. Successively more complicated net and graph structures have been developed by Holt and others to depict generalized system behavior concisely.

6. Coffman, E. G., Muntz, R. R., & Trotter, H., "Waiting Time Distributions for Processor Sharing Systems," **JACM**, Vol. 17, No. 1, pp. 123-130, Jan. 1970.
7. Martin, D. F., & Estrin, G., "Path Length Computations on Graph Models of Computations," **IEEE Transactions on Computers**, Vol. C18, No. 6, pp. 530-536, June 1969.
8. Petri, C. A., "Kommunikation mit Automaten," **Schriften des Rheinsch—Westfalischen Institutes fur Instrumentelle Mathematik**, an der Universitat Bonn, Hft. 2, Bonn, 1962.
9. Holt, A., **"Information System Theory Project,"** Clearinghouse, AD 676-972, Sept. 1968.

These network structures contain the essence of the information content in systems. It appears that these techniques offer real potential for the development of basic measures about system behavior. For example, the "information work" done in traversing a Petri net appears to occur at the event transitions, and the resources required appear as the conditions.

Algorithmic analysis. Analytic or algorithmic representations of computer throughput have been attempted for specific architectures. One interesting result is that of Belady and Kuehner.[10] They analyzed the behavior of programs under memory saturation (requested memory exceeding available) and considered processor efficiency, cost of storage, and execution times. Their concept of value per unit cost is used to demonstrate that memory allocation strategies which attempt to restrict the memory allocated to large tasks (in order to reduce the impact of such large tasks on system throughput) will fail unless the total amount of memory available is much greater than that normally required.

Another interesting analytical approach to describing the behavior of paged systems is by Fenichel and Grossman.[11] They measure performance by "completed interactions per unit time," the same measure proposed by Gaver.[12]

A third kind of approach to the problem of analytically describing the behavior of computers is by Reigel.[13] He analyzed the exploitation of parallelism both within and among programs. Coffman[14] demonstrated that exploiting such parallelism improved waiting times and processor utilization using multiprocessing models.

Although the industry is still in the observe, hypothesize and experiment phases, some understanding has been achieved about parameters significantly influencing throughput. The results are beginning to appear in new software structure[15] and hardware structures[16,17,18] which are evaluated first in the design phase and then subsequently in actual operation using specific performance measurement criteria.

Examples of this understanding to be cited here will consist of results illustrating the following particular aspects of system design: memory utilization, instruction utilization, information content (code compaction), and time-sharing experience.

Memory utilization. The extensive literature on the studies of the effects of paging provide a unique insight into this aspect of system design. This is probably the most studied aspect of system performance, perhaps because it seems to be such a problem and/or such a critical thing to control.

A basic difficulty with paging is the frequency with which pages have to be turned. A good paper describing this is Coffman and Varian[19] and their study of the 360/50 at Princeton.

An idea of their frequency of page faulting can be obtained by deriving the number of page faults per page of instructions that were incurred in executing a 37,000 word Snobol program, with a page size of 1,024 (1K) words (Fig. 1).

With four pages (4K words) resident, a page must be turned for every ten instructions executed. If the processor worked at 100,000 instructions per second, this would give a required I/O rate of 2 x 10^7 words/sec just for page turning. This assumes processor utilization for page turning limited it to the 100,000 Snobol instructions/sec and that the paging programs were also resident.

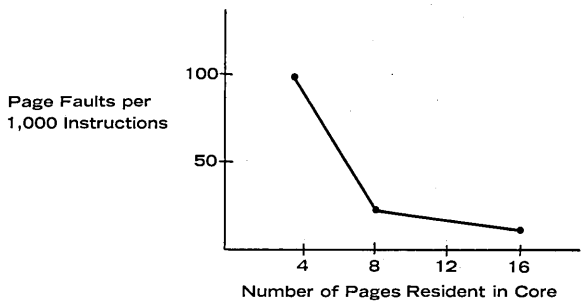


Fig. 1. Belady optimum page replacement algorithm.

Naturally the Coffman/Varian study was concentrated further out on the curve where many pages are resident. This is the only way to reduce the number of requests for new pages and to handle the consequent I/O flow.

The point is: the incidence of page faulting is a significant indicator of performance degradation. This can be due to interference between I/O flows to handle paging needs vs. other I/O, or due to the cpu being idle waiting for new pages. To avoid these effects, system designers place large requirements for resident core for many resident pages.

A second major factor affecting system performance is the amount of main memory available for programs. The throughput reduction is spectacular for paged systems whenever less than the complete program can be resident. The availability of main core memory is probably the greatest single factor governing throughput.

A significant study on the efficiency of utilization of these large amounts of main memory has been done by Brian Randell, now at University of Newcastle.[20] He defines two concepts: external fragmentation as the loss in storage due to gaps between assigned blocks, and internal fragmentation as the loss in storage due to unused memory with assigned blocks of a

10. Belady, L. A., & Kuehner, C., "Dynamic Space Sharing in Computer Systems," **Comm. ACM,** Vol. 12, No. 5, pp. 282-288, May 1969.
11. Fenichel, R., & Grossman, A., "An Analytical Model of Multiprogrammed Computing," **Proc. SJCC,** pp. 717-721, 1969.
12. Gaver, D. P., "Probability Models for Multiprogramming Computer Systems," **Journal ACM,** Vol. 14, No. 3, pp. 423-438, July 1967.
13. Reigel, E. W., "Parallelism Exposure & Exploitation in Digital Computing Systems," Burroughs Report, TR 69-4, (DDC, ECOM-02463-8), p. 259, April 1969.
14. Coffman, E., "Stochastic Models of Multiple and Time Shared Computer Operations," UCLA 66-38, AD 636-976, June 1966.
15. Dijkstra, E. W., "The Structure of the 'THE' Multiprogramming System," **Comm. ACM,** Vol. 11, No. 8, pp. 341-346, May 1968.
16. Belady, L. A., "A Study of Replacement Algorithms for a Virtual Storage Computer," **IBM Systems Journal,** Vol. 5, No. 2, pp. 78-101, 1966.
17. Fine, Jackson, McIssac, "Dynamic Program Behavior Under Paging," **Proc. ACM Conference,** pp. 223-228, 1966.
18. Bell, G., Cady, H., McFarland, H., DeLagi, B., O'Laughlin, J., & Norman, R., "A New Architecture for Minicomputers—the PDP-11," **Proc. SJCC,** pp. 657-675, 1970.
19. Coffman, E., and Varian, L., "Further Experimental Data on Program in a Paging Environment," **Comm. ACM,** Vol. 11, No. 7, pp. 471-474, July 1968.
20. Randell, B., "A Note on Storage Fragmentation and Program Segmentation," **Comm. ACM,** Vol. 12, No. 7, pp. 365-369, July 1969.

fixed size. His conclusions: As the size of such blocks increases, much more memory is lost due to increased internal fragmentation than is gained by decreased external fragmentation. The loss is substantial. In one example, using a 32K-word memory, and a mean request size of 1K words, *lost* memory was:

"Page" Size	External Frag. Loss	Internal Frag. Loss
1 word	11%	0%
1K words	3%	29%

In his simulation study, the variation between these limits was about linear.

The sensitivity of execution speed to availability of main core is indicated by the study of Stanley and Hertel.[21] They analyzed the performance of the 360/75s in use on the real-time Apollo program by means of models constructed using GPSS/360. The study of interest here was made to determine the significance of main store size to one Apollo application program. When the main storage available is 10% less than that required for all load modules, data tables, and subpools, the speed of the system was 40% slower than when available store equals required store. From the 10% point, approximately a linear decrease in speed was observed until at that point at which main store is only half that required by the application program the speed is half that achieved with available store equal to required store. (Fig. 2.)

The impact of such memory losses in multiprogrammed computers (whose objective is to run a mix of programs to fully utilize all parts of the system) or in time-sharing systems is substantial. This loss means programs that can't be entered into the mix, terminals that can't be serviced, or a significant increase in I/O demand to handle the page servicing required from the reduced number of resident pages possible.

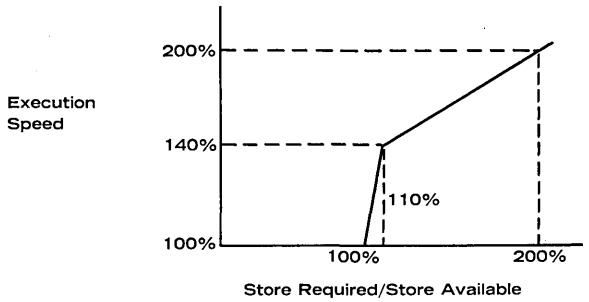


Fig. 2.

A delightful little description of resource utilization is given by Cantrell and Ellison.[22] They observe that it is never advantageous to arbitrarily defer resource utilization (processor, I/O channel, memory, etc.) until a future time if that resource can be used now. Unused resource capability can never be recovered. They comment, "This is like betting a dollar that you already have, on a chance that you may win only that dollar back. You can only lose, or at best break even."

Much of the difficulty encountered when evaluating modern computer systems stems from the difficulty of properly evaluating the benefits of multiprogramming and multiprocessing techniques. Since these techniques were developed to make use of otherwise idle and lost resource capabilities, their effects need to be measured.

The criterion proposed by Cantrell and Ellison to use in planning optimum utilization of all the shared resources in a multiprogrammed system is resource-seconds. The optimum system strategy is that which minimizes the number of resource-seconds required to accomplish a given mix of tasks.

A potential uncertainty arises as to what to consider as idle time. Much of the industry discussion about system overhead sounds as though this were considered "idle" time. For example, time spent in core compaction transfers is not idle; such time is not by itself doing useful application work, but it can have extremely useful benefits on application work done subsequently. The overhead question should be: What is the best way to accomplish the right set of management tasks? The measurement of the total (management plus operations) result is what counts. Overhead management tasks can be wasted effort, or poorly done; but judgments about this, especially made out of context, are risky.

The significance of these four system aspects (faulting, fragmentation, execution speed, and cpu utilization) can be put into perspective by another example from Coffman and Varian.[19] One of the programs they analyzed was a differential equation solver. Their conclusion: For small programs even more substantial portions of the complete program must be resident to achieve reasonable page *residence* times. In an example with a program of about 6,000 words, and with four 1K-word pages resident, the average page residency time was 134.5 instructions. This would correspond to 134.5 μsec page residence with one μsec instructions. If 5 msec is required for page transfers from external drum, then the cpu utilization is only 3%. This assumes the cpu isn't involved in the drum to memory transfer. If the cpu is required for this, its utilization is more. If 10 μsec instructions are used, and 5 msec for page transfers, then cpu utilization is 27%

Consider the problem of increasing the number of terminals which can be serviced from an existing computer. The factor to be optimized is *cost per resource-second* provided by the enhanced design.

Four system configurations are considered, three of which are to expand the power of the basic system to handle terminals. (Fig. 3.)

The basic assumptions used here will be:

Basic Serial System: costs $100,000, serves 4 terminals, provides 3,000 words of memory per terminal, cpu utilization 33%.

Enlarged Memory Serial System: costs $60,000 more than basic, serves 12 terminals, provides 3,000 words of memory per terminal, cpu utilization 100%.

Swapping Disc Serial System: costs $10,000 more than basic, serves 12 terminals, provides 3,000 words per terminal, cpu utilization 50%.

Exchange System with Swapping Disc which allows concurrent transfers between disc and cpu or I/O with memory: costs $13,000 more than basic, serves 12 terminals, provides 3,000 words per terminal, cpu utilization 90%.

While this data is stated as an assumption, in an

21. Stanley, W. I., and Hertel, H. F., "Statics Gathering and Simulation for the Apollo Real Time Operating System," **IBM Systems Journal**, Vol. 9. No. 2, pp. 85-102, 1968.
22. Cantrell, H., and Ellison, A., "Multiprogramming System Performance Measurement & Analysis," **Proc. SJCC**, pp. 213-222, 1968.

actual system these parameters would be derived from the actual costs and performance achievable.

The factor to be optimized is Cost per Resource-Second (C/RS). For the basic serial system, C/RS equals:

$$\frac{\$100{,}000 \text{ for basic system}}{\left(4 \text{ terminals} \times 3{,}000 \frac{\text{words}}{\text{terminal}}\right)\left(\frac{A}{3} \frac{\text{cpu sec}}{\text{available}}\right)}$$

where A = total number of cpu seconds available and distributed over all terminals served for the period of system usage of interest (perhaps a month).

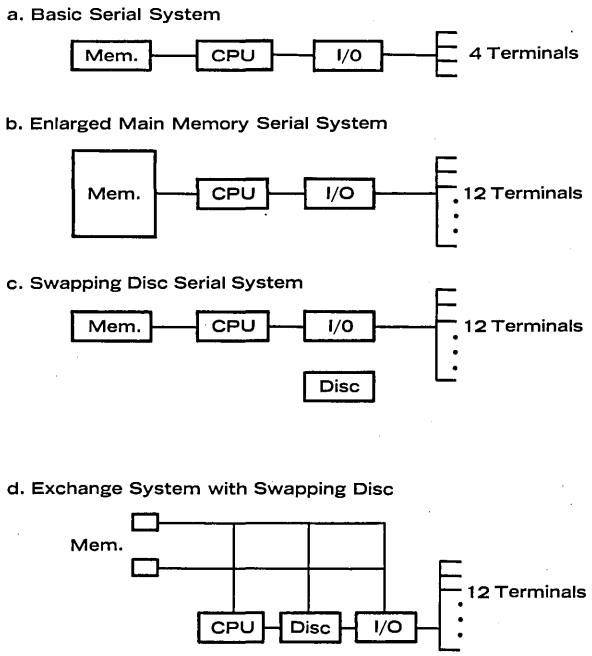


Fig. 3.

Table 1 summarizes price, cost/resource-second, and performance provided.

From this analysis, one can select the system which provides minimum cost per resource-second, or the system with minimal initial cost and nearly minimum cost per resource-second.

System	Price	Cost/Resource-Second	Performance/Terminal
Basic Serial	$110K	25/A	250A
Extended Memory (Serial)	$160K	33/A	250A
Swapping Disc (Serial)	$110K	6.1/A	125A
Swapping Disc (Exchange)	$113K	3.5/A	225A

Table 1.

Instruction utilization. A noticeable effort has been expended in the industry to determine what a program does. One approach to this is to count the number of instructions of different kinds actually used during program execution. In his 1969 lectures at Hyeres, Amdahl reported that IBM had found that:

1. Actually executed instruction frequencies by type are only about 60% of the incidence obtained by hand count of the program itself (especially for FORTRAN). Resource management, editing, and data management (even for scientific FORTRAN programs) constitute the 40% added during actual execution!

2. Branch instructions executed range from 10% to 30% with an average in excess of 20%. More conditional branches are taken than not.

3. Arithmetic operations in large scientific problems actually constitute from 10% to 20% of the mix. These operations are supported by about two-thirds as many loads and stores directly associated with them.

4. Of the remainder, address manipulations, compares, and flag testing appear in descending order of incidence.

5. I/O activity has remained constant over the last 20 years when measured as the ratio:

$$\frac{\text{Bits of I/O}}{\text{Number of cpu Instructions}}$$

and that this ratio is approximately 1!

(Note: This data was probably taken for serial systems of the "basic" kind described in (3) above. If it did not consider exchange-oriented systems, the 1:1 ratio of I/O to cpu instructions could be explained by the architectural limitations of the sampled systems.)

6. I/O record sizes have a mean of approximately 500 bytes.

7. Intrinsic overlap of I/O with processing has been studied for 7090 and 360/50 and shows a potential of at least one-third overlap of I/O with processing.

Information content. Another factor to be evaluated when analyzing the work done by an information processor is the information content of its programs and codes. Stated another way, different system structures require differing amounts of code to represent solutions to the same problems. The challenge is to devise hardware/software structures that achieve the densest, most compact code. This code compaction results in savings in main memory, in file storage memory, in savings in direct execution times, and reductions in transfer times through the I/O busses and across the exchanges in the central system.

Some examples of simple code compaction are available. McKeeman[23] cites a comparison between comparable FORTRAN compilers written for two different, stack oriented, computers. One machine had the "programming flexibility" of many arithemetic and register formats available to the programmer; the second machine had just a simple stack structure with only a simple and consistent format accessible to the

23. McKeeman, W. M., "Language Directed Computer Design," Proc. FJCC, Vol. 31, pp. 413-417, 1967.

programmer. The compiler for the simple stack machine required only one-third the code of the compiler for the multiformat machine for the portions of these compilers related to these functions.

A last perspective on information content of instruction codes is to note the results of attempts to measure the basic information content in a 7094 instruction and in a B5500 instruction. Constantine[24] estimated the information content of a 7094 36-bit instruction as about 7 bits. Bingham and Kaufman[25] computed the information content of the B5500 12-bit syllables to average 8.9 bits/syllable for COBOL programs and 7.6 bits/syllable for ALGOL programs. The significant inefficiency in the 7094 instruction is its large address and displacement fields (15 bits each). If the information to describe algorithms were constant, B5500 programs would then be only one-third to one-fourth the length of comparable 7094 programs.

Time-sharing experience. The pioneering application of time-sharing is at MIT. Project MAC accomplishments and imagination have led to the widespread use of multiaccess computer systems. Time-sharing the central processor is presently the technique used to provide this capability.

The challenge is to devise hardware/software structures that achieve the densest, most compact code.

MIT has two time-sharing systems. The first, CTSS, uses a 7094 central processor and 7750 communications controller, and is of the Basic Serial type system described previously. An excellent report has been written by Scherr[26] describing the statistical characteristics of the users, the performance of the system, and developing a Markov model which reasonably accurately describes the behavior of the system.

The performance of the bigger GE 645 Multics system which was added later at MIT has not been described as extensively in the literature as was that of CTSS. Saltzer and Gintell[27] have described the methodology and techniques employed in measuring Multics, but very little data is published about the results of these measurements.

Significant parameters of system performance have been identified, and practical tools are evolving to measure some factors influencing system performance. Lacking yet is a way to relate the many different and frequently related factors characterizing performance but most significantly still missing is any identification or classification of the "work" that computers are asked to do. Mixes of problems appear to be the only way to characterize the difference between one class of work and another. But the difficulty and danger involved with this is characterized by a quote from the designers of the PDP-11[18]:

"A multi-register computer was proposed. . . . Benchmark programs were coded on each of ten competitive machines, and the object of the design was to propose a machine which gave the best score on the benchmarks. This approach had several falacies:

the proposed machine had no character of its own;

the machine was difficult to program since the multiple registers were assigned to specific functions and had inherent idiosyncrasies to score well on the benchmarks;

the machine did not perform well for programs on the benchmarks;

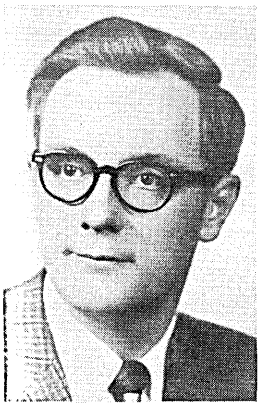
and finally, compilers which took advantage of the machine appeared to be difficult to write.

. . . still missing is any identification or classification of the "work" that computers are asked to do.

Since the competitive machines had been hand coded from a common flowchart rather than separate flowcharts for each machine, the apparent high performance . . . of the proposed computer . . . may have been due to the flowchart organization."

The bottleneck impeding solution of the measures and evaluation problem appears to be the lack of a means to measure the information work done by a computer in executing a computer program without actually building a computer and programming it.

Pending the development of a theory capable of analyzing information work, continued efforts of the kind described in this paper will be necessary to identify and quantify all major factors that significantly affect information system performance. ■



Dr. Johnson is currently vice president-engineering of Burroughs Corp. He has been with Burroughs since 1964, previously serving as director of engineering-commercial data processing systems and equipment and electronic business machines. Prior to this, he was manager of engineering for the GE computer department in Phoenix. He also worked as a research physicist for Hughes Aircraft Co. His BS is from the Univ. of Wisconsin, his ME from Yale Univ., and his PhD from Caltech.

24. Constantine, L. L., "Integrated Hardware/Software Design, Part 7, Formalization of Computer Power," **Modern Data Systems,** Vol. 1, No. 9, pp. 58-66, Nov. 1968.
25. Bingham, H. W., & Kaufman, S. B., "Analysis of Static Object Code Produced by Algol & Cobol Compilers for Burroughs B5500," Burroughs Report, TR 69-1, Feb. 1969.
26. Scherr, A. L., **An Analysis of Time Shared Computer Systems,** MIT Press, 1967.
27. Saltzer, J., and Gintell, J., "The Instrumentation of Multics," MIT Report MO 112, July 1969.

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Thumbnail sketches of major computer performance evaluation products and services

The User's Guide to

One of the major areas of importance in the computer market today is that of computer system performance evaluation. Currently, there are several companies producing evaluation products and a few consulting services familiar with various products and their applications. There will be many more companies emerging in the future as the computer field realizes the value of computer performance evaluation.

The following is an alphabetical listing of the various companies involved in computer evaluation with which I have had experience. The main areas of performance evaluation included are hardware monitors, software monitors, simulation, and system design and evaluation service bureaus.

Applied Data Research, Inc.
Route 206 Center
Princeton, N.J. 08540
telephone: (609) 921-8550

Applied Data Research (ADR) offers a proprietary software product known as the Systems Analysis Machine (SAM) which is a simulation software product. SAM is designed for the analysis of proposed and current computer hardware, software, and applications. Some of the features of SAM are: (1) discrete step simulation, (2) providing a simple language for representing and simulating computer systems, (3) simulation of single cpu systems and multiple cpu systems with real-time, I/O contention and I/O-compute overlap, (4) complete library of hardware and software in the market, (5) output selection by the user, and (6) inclusion of user FORTRAN or assembly modules.

Allied Computer Technology, Inc.
Hueristics Systems Div.
1610 Twenty-Sixth Street
Santa Monica, Calif. 90404
telephone: (213) 828-7471

Allied Computer Technology (ACT) produces a device known as the Computer Performance Monitor II (CPM II) which includes: logic control panel, independent 24 hour real time clock, magnetic tape unit, address comparator, external sync and sync output. ACT also provides associated software in the form of the Measurement Summary Report Program (MSR). The MSR includes: variable summary interval, variable report format, plot output, variable derived measurements, documentation with FORTRAN source statements and flowcharts. The CPM II is designed to provide a method of locating system imbalances, monitoring system utilization and performance blocks and evaluation base for system operator and program performance. As is the case with hardware monitors, the CPM II places no additional overhead on the operating system.

Applied Systems Div.
Computer Learning and Systems Corp.
5530 Wisconsin Ave., Suite 1600
Chevy Chase, Md. 20015
telephone: (301) 652-9220

Applied Systems provides two different system evaluation products, one a simulation software product and the other a hardware monitoring device.

CASE, the simulation product, is designed to accommodate multiprogramming, multiprocessing and immediate access for any application mix of business, scientific, real-time, and communications. CASE contains a large library of the major manufacturer's products for accurate simulation. Applied Systems recommends CASE in feasibility studies, overall system design, equipment selection, configuration management, installation audit, and special studies.

Execution-Recorder/Analyzer (X-RAY), the hardware monitor provided by Applied Systems, is a data collection, reduction, and analysis facility designed for accurate reporting on all areas of system operation. Some major areas of measurement are: computer system utilization, system software overhead, problem program efficiency, and data base element activity. X-RAY enables the user to employ system improvement measures such as: equipment configuration balancing, job scheduling procedure modifica-

Evaluation Products

by L. E. Hart

tion, operating system residence reallocation, and many more. X-RAY data may also be collected for input to CASE. X-RAY consists of: (1) recorder to monitor the operation of the computer by sampling of registers, indicators and various passive signal lines, (2) editor which is an applications program used to preprocess programs and data sets to be examined by the recorder, and (3) analyzer which is a report program generator which correlates and analyzes input from the recorder and editor to produce user-defined reports.

Boole & Babbage
1121 San Antonio Rd.
Palo Alto, Calif. 94303
telephone: (415) 961-4440

Boole & Babbage produces several system measurement software (SMS) products and has primarily applied their products to OS and DOS 360.

The first product is SMS/360 Configuration Utilization Efficiency (CUE) which evaluates the hardware and operating system configuration efficiency. CUE consists of two programs: the extractor program which samples the activity of the entire systems and outputs this information to the extractor data set, and the analyzer program which prepares a report from the extractor data set(s). The analyzer program is run as a separate program. The system overhead added by CUE is typically 5% or less. The operating systems required are OS MFT, EMFT, MFT-2, MVT with HASP or ASP. Data on hardware usage, data cell or disc head movement, or transient SVC usage may be collected and written onto the tape. The analyzer can produce a variety of reports from the data collected. Three basic reports are produced: equipment subreport, head movement subreport and the SVC subreport. The equipment subreport allows the examination of cpu utilization, device utilization and channel balance. The head movement subreport can enable one to rearrange data files to minimize seek time. Finally, the SVC subreport is used to evaluate the usage of nonresident SVC's to determine if it is valuable to make them resident.

The next product is the SMS/360 Problem Program Efficiency (PPE) program. PPE consists of two programs, the extractor and the analyzer. This program can be used with OS MVT, MFT, PCP, EMFT, MFT-2 and the overhead is again typically less than 5%. The extractor samples the problem program under study at an interval rate specified by the user. The limits of core for data to be collected may be specified by the user. Code efficiency reports, and instructional-level analysis are prepared by the analyzer.

The final product is the SMS/360 Data Set Optimizer (DSO), which provides the user with a tool to aid him in reducing system/program wait time associated with data sets located on discs. DSO provides a report concerning the data set organization of disc volumes, information on head movement between data set pairs and new data set organization that could reduce volume head movement. DSO consists of two programs, an extractor and an analyzer. The extractor collects head movement data and VTOC information from specified volumes on specified devices.

Computer Management Sciences
Suite B, Fenwick House
1316 Fenwick Lane
Silver Spring, Md. 20910
telephone: (301) 588-6084

Computer Management Sciences (CMS) produces a proprietary software package known as the Measurement-Test (M-Test) system. The M-Test system uses active measurement methods to produce measurement information. This information may be used to: improve COBOL object program performance, pinpoint inefficiencies in the system software and comparison of hardware/software combinations for various systems. The M-Test system prepares input for the Automatic Factors Analysis System. The Automatic Factors Analysis System prepares specified reports from the M-Test data. CMS software has been used on Honeywell 200 and IBM 360. M-Test requires peripheral hardware factors, workload definition and cpu/software timing factors for the timing packages.

(Continued on page 34)

Computer Programming & Analysis, Inc.
1103 Kings Highway North
Cherry Hill, N.J. 08034
telephone: (609) 667-8500

Computer Programming and Analysis (CPA) offers a hardware monitor known as the CPA Series 7700. The CPA 7700 is designed to allow even the smallest user of computer equipment to obtain measurements economically and without interference to the system operation or performance. The CPA 7700 is designed to accommodate all types of systems. It utilizes a method which allows single, simultaneous or overlapping measurements in either a counting or timing mode. Typical measurements taken: I/O channel utilization, system wait state, and problem and supervision time allocation. Through analysis of the collected data, system throughput can be increased, overhead reduced and accurate configuration analysis conducted. Other applications: hardware performance, program interaction in a multiprogramming environment, system overhead, message handling time, simulation statistics, OP code usage, device utilization and so on. The CPA 7700 counter provides the standard hardware counter features along with a complete set of logic functions on each counter and a separate logic unit. CPA also offers a comparator to be used in conjunction with the 7700. The comparator has its own logic panel and has 32 bits for comparison usage. The CPA 7700 and comparator(s) provide a very powerful measurement tool. With the comparator one can measure time within a given range in memory, number of entries and exits from a given routine, number of transfers from one routine to another, and many more. The CPA 7700 also offers an attached tape drive for storing of measurement data.

"I want a new modular incremental plotter with all input options allowing multiple step programming and block transfer of data for more economic plotting applications on-site or at remote terminals."

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Computer Programming and Consultation
4151 Cleveland Ave. Apt. 58
Columbus, Ohio 43224
telephone: (614) 471-7204

Computer Programming and Consultation (COPAC) is a hardware/software system design and evaluation firm. COPAC has utilized system performance evaluation tools in the many areas of the computer field, such as initial computer selection and installation, system design and maintenance, and finally through system optimization and upgrade.

COPAC can provide the prospective and current user with the technical expertise to: (1) select the best computer system for his needs, (2) design and select the optimum software system and application programs, (3) optimize the overall hardware/software system, and (4) provide the necessary information to keep the system hardware/software ahead of the changing needs of the user. COPAC can provide you with the fastest and least expensive method of selecting or evaluating a total computer system.

Computer Synectics, Inc.
328 Martin Ave.
Santa Clara, Calif. 95050
telephone: (408) 247-0200

Computer Synectics manufactures a hardware monitor known as the System Utilization Monitor (SUM). The purpose of SUM is to count the number or measure the duration of various signals within the computer. Some typical measurements of SUM are: wait state time, problem time vs. supervisor time, channel usage, operator response time, seeks performed, number of instructions executed, number of cards read or punched, I/O cpu and storage errors and others. SUM also offers a Boolean logic capability for manipulation and combination of the signals for desired output. It has a tape drive with variable output to tape frequency for storage of measurements. The tapes are written in IBM-compatible tape records. Computer Synectics also provides data reduction and analysis programs that prepare graphical reports on the utilization of the system functions. The tabular report is in two parts: one supplies the detailed periodic measurements, and the other gives an overview of the system utilization through summation of the measurements for each function. Computer Synectics also offers comparators which allow comparison of 24 bits of information for memory address, accumulator compares, etc. Finally, a real-time clock is provided for measurements requiring a 24 hour clock. This can be used to control the interval for writing the measurements to tape.

COMRESS
Two Research Court
Rockville, Md. 20850
telephone: (301) 948-8000

COMRESS produces a hardware monitor system known as Dynaprobe/Dynapar. Dynaprobe is a portable hardware device which measures and

records performance activity and system utilization, is designed to study central processor activity vs. data channel and I/O component usage, and includes a magnetic tape unit for measurement storage. Typical measurements are: system state, cpu active, cpu wait, channel busy, system active, system idle, device busy, device idle, file access rate, instruction class, etc. Dynaprobe can enable one to determine central processor utilization, selector channel utilization, seek activity and many more. Dynapar is the report program that utilizes Dynaprobe measurements. Dynapar reports include: (1) report summary which highlights the major features of the study, including dates, times, intervals and totals from each counter, (2) intermediate statistical summary which covers the contents of the counters at the selected intervals, with totals to that point, and absolute and percentile totals, (3) final statistical summary which contains total duration or number of occurrences of each event, and also percentages as specified, (4) system utilization profile including plots of timed events, (5) system event histograms, and (6) composite event histograms.

COMRESS also offers a simulation system known as Systems and Computers Evaluation and Review Technique (SCERT). SCERT is a family of programs used to simulate the performance of a user's processing requirements against cost/performance models of selected computers. SCERT has a complete library of computer systems and hardware characteristics. The system can provide answers to such questions as: Is equipment utilized efficiently? Is computer capacity optimized? Do I need additional operations?

International Business Machines Corp.
Poughkeepsie, N.Y.
Kingston, N.Y.
Yorktown Heights, N.Y.

IBM has many monitoring techniques and I will only attempt to list the pertinent ones here. Further information should be obtained from the IBM representatives.

AMAP—simulation package.

SIPE—System Internal Performance Evaluation Program; software package.

IS/SPAR—Time Sharing System Performance Activity Records; hardware measuring machine used to collect performance data for system users and designers.

System Logic and Usage Records—Data is collected in the host computer through a special monitor interface to the records for performance evaluation.

IBM has a complete set of hardware, software, and simulation performance evaluation tools.

Lambda Corp.
1501 Wilson Blvd.
Arlington, Va. 22209
telephone: (703) 528-8200

Lambda Corp. offers a software monitoring program known as the Lambda Efficiency Analysis Program (LEAP) available for all IBM 360 os users. An easy to use diagnostic tool, LEAP monitors a normal production run, analyzes the time distribution and presents several useful reports, such as time spent in line by line coding, as well as time interactions between specific sections of code. LEAP also provides information on interactions between program code and supervisor functions such as I/O, segment loading, etc. LEAP therefore presents a total picture of the program in its operating environment. By using LEAP, the user can rearrange code, remove time consuming steps, precompute and store intermediate results for critical calculations, construct valuable tables, etc. LEAP consists of two parts: the monitor, which resides in core, and the analysis module, which prepares the reports. The user need not supply any information to LEAP, making it fully automatic. Some of the reports provided are: channel activity, module analysis, entry point analysis, timing graph, and direct time distribution. LEAP is an extremely useful tool.

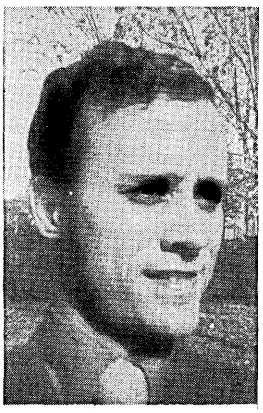
Stanford Linear Accelerator Center
P.O. Box 4349
Stanford Univ.
Stanford, Calif. 54305
telephone: (415) 854-3300

Stanford has a monitoring program known as PROGLOOK which consists of two programs, PROGTIME and PROGPLOT. These programs provide detailed measurements of the user program run under os/360 MVT to improve program performance. PROGTIME uses an interval timer to catch a picture of any program and records the appropriate measurements. PROGPLOT accepts the specially formatted data from PROGTIME and prints summaries of the measurements. Graphs of program time and performance are produced.

Univ. of California at Los Angeles
Dept. of Engineering & Applied Science
3732 Boelter Hall
Los Angeles, Calif. 90024
telephone: (213) 825-2050

UCLA has developed a hardware device known as the SNUPER computer. The SNUPER computer is designed toward measurements in the following areas: execution activity at the statement level for source language programs, and program execution activity at the instruction level for machine language programs.

I feel that computer performance evaluation is within the reach of every computer user and a must to be competitive in today's business world. Contact one of the above firms about their products or consulting services today and get better computer performance tomorrow. ■



Mr. Hart is currently assigned to the program definition group at Univac, where he is responsible for evaluation of all past, present, and future performance evaluation efforts in the computer field. He has also worked in the systems communications group, where he assisted in the design and development of communications processors, concentrators, and terminals. He is a member of ACM and ASM. His BS is from Ohio State Univ.

"Most multi-keyboard data preparation systems have had one big failing:

They were supposed to save money. But they didn't.

So Mohawk designed System 9000."

Richard Rifenburgh, MDS President, unveils Mohawk's latest brainchild.

CIRCLE 27 ON READER CARD

We studied multiple-keyboard concepts for three years. They all looked good at first, but we kept seeing holes in the theories.

Some of the systems we looked at were so inflexible that they weren't suitable for most applications.

Others sacrificed productivity just to be up-to-date.

The rest were put together by companies that are strong on technical abilities but weak on field service. Their systems go down and 32 girls take a few extra days off.

Mohawk set out to change that. And succeeded with System 9000.

The first problem we attacked was increasing productivity:

We built a system that gives the operator uninterrupted keying cadence for increased accuracy and speed.

With the flick of a few switches, the system partitions into subunits handling different jobs. There's never a reason for idle keyboards.

And System 9000 produces finished computer tapes, with no costly intermediate handling.

The second problem we attacked was flexibility.

There isn't one best method of data verification. And there isn't one best degree of sequence integrity. Both vary with the application.

So System 9000 Level 2 may have two, one, or zero tape cassettes at any keyboard station. If records have to be kept together, they stay right in the cassette. And before it's pooled onto a computer tape, the cassette can be verified at any keyboard.

System 9000 comes in a range of capacities and with lots of options—from simple data communications to expanded editing. So you only pay for what you need.

The third problem—reliability and maintenance—wasn't a problem for us. Mohawk's fast service and reliability engineering are famous.

It took us three years. But we came up with a high-volume data entry system that makes sense. Instead of making claims.

Mohawk Data Sciences Corp.
Herkimer, New York

MDS

the UNIVAC 1110

A powerful new computer for today's full range of applications, whether local or remote, batch, time-sharing or real-time, business or scientific.

When we designed the UNIVAC® 1110, we set a new standard.

We wanted a computer system that would do nearly anything that anybody could want.

Whether local or remote, batch, time-sharing or real-time, business or scientific. All that, in one system.

We succeeded.

The new UNIVAC 1110 is a large-scale, general-purpose computer with the most advanced proven software systems available.

It has been engineered for superior cost performance to give you the utmost value for your data processing dollar.

UNIVAC 1106 and 1108 users can expand up to it easily, using the hardware and software they now have. The 1110 is readily adaptable to meet future needs.

The basic UNIVAC 1110 central processing system has the capacity to process more than 3 million instructions per second.

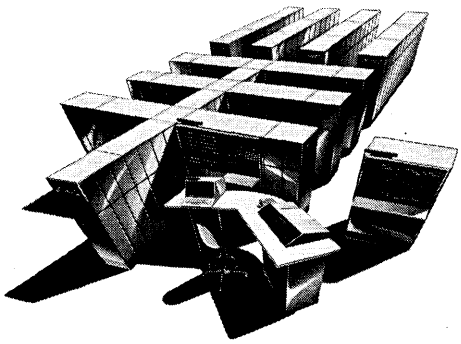
Multiprocessing performance is increased by the modularity of the main memory. A communications/symbiont processor enhances the system's performance by unburdening the CPU software of the need for handlers for the slow-speed peripheral devices and the many communications handlers and subroutines.

The UNIVAC 1110 can be configured for full redundancy where "never down" operation is essential. Its extensive real-time capabilities, vast on-line storage, and tremendous computational power permit large, comprehensive information systems. In addition, the high throughput of batch and demand applications will meet big-volume business requirements.

We created the new industry standard for a powerful and versatile new computer system designed to handle the broad range of today's many varied applications.

In doing so, we have set a new world standard for computer performance.

Find out what this new standard can mean to you. Compare the 1110 with the system you now have, or any system you are thinking of. Univac representatives will be happy to make a presentation at your convenience.



UNIVAC

First in real-time computer systems

SPERRY RAND

yuletide at the computation center

by David M. Jones

The holiday season is viewed with mixed feeling by many suppliers of edp services and equipment.

"Call me a Scrooge if you will. I still maintain that Christmas is a total bust, businesswise," the director of a major time-sharing service confided to me recently. "Know what I mean? Parties, late nights, carousing, hangovers, days off, the general goofing off that goes on at this season—it all adds up to a definite slackening in the tempo of computer usage. In my shop this shows up only too clearly, in the form of a sharp decrease in the job flow rate, idle cpu time, and an estimated 20% to 25% drop in billings. Bah, humbug!" he added, with melancholy humor.

I have heard these or similar complaints voiced in all segments of the industry. What makes it really galling, though, is the fact that most other business enterprises do not seem to suffer from this seasonal depression. In fact, for many it is a period of increased activity and soaring profits. Small wonder, then, that the technocrats of Armonk and Minneapolis gnash their teeth and—figuratively, at least—rend their conservative garments in twain when the first styrofoam snow appears in the department store windows.

The question I now pose is: does the electronic data processing industry have to resign itself to this unfortunate situation? Should it write Christmas off as a recurrent, unavoidable source of financial loss? I will answer my own question in the resounding words of the immortal Mr. Pickwick: "Nay! Not on your nelly!" One thing I have learned in the course of my employment as director of a large computer facility is this: by wholeheatedly embracing the spirit of the Joyous Season, and ensuring that it permeates to the appropriate functions within the operation, it is possible to *eliminate* the seasonal slack—while simultaneously laying the foundation for *increased* profitability throughout the coming year!

God rest ye merry, gentlemen!

"But how do you actually do it?" envious and incredulous colleagues ask.

I tell them that the key to my whole approach is perhaps symbolized by the demeanor of my personnel in their dealings with our clients. From mid-December through New Year's Eve I require them to display, during all customer contacts, a spirit of hearty and sincere good-fellowship in consonance with the season. This rule is strictly enforced all the way down the line.[1]

The December users' conference furnishes an instructive microcosm of the larger, richly jocund whole which I seek to create, and demonstrates the payoff in tinkling cash. I should first explain that these conferences are monthly affairs, open to the managers of departments using either the central facility or its remote terminals. Typically, they consist of three solid hours of complaints, demands, and threats both veiled and overt. I have my chief systems man Sneed on hand to field the tougher technical questions, and also Bottomley, who heads the operations end and is good

1. An important exception will be noted later in this article.

at blustering through when reason fails.

At the December conference I abandon my usual defensive posture. I strike out boldly and aggressively at the users, in a determined effort to force upon them—whether they like it or not—a mood of good will, merriment, and Christian forgiveness. To achieve this end I employ the traditional trappings of cardboard Santa Clauses, tinsel, artificial snowmen, etc., but the main thrust of my attack consists in assailing the users with boisterous Yuletide greetings, delivered with the help of a task force of three or four robust and hearty programmer/analysts. These men operate under Bottomley's command. Ideally, they should resemble him. The kind of person I look for has a 40-inch waistline, florid complexion, min. 5 years exp. COBOL or BAL, pref. MBA, buoyant disposition. In view of the current shortage of qualified edp personnel it is of course difficult to create an optimum assemblage and compromises must inevitably be made. (I do not wish to appear overcritical, but it seems to me that the majority of programmers are pale or thin or moody—often all three.)

The brashly cheerful decorations, the crackling

humor of my stout assistants, Bottomley's laugh booming away in the background—all this has quite an impact on the assembled users. If there are those among us too mean of spirit to respond, we redouble our efforts. In this context it is of interest to describe how we won Purvis over last December. Purvis, a loathsome individual who unfortunately exerts considerable influence throughout the company, has always been a thorn in our flesh. As soon as he entered my conference room, brimming over with ill-humor and complaints, we nimbly intercepted him.

"William, my dear old fellow!" I exclaimed, shaking hands while also clasping his right shoulder and gazing sincerely into his beady eyes. "Allow me to wish you the merriest of merry Christmases!" After my prolonged handshake was over, Sneed came forward and humbly wished the very best of health and happiness to Purvis and his loved ones "this Christmas and throughout the coming year." Finally Bottomley, in a sudden and spontaneous expression of seasonal exuberance, thumped Purvis heartily between the shoulderblades with a force that could have felled a 20-foot fir tree.

Purvis was unusually quiet after all this. The complaints he later made were minor, and seemed strangely muted in tone. In fact, Purvis became almost likeable that morning. To me at least, this clearly illustrated how effectively I had captured the true spirit of Christmas, since under normal circumstances it is difficult to even tolerate the vile man's presence.

In practice, few of the users need to be singled out for individual attention. Since the decent fellows cannot find it in them, in these joyous circumstances, to submit their usual, niggardly requests for refunds on jobs we have fouled up, the resulting savings to the center can amount to several thousand dollars.

Touch of pathos

A word about Sneed.

As I have already observed, most programmers appear to be pallid and gloomy. Sneed is no exception. Bottomley believes that this may be partly due to his exposure to ALGOL at an early age, and he has suggested that it might be wise to actually exclude Sneed from the December conferences.

At first, this notion seemed attractive. However, on mature reflection I came to realize that the image which Sneed presents has certain qualities which, in a seedy sort of way, make a positive contribution. When he appears wearing suspenders, watch-chain, and threadbare trousers—as, indeed, he normally does at the office—it requires little imagination to perceive in him the Victorian clerk immortalized by Dickens. This impression is greatly enhanced if he sits on a high stool and peers over the top of his glasses. Accordingly, I conduct the December conference with Sneed perched in an elevated position on the podium, wearing suspenders, etc., and making notes in a stout systems manual which looks a bit like a ledger. Bottomley has suggested that we equip him with a candle as well, but I feel that the over-all effect might seem too artificial and contrived, somehow.

Last year, by a stroke of sheer good luck, the eldest of Sneed's many sons broke a toe while playing football, and my solicitous enquiries ("It must be terrible for the young fella to see his friends running around —Dare we hope that the lad will walk again soon?") were not lost upon the warm-hearted users. Thus I have found that the wretched figure of Sneed, like some subtle discord in a great orchestral work, serves actually to enrich and heighten the ultimate harmony.

Trogg the dispatcher

Trogg the dispatcher worked out of a sort of hole in the wall between the machine room and corridor, handling central batch processing jobs. He was therefore thrust into daily association with many customers.

His was an undemanding job, requiring little mental or physical exertion. Christmas comes but once a year, and I felt it was reasonable to require Trogg to put a little more into his work at this time.

"Grunts and wheezes. These are the only things our batch-mode users ever hear from Trogg," I complained to Bottomley last December. "They deserve better. A spark of Christian charity, if you please; a

little humanity, some halting but sincere expression of good will—surely Trogg is capable of doing this much for the department."

With Bottomley's assistance, Trogg learned a short fragment of verse (*Glad tidings to you on this merry season, and may jolly good health . . . etc.*) which he recited to the customers as they brought their jobs in. The scheme met with only limited success, being marred by the mechanical, almost surly nature of Trogg's delivery. Bottomley tried to compensate for these deficiencies by having him lean out of the window and clasp the customer by both shoulders during the recitation, a gesture which he hoped would lend a little much-needed warmth to the greeting.

The results were disappointing. Some users thought Trogg was reaching out to take their card trays, while others, accustomed to Trogg's habitual air of smoldering resentment, mistook his sudden lunge for an explosive release of pent-up aggression. There was considerable confusion, and many card decks were dropped. The whole experiment came to an untimely end on Dec. 20, when Trogg leaned out to embrace an unusually short customer and slipped a disk (spinal, not magnetic).

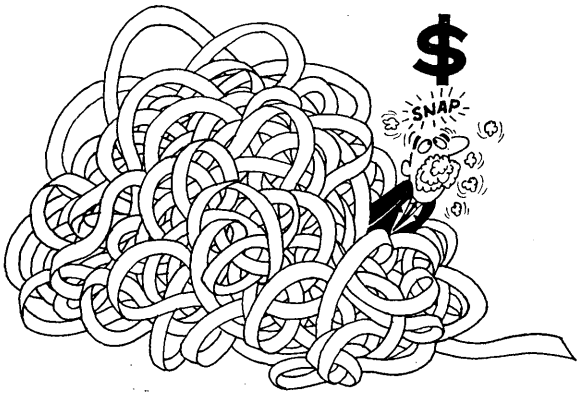
I was on my way to the computer room at the time of Trogg's sudden and painful deliverance from the assignment for which, alas, he was so ill-suited. I spoke to him frankly.

"One cannot help wondering whether some basic revulsion you may feel against wishing the customers well has actually *caused* the disk to slip," I told him. The unhappy man was still leaning out of his window, quite unable to correct his bent posture or indeed move in any direction at this time. "I feel that you will be better-suited to the night shift, working on the tabulating machines."

Trogg remained rigidly at his post, like the Roman sentry at Pompeii, until we extricated him and brought in a more suitable person.

My biggest direct cost savings during the Joyous Season are afforded by the remote terminals.

The Teletype users, instead of getting the terse READY message at initial sign-on, are treated to a printout of *The Twelve Days of Christmas* in its entirety, followed by a clever picture of Santa Claus done in alphanumeric characters. Sneed is modifying our compilers to print additional salutations with the diagnostics and at execution time.



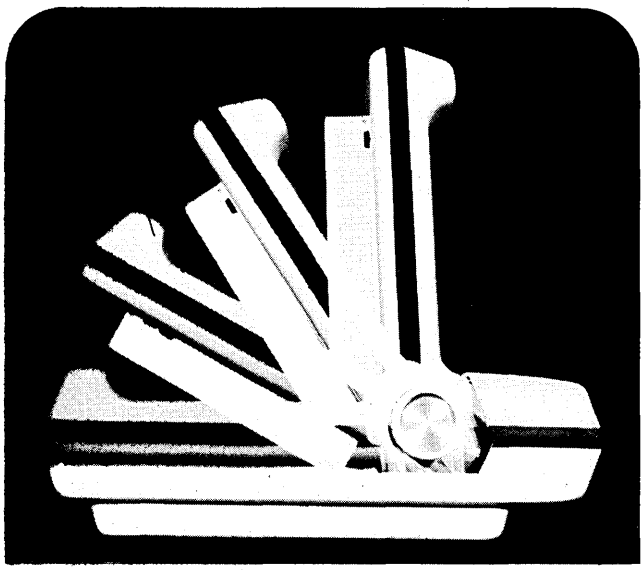
It has been reported that a few users are somewhat irritated by our seasonal outburst of pictures and verse. Since they pay $50/hour connect time, their attitude is understandable (though churlish and ungenerous, in my opinion). The threshold of impatience is usually crossed somewhere between *Seven Swans A Swimming* and *Ten Lords A Leaping*, and one user was observed to actually foam at the mouth at the start of the last verse (*Twelve Drummers Drumming*).

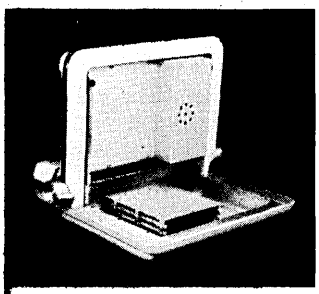
This year we intend to alleviate the problem by stopping at *Eight Maids A Milking*, after which a message will be printed stating that the connect-time charges for these verbal trimmings are being cheerfully assumed by the computation center. Naturally, this will not really be the case. The intention here, however, is to spread good will and jollity rather than to dully inform with cold accuracy. Surely, this is what Christmas is all about, and the 50-100% increase in income from the remotes is regarded by us as a tangible gesture of customer reciprocation.

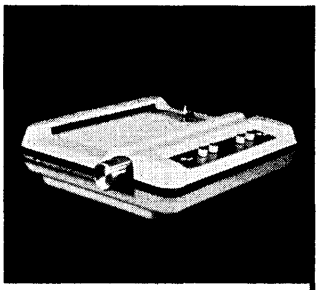
We'll keep our Christmas merry still!

One of Sneed's innocent domestic pastimes is the construction of Christmas wreaths out of punched cards. This year I have asked him to assemble a gross of these pleasing decorations, for presentation to our best customers. The potential of cards is one which in fact we are only just starting to explore, and Bottomley has plans for punching everything on stock of brilliant, seasonal reds and greens. There are also schemes for sending out "Christmas cards" to each user, bearing punched/interpreted greetings whose intensity and length will vary with the cumulative billing total recorded under the user's account number. It all represents a lot of extra work for Sneed. However, as I have told him, this is a time of giving and we therefore look to our people to give freely (i.e., no overtime pay).

While experimenting with new ideas, we are constantly revising the old. This year the emphasis will







plotter x 3 = Fasplot

It's a simple equation.

FASPLOT—The time-share analog plotter from Omega-t Systems, with a pen speed of 10 inches per second, is over three times faster than the competition's 3 ips.

- Because no special programs are required, anyone can learn to operate the FASPLOT with only a few minutes of instruction.
- The FASPLOT's interfaces include on-line or local modes of operation, hardwired TTY, EIA, 30 CPS Paper Tape Reader, and Logic Level.
- FASPLOT is fast, too! It has the capability to accept inputs from TTY or TTY replacement terminals at 10, 15, or 30 CPS.
- A tiltable plotting bed up to 90° provides for convenient viewing while a special muting feature keeps input terminal operations silent.

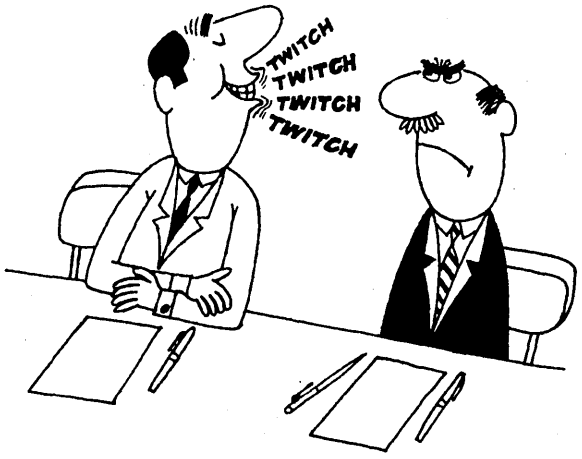
FASPLOT: There are three models to suit your time-share needs. Glen Renfro will be glad to tell you how FASPLOT can save you time and money. *Write or call him at:* Omega-t Systems, Inc.; 300 Terrace Village; Richardson, Texas 75080; (214) 231-5121.

omega-t systems incorporated

CIRCLE 47 ON READER CARD

Yuletide at the Center . . .

be upon refinement and even retrenchment of established procedures. For instance, I have informed those concerned that, while short bursts of laughter will still have their place at the users' conference, quiet and restrained merriment is to be preferred. This change is sorely needed. Last December, I am embarrassed to recall, the random bursts of scattered background laughter freakishly combined, with shattering effect, just as Dr. Liebnitz was gently complaining that the system had clobbered his output



tape from a six-hour LP run. Suppressed chuckles, I tell my assistants, and humorously twitching lips—these are worth a thousand outright guffaws. In a similar vein, I am planning to keep the spirit of the Joyous Season out of the machine room in the future. It is true that the computer operators, visible at all times through plate glass windows, have vicarious contact with the customers and in principle should therefore display hearty and sincere good-fellowship, etc. Experience has shown, however, that when they do so, an unfortunate impression of drunkenness is conveyed.

The fact that, within the modest and cheerful confines of our computation center, we have discovered how to show a neat profit in a basically unfavorable situation is a cause for rejoicing, but not for smugness. Much remains to be done. Looking into an uncertain future, as though conveyed there by the awesome, hooded spectre in Dickens' immortal classic, I take comfort in quoting the ebullient words of Scott:

Heap on more wood!—the wind is chill;
But let it whistle as it will,
We'll keep our Christmas merry still.

Veteran and inveterate data processor that I am, I sometimes think of our Yuletide activities as a kind of master file, which we process each December after the execution of judicious changes, additions, and deletions. Like all else in the burgeoning edp industry, it is continually being updated and improved. Change is inevitable, and I welcome it. T. Watson, Senior, expressed it admirably during the December, 1952, address to IBM employees when, in a moment of unashamed exuberance, he tossed aside his prepared speech and feverishly sang:

Hail the new, ye lads and lasses,
Fa la la la la, la la, la la! ■

IBM announces eight new ways it's the company behind the computer:

Two new four-

IBM's new System/7.
It's a laboratory computer, a process control computer, a plant automation computer, a data acquisition computer.

It brings a new world of sensor-based information to your information system.

If you're a scientist, you can use IBM's System/7 to monitor and analyze readings coming in from laboratory instruments.

If you're an engineer in a process industry, you can use it to keep the correct measure of ingredients flowing into a paint formula, or control the thickness of paper in a paper mill.

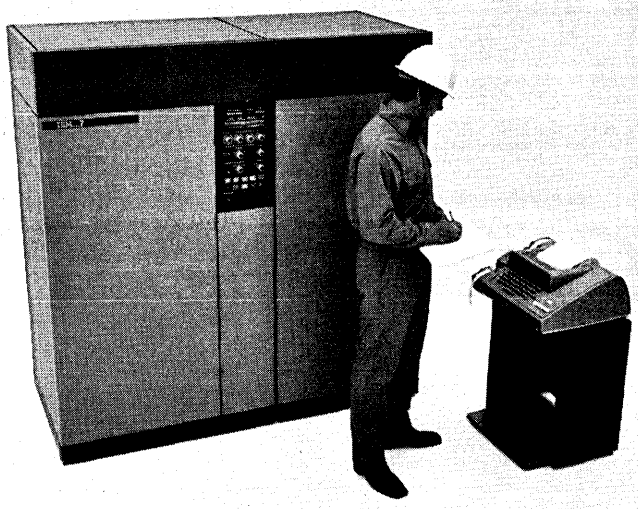
If you're a manufacturer, you can use it to monitor the number and quality of pieces coming off an assembly line.

If you're in any number of businesses, you can use IBM's System/7 to gather *sensor-based data* directly from your working environment. And make it a normal part of your data base.

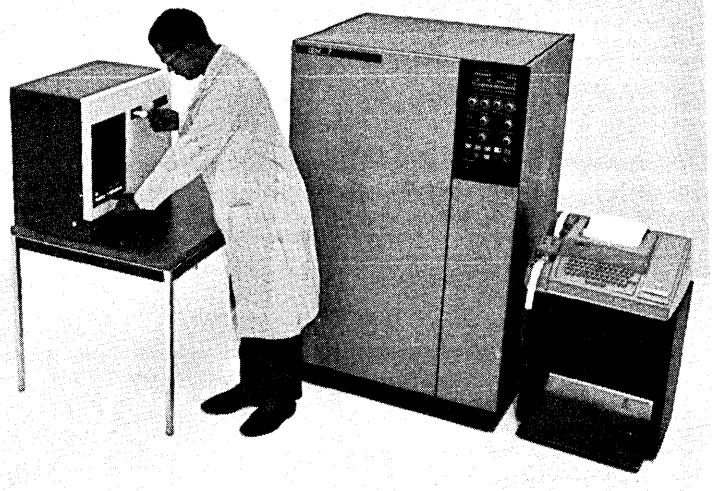
Information that right now may not be a part of your information system. But, nevertheless, belongs in the mainstream of information processing. System/7, IBM's lowest-cost computer, can put it there.

IBM's System/7, with advanced technology, *monolithic logic and memory*, can operate on its own. Or become an integral part of your information system. Because it easily ties into System/360, or System/370, or the 1800, or the 1130.

It's four more ways we're the company behind the computer.

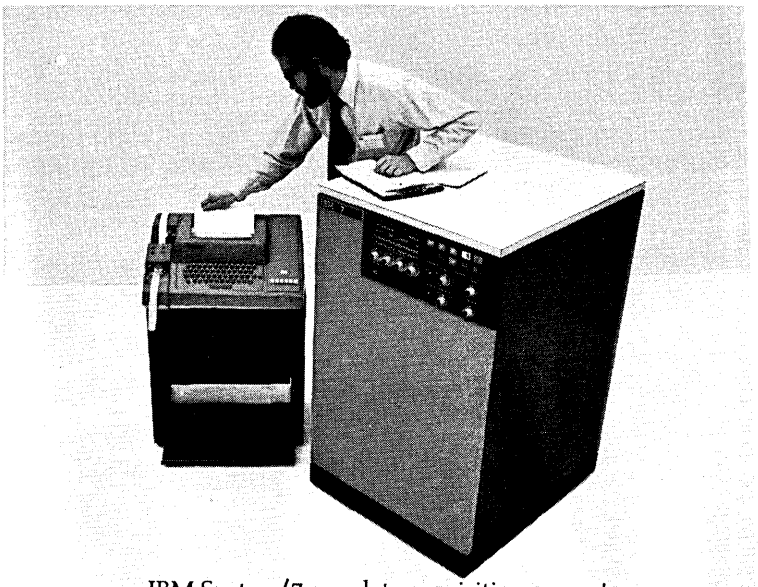


IBM System/7 as a process control computer.



IBM System/7 as a plant automation computer.

IBM System/7 as a laboratory computer.



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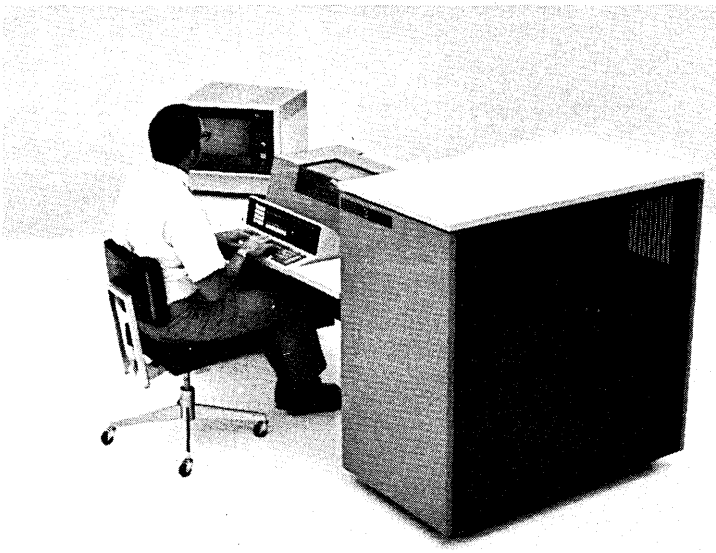
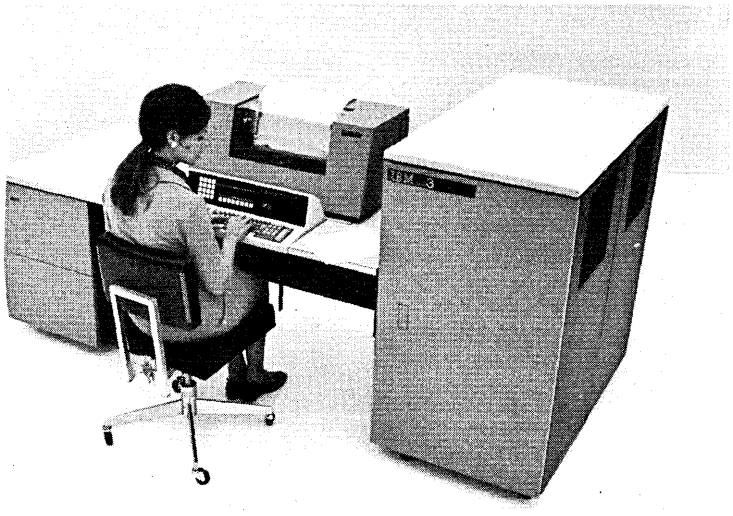


IBM System/3 Model 6 as a problem-solving computer.



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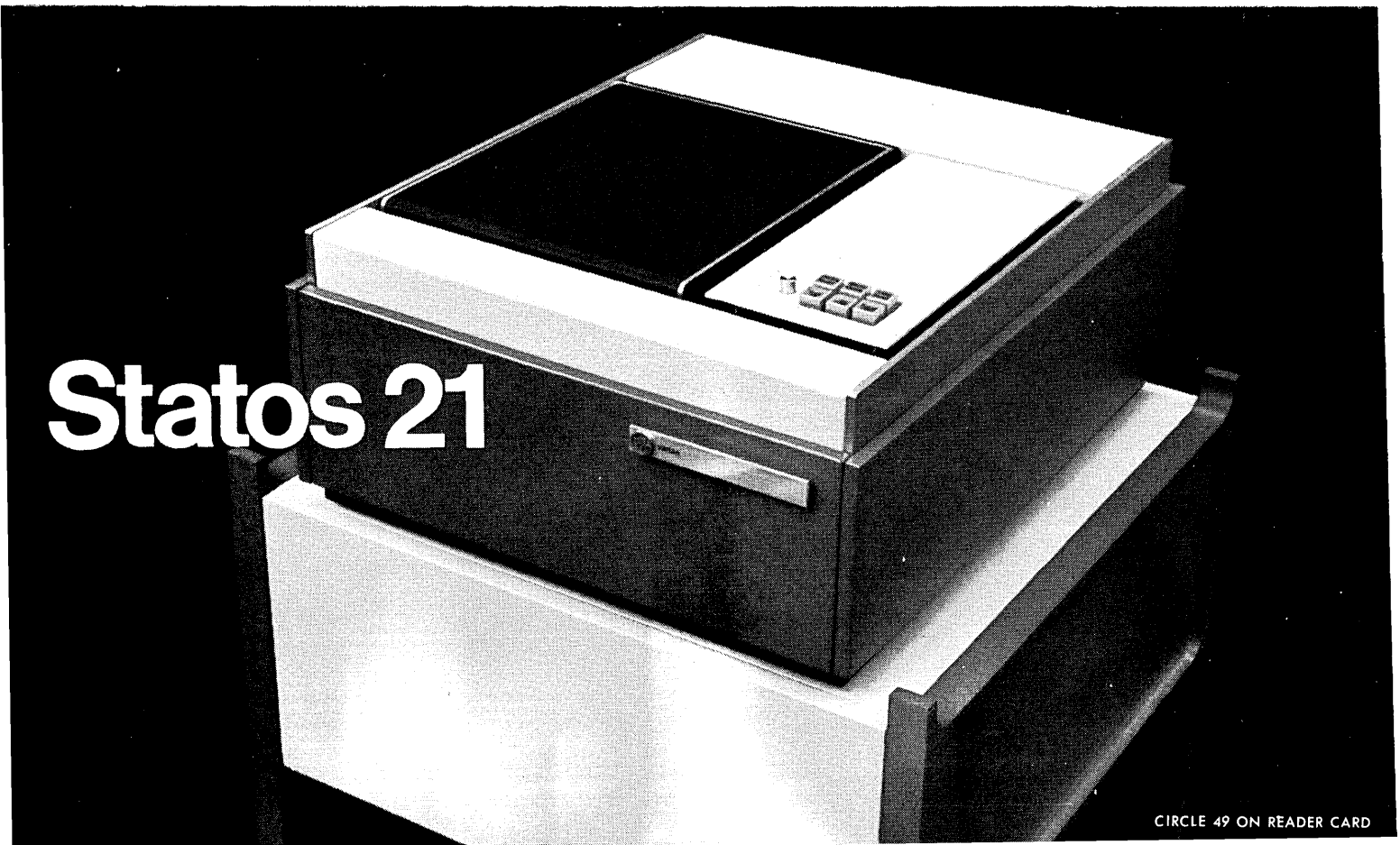


CIRCLE 49 ON READER CARD

A Conference Report

Railroad Data Systems Meeting

by F. Barry Nelson, Eastern Editor

The railroads' uses of computers don't get much publicity, but the railroads themselves take their computer capabilities very seriously. The three-day sixth annual meeting of the Association of American Railroads' Data Systems Division found nearly four hundred persons in attendance at Atlanta, with the registration list showing titles ranging from programmer to president. And most of the railroads' computer personnel seem to be railroaders first, and computermen second—their allegiance is to the railroad industry, not to the ill-defined "computer industry."

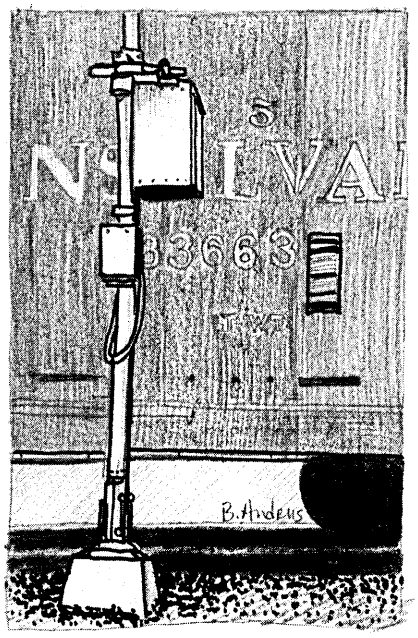
Top management is often dismissed as being unaware of computer capabilities, but no less than the presidents of two railways gave lengthy and highly competent addresses on how the railroads should utilize computers. Still, audience reaction wasn't completely favorable. As the applause subsided, one could hear murmuring to the effect that the chief executives talk one way, yet act another, or are at least unable to effect the sort of atmosphere of innovation they seek to create.

And, of course, we must remember this is the railroad industry, with its reputation for being archaic, and its admitted reluctance to change. The railroadmen somewhat lived up to their reputation by endeavoring to preserve an air of secrecy in some cases. A workshop session on "Computer Planning in Mergers" was closed to the press, allegedly at the request of Penn Central assistant vice president, systems development, J. M. Ostrow. Yet all he had to say—as related by outspoken attendees—was that the recent press assertions that computer problems played a major role in the fall of the Penn Central Railroad into bankruptcy were gross exaggerations. One could hardly dispute his claim, but he didn't go into detail about what the problems were that had inspired this misinterpretation.

Others discussed Penn Central computer problems, however. Conversing over cocktails, a PC employee said the causes were strictly managerial. He admitted there were computer problems, in that the Pennsylvania and New York Central railroads had different computer philosophies and no compatibility, but this could have been overcome if the proper managers had ever decreed settlements of the differences. No one ever said whether the Pennsylvania or New York Central techniques would prevail.

Failures off the record

At a workshop on marketing applications—hardly a controversial subject—which was open to the press, almost the first words from the moderator's mouth were that the discussion would be off the record and was not intended for publication, because



"we're going to talk about our failures as well as our successes." Well, most of the railroads' failures don't seem to be all that secret anyway.

But the big talk at the meeting was still about automated car identification, ACI. This is the system whereby trackside scanners detect color-coded identification panels on the sides of passing cars for input to central computers. Some 80-90% of all freight cars are now labeled, and the immediate problem seems to be getting the railroads to implement the necessary scanning equipment and software to utilize this new source of data. All cars are scheduled to be labeled by January. If ACI works as planned, the era of the lost freight car should be over.

A representative of Computer Identics, a firm that makes ACI equipment, claimed it would be as big an advance for the railroads as was the diesel locomotive. When this reporter repeated the remark to railroad personnel their response was less enthusiastic, however. One middle manager, who couldn't have been 40 years old, even said ACI "wouldn't make much difference."

Communications are an important, implicit theme in most railroad computer utilization. All the ACI input will be usable to maximum effect only when systems are implemented to exchange this data between railroads. All the railroads add up to a single transportation system, and the exchange of information is vital. Railroads are one industry where synergism has validity.

The keynote address, delivered by W. Graham Claytor, Jr., president of the Southern Railway, was certainly the most significant presentation at the meeting. In his talk, entitled "A Look Back—a Look Ahead," Claytor said the past decade had been the "batch decade," in which mundane problems like payrolls and accounts receivables had been computerized – existing, well-defined processes

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Railroad Meeting . . .

which lent themselves to savings of time and expense through data processing. During this period a communications gap developed between computer personnel and management. Management became disillusioned with computer projects which were often more expensive and less effective than advertised, and computer personnel appeared to be mere technicians, "saving microseconds and posting 'no trespassing' signs on their electronic playground." While for their part, "computer people assumed that all corporate problems would yield readily to the clean and straightforward logic of computer processing. They were only surprised that management had not discovered this a lot sooner."

Hopefully, these divergent viewpoints have now been brought together. Southern Railway helped close the gap by requiring attendance by all top management personnel, including Claytor, at a computer concepts course.

Insight and fortitude

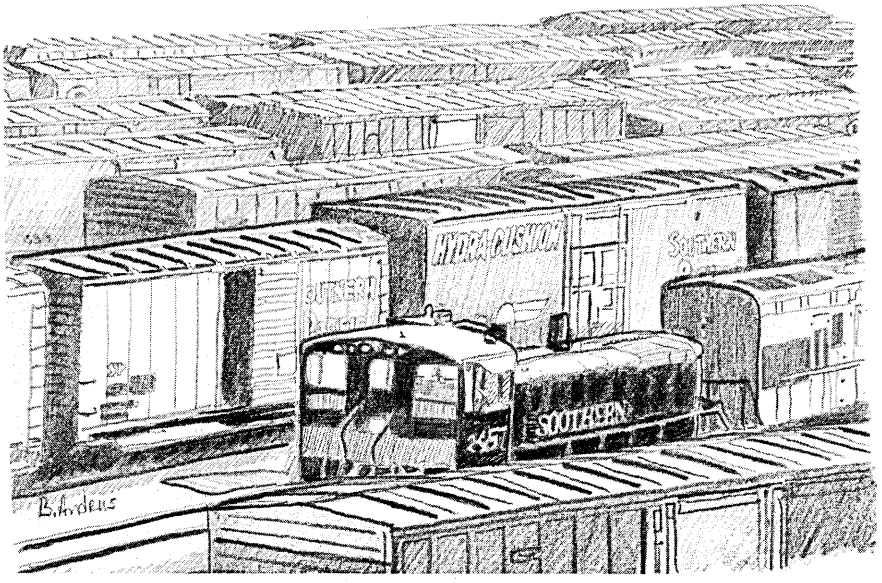
For the '70s, Claytor sees the trend toward terminal-oriented systems coming to the fore, with attendant problems that new computer capabilities are "meant to do things that people alone *cannot* do because of the sheer volume and speed of the operations required. Basically, these are new types of processes designed to help the railroads operate more effectively, and therefore more successfully . . . However, the return from this kind of computer and systems approach is not so immediately apparent as the savings from automating paperwork. It takes considerable management insight and fortitude to put the necessary money on the line and hold it there until the benefits begin to appear . . . "

Claytor sees the greatest potential gain in the use of computers in the area of operations. But the railroads "need some significant refinement of the simulation techniques [used] to get the answers to 'what if' questions about changes in our way of doing things. . . . we have yet to make [simulation] an easy-to-use, proven, and immediate tool for the operating man. Our best approach . . . is to work from the bottom up. Systems and computer people must look toward helping the man in the field do a better job. Don't put the first terminal on my desk . . . put it where the day-to-day action is."

CIRCLE 32 ON READER CARD

Following Claytor's address, R. P. Neuschel of McKinsey & Co. spoke in a somewhat more pessimistic vein, suggesting that limited computer successes in the past are causing growing management skepticism today. He also noted that "more than half" of all computer applications he's seen were originated by proposals from computer people, *not* proposals from operating executives in consultation with edp personnel. And, he said, most successful applications result from the latter technique, and the progress of the '70s will be a management achievement, not a technical achievement.

The first luncheon address, by Prime F. Osborn, III, president of the Seaboard Coast Line, showed that Claytor isn't the only railroad president who understands computers.



But Osborn was more specifically railroad oriented. He noted that the railroads have a great opportunity for self-help with edp, because it is not a regulated function; in contrast, the railroads are prevented from helping themselves in elimination of passenger trains and in increasing freight rates.

Computers are also good for the railroads' image. The public thinks railroads are "antiquated and dying," but the effective use of computers helps to change this. Yet the use of computers, though not hamstrung by government, is severely impinged by the "tremendous difficulty of accepting change in the railroad industry."

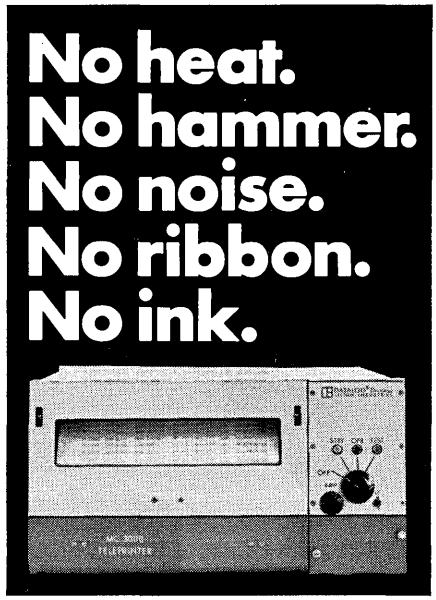
Osborn said the railroads may have made a mistake in their recent improvements in rolling stock, in that larger equipment—bigger cars, engines, and yards—have amounted to emphasis on *space* rather than *time*. Instead, he suggested, it may be possible—and desirable—to run shorter, faster trains, with computers controlling car assignments, power utilization, crews, and dispatching.

Finale by Cmdr. Hopper

The third and final day of the meeting was begun with an address by none other than Cmdr. Grace Hopper. Her talk, which had no title, ranged variously from hilarious descriptions of her work both in by-gone years and today for the Navy, to general computer talk. She said the pace of change in the computer industry is accelerating, and there's a changing emphasis in coding. "There's always a trade-off between core and speed —but the tightest core isn't the fastest. And in today's on-line environment, speed is of the essence."

In a field more closely related to the railroads, Cmdr. Hopper said that a common data description language must be defined, because "in three to five years we'll all be exchanging data between different computers." That certainly applies doubly to the railroads. They've got to be able to exchange data better as soon as possible.

The meeting officially ended with the "Get-Away Luncheon," after which most of the railroadmen went to the airport to fly home, avoiding their industry's unprofitable passenger services. That evening on the northbound Southern Railway streamliner, only three attendees were observed drinking in the lounge car. The other two requested their names not be revealed. ■



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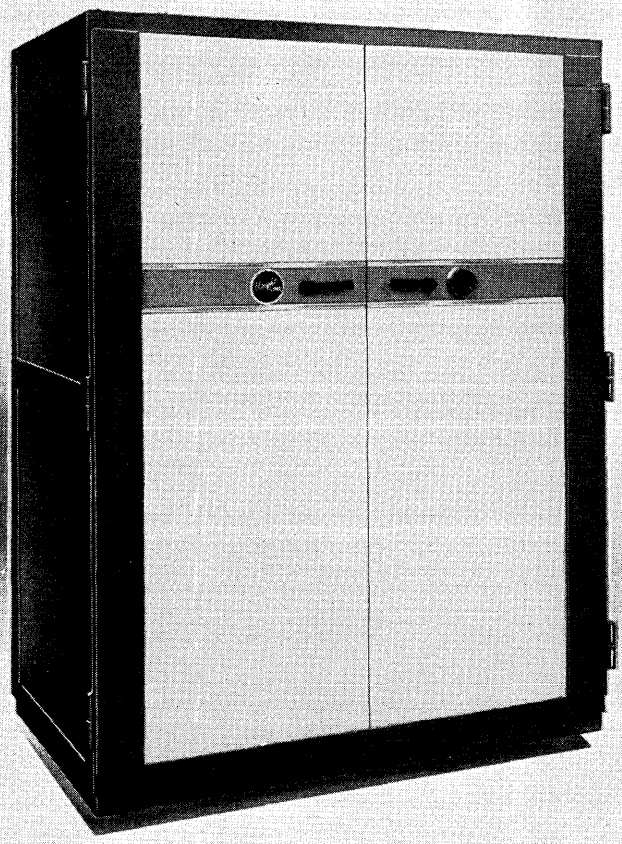

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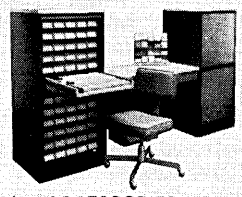

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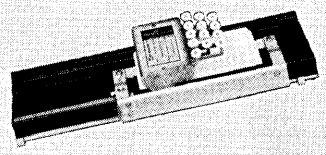

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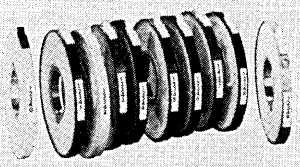

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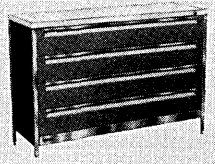

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How to make managers more socially responsive

SMIS Conference

by Phil Hirsch, Washington Editor

"Stay loose and keep in touch," a university president in effect told the Society for Management Information Systems recently at their second annual conference. Several other speakers offered basically the same advice.

Dr. Clarence Walton, president of Catholic University, was the conference keynoter; he argued that today political power is being transferred to new groups, as has happened often in the past.

To deal effectively with the current transfer, he said, requires the development of "appropriate mechanisms in institutions" so that contemporary aspirations and ideals, to which politically significant groups are committed, can be translated into "meaningful reality." "The lesson has begun to emerge very clearly for organizations like (SMIS), for business executives at the highest level. . . " Dr. Watson added that the mechanisms can't develop unless institutional managers, including particularly those who are associated with management information systems, enlarge and supplement their contacts with "those who will make or remake the society of which we are a part."

Another speaker, George F. Weinwurm, of Security Pacific National Bank, added: "Much remains to be done if an environment that fosters individual expression and fulfillment is to be realized by means of the increasingly complex institutional behemoths with which we are surrounded. Ultimately, the extent to which our society is democratic . . . is going to be determined in large part by the willingness and the practical ability of institutional managers to bear with and even encourage manifestations of the multifacetedness of human nature."

Weinwurm argued that before bureaucrats can become completely humanized, the current overreliance of managerial information systems on quantitative data must be remedied. The information system of the future will need to reflect the imprecise human side of institutional management as meaningfully as it has represented the inanimate aspects of money, materials, machines, and the like.

Also, "we need to reassess the notion that managerial information systems ought to provide an objective view of (a) problem . . . it is far more common for these systems to reinforce than to contradict the conventional wisdom."

Managerial genius defined

Earlier in his address, Weinwurm quoted Dr. Russell Ackoff in suggesting that "The genius of a good manager lies in his ability to control effectively complex systems that he does *not* understand." Dr. Walton, in his keynote speech, had referred to the same concept by talking about the "manager of intuition."

Comparing this idea with Weinwurm's suggestion that the imprecise and qualitative aspects of management should be cranked into management information systems raises an interesting question: Can this kind of input be automated or even systematized?

Weinwurm implied that the answer is "yes," but it could very well be that tomorrow's manager, in an age of even more sophisticated hardware and software, will have to continue relying on management by intuition at least as much as his present counterparts. If that's true, trying to make information systems more responsive to the non-quantitative side of management will be a waste of time and possibly dangerous besides, because it may encourage managers to believe they have an accurate picture of these qualitative factors when they actually don't.

Even if it is technologically possible to give information systems a greater role in managerial decision-making, it may not be socially desirable, as Prof. William Gomberg of the University of Pennsylvania indicated in an address entitled "People-Sensitive Issues in Management Information Systems."

Need for protection

He concluded that "the computer is in the course of doing to the white collar worker what an earlier mechanization (did) to the blue collar worker," and that to protect his status and bargaining power vis-à-vis management, the white collar worker needs "a due process mechanism." Gomberg insisted that "middle managers" are fooling themselves, and

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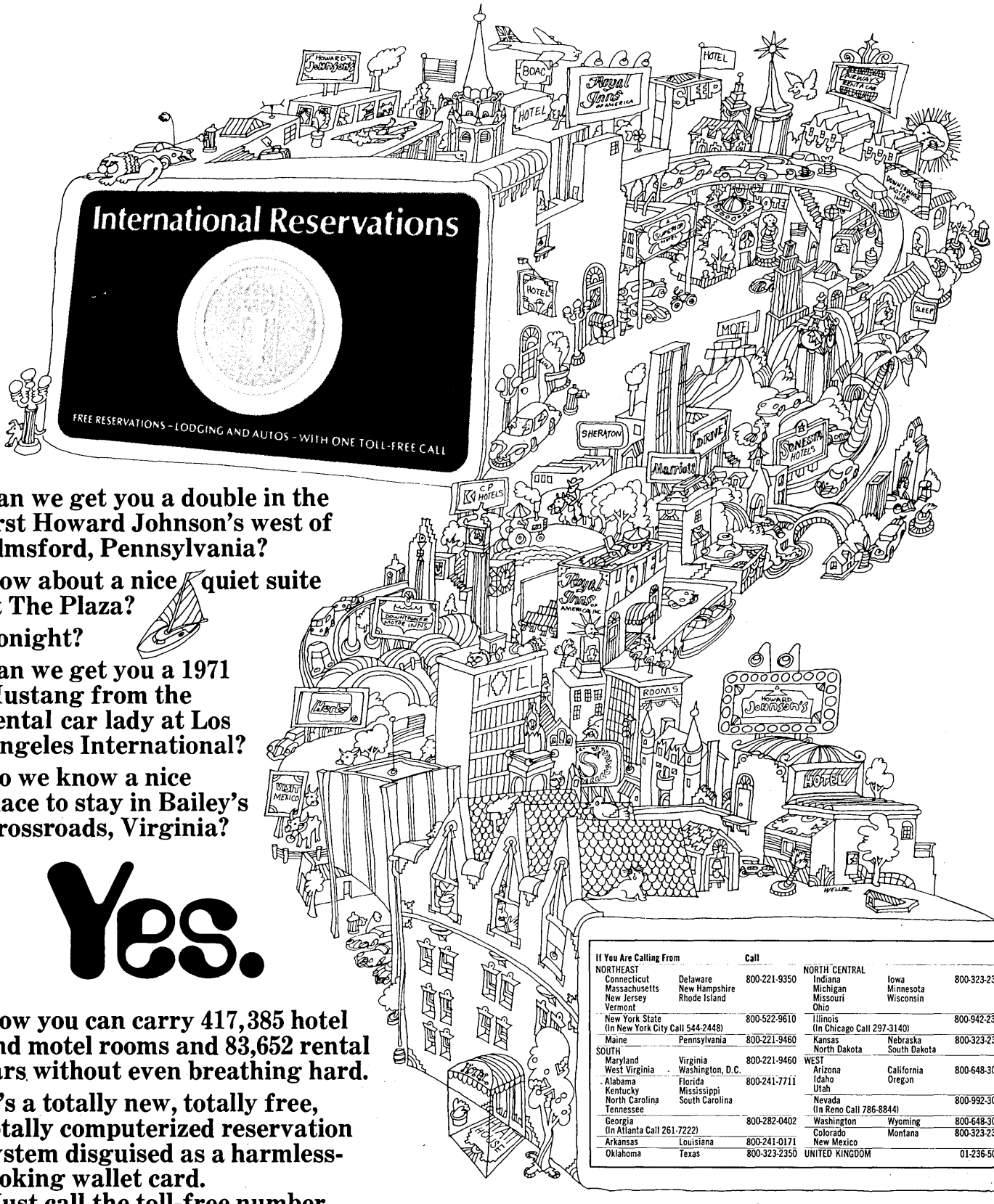

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asking to be victimized, when they use that title; they're really white collar workers.

Trade unionism is probably not an appropriate due process mechanism for white collar workers, Gomberg said. He added that the computer doesn't seem to have affected consumers deeply, but it has "imparted a terrible potential source of power" over the citizen "which can be usurped by unrestrained bureaucrats." He offered no suggestions on how to curb this latter threat.

David B. Hertz, a director of McKinsey & Co., assumed that better management information systems would promote "competitive progress in business and social progress in government." He then suggested some ways in which these systems can be improved.

Hertz argued that "the management scientist cannot attempt to develop decision-making models on a global scale for the entire business if he wishes to produce testable and implementable information structures." Rather, he should sneak up on the global model by developing it a module at a time, making sure that each is interconnected to its predecessors and that the process includes close, continuing coordination with the system designer.

Another technical topic discussed at the meeting was centralization vs. decentralization of the MIS effort. M. L. Roark, director of the systems office of the Ford Motor Co., after listing the pros and cons of each, concluded that an MIS system organization is too decentralized if: the systems groups are too small to attract good people; there is substantial duplication of files and computer programs; top management doesn't have direct access to responsive group leaders who in turn have ready access to all necessary information resources.

. . . or too centralized

An organization may be too centralized, he added, if: the central organization is unaware of, and unresponsive to, the problems and the opportunities for innovation in the line of organizations; the central office gets weak political support from line management; and if the perception of costs and benefits has become blurred.

An organization that considers shifting toward either greater centralization or decentralization, said Roark, must remember that the old managers, in most cases, will find it difficult to adapt to the new environment. So, as in many areas of decision, we have to approach organization not only on the basis of what we would like ideally, but also on the basis of the organization we have inherited. Perhaps this is the reason so few organizations ever come close to achieving the ideal.

About 300 people attended the two-day SMIS meeting, held in Washington, D.C. The following new officers were elected: Herb Schwartz, AEC, president; Jim Rude, Standard Computer Corp., vp; Dick Dooley, First National Bank of Chicago, treasurer; and Jerry Hoffman, Standard Oil of Indiana, secretary. The following new executive council members were also elected: F. G. Withington, A. D. Little; J. D. Couger, Univ. of California; Norm Ream, S. Leidesdorf & Co.; Don Malcolm, Computer Applications Inc.; John Phillip, Insurance Company of North America. ■

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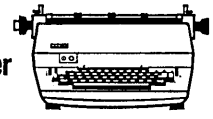

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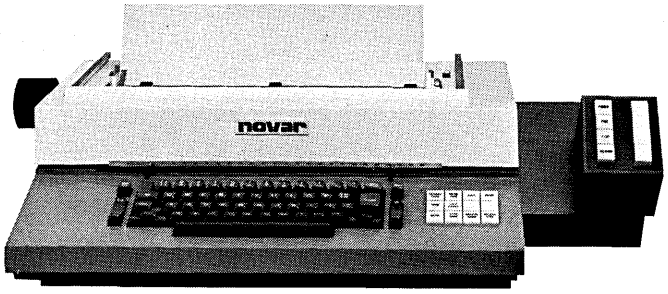

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PERSPECTIVE

an interpretive review of significant developments

An Up Field in a Down-turn: Taxes the Imagination

It's said there's nothing certain but death and taxes. And what could be better in a down economy than a market that can be labeled certain. While there's not much in the first for the data processing industry, there's plenty in the last, much still untapped.

Computerized preparation of income tax returns got going as a business eight years ago when Computer Sciences Corp.'s Computax was formed, the first and still the biggest in a field in which, as one man in it put it, "the companies are proliferating like the sands of the seas."

This month an estimated 40-plus companies are gearing up for the big wave of business which will start building up Jan. 1. They are expecting to process about 1½ million returns by computer this year, up from just under one million 1969 returns.

And this is still just scratching the surface of the market. Of some 75 million tax returns filed last year, about half were prepared by persons other than the taxpayer, and this half is the market the computer service companies are eyeing.

Business is booming

"Initially we had to sell the concept of preparing returns on a computer," said a Computax spokesman. "There's little of that now. It's a matter of which to use and how much it costs."

An officer of Autotax, Falls Church, Va., a division of the Research Institute of America, agreed. "Accountants are very conservative people, but the increasing complexity of tax law is bringing them around to feeling why do it by pencil and to realizing it won't be possible by pencil in a few years."

Computax says it has averaged a 50% increase in business each year over the last four. Autotax, in its sixth year of processing, has experienced a similar steady increase. They are numbers one and two, respectively, of four big firms who sell their services nationally, are fully computerized, and handle all of the many government tax forms. Numbers three and four are Fast Tax of Dallas, a division of Computer Language Research, and Dynatax, Wichita, Kansas, a unit of Dynafax Corp. which operates a national network of six CPA-oriented data centers.

Dynatax, the newcomer in the group, processed some 17,000 returns last year, its first year, and had signed contracts by mid-November which would bring this to more than 100,000 this year for Dynatax alone and to more than 150,000 including work of three licensees. Said Bob Young, Dynatax sales manager, "We were a distant fourth last year, but we expect to pick up considerably this year and to be the biggest eventually."

They'll have to scramble. Computax is the biggest of the all-forms companies by a wide margin and plans to stay that way. And something new has been added to the field of computerized preparation of complex and "sophisticated" returns, an on-line conversational service. This is offered by Multicomp Tax System, Wellesley Hills, Mass., a unit of Multicomp, Inc. Multicomp experimented with its system last year in New York City and Boston and deemed the experiment successful. This year it will provide conversational, on-line tax preparation services to tax practioners, mainly large banks and accounting firms, in major cities up and down the eastern seaboard who will use a variety of terminals they already have in their offices to communicate with the firm's two CDC 3600s in Waltham, Mass.

And Autotax feels it's moving up and claims such "exclusive" advantages as: input forms that require "virtually no" computation by the tax practitioner; an ability to compute a tax using 72 different combinations of data and select the most advantageous; and a network of 100 salesmen who are calling on tax practitioners all year around on behalf of its parent's Tax Research Institute division. And they claim to be the only service which, when their system detects an input error which would lead to an incorrect return, will correct this immediately, even if it means phoning the tax practioner for correct data, and provide a correct return without a reprocessing charge.

Autotax, which has been processing only in Falls Church till now, this year will be processing returns in two new centers in Atlanta and San Francisco. In Atlanta they will be experimenting for the first time with optical scanning of input under an arrangement with Optimation, Inc.

Organization types

The majority of firms in the field keypunch their input, with the notable exception of Digitax, Bethpage, N.Y., which has been using optical scanning exclusively in the four years it has been operating and until this year was the only firm using it.

Digitax, a division of COAP Systems, Inc., is one of the largest of the second group of computerized tax service companies, the so-called low-cost services which concentrate on the less complex returns that numerically account for the bulk of total computer-prepared returns each year. Like others in this group, Digitax franchises its services to groups dealing directly with taxpayers, in its case to what are called Ameritax centers.

While this kind of franchising is widespread among the low-cost service groups, only Dynatax does so among the big four, and it's not so sure this is the way to go. It has two franchisees operating under the Dynatax name, one in North Carolina and one in Nashville, which work through practitioners, and it's not looking for more. The third licensee is S. D. Leidesdorf Co., the nation's No. 11 ranking CPA firm, which provides the service directly to taxpayer clients. This Dynatax likes, according to Young, and more of the same would be welcome. "They have their computer, and we have the system, so it's an easy and good deal for both of us."

Unitax of Whittier, Calif., lays claim to being the largest and oldest of the low-cost services. They processed a quarter million federal returns last year and an equal number of state returns. The seven-year-old company

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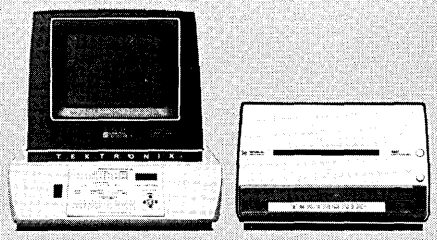

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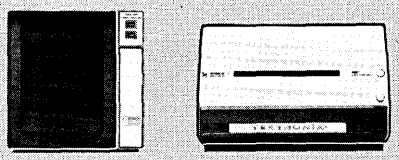

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does its biggest business in California where it has centers north and south. But it also maintains centers in Michigan City, Ind., and Dallas. The Dallas and Northern California centers are new this year. Unitax looks for a 40% increase in business this year.

Walter Farrell of Unitax says the firm's most direct competition comes from Computer Tax Service of Glendale, Calif., and Programmed Tax Systems, Minneola, N.Y., new to the field last year. "And there are a lot of new firms coming in that we don't know much about yet."

Farrell described the Unitax service as partially computerized. In itemized deductions, he explained, "we would keypunch only totals for categories such as contributions or interest, while the fully computerized services keypunch each individual item." This makes for lower cost but restricts them to less complex returns.

Sta-Fed Computer Tax of Cedar Rapids, Iowa, in the same ball park and in its third year of operation, processed 5,000 returns for 40 clients the first year; 33,000 for 370 clients the second year, and anticipates processing 100,000 returns this year. The firm boasts one of the simplest rate structures in the field. Most are so complex it would be difficult at best to quote an average per-return fee, but Sta-Fed charges a practioner a flat $25 when he signs up, at which time he estimates his work load, and after that, a flat $5.25 per client for both state and federal returns.

A privacy problem?

Firms in the field apparantly are experiencing little sales resistance based on fear of confidentiality of information. All say they don't retain any of the information processed; that data is processed at such high speeds it would be hard for anyone to collect anything meaningful from it; and that all personnel are very carefully screened.

An Autotax spokesman recalled hearing of a firm which did retain some data, such as names, addresses, and general income levels, which it peddled to mailing houses but was soon exposed and stopped. "Most of the companies in the field," he contended, "are highly reputable and wouldn't stoop to such activity." And to placate the wary tax practitioner, most can handle "John Doe" returns where the name, address, and social security number are added by the practioner when the return gets back to him.

And what of the IRS? The industry is trying to communicate. The National Association for Tax Return Standards, formed last summer and composed of 16 firms doing computerized tax returns, is pushing right now to get government to provide forms earlier than mid-December. According to Keith Bronitt of Digitax, a co-executive director, an ultimate goal is complete abolition of forms—a system whereby tax payers would get details on plain paper and the services would furnish IRS with the details on magnetic tape. This he sees as seven to ten years away.

The checkless society ... the form-less society ... the Tax-Less Society?????

—Edith Myers

ITT Switches on European Production Lines for the "Rationale" Computers

Production of a new range of computers has been started by ITT companies operating in Belgium and France as part of an ambitious plan involving all the corporation's European companies. Main target is the new generation of telephone exchanges, data networks, and telecommunications message switching systems being built around a central computer controller.

Although these areas of computer application probably will provide ITT companies with their largest single market sector over the next 10-15 years, the development program is set against an atmosphere of uncertainty surrounding the computer business in general. Most of the big manufacturers in Europe still are negotiating among themselves to find the best way of concentrating their resources in this competitive field. Scarcely a week goes by without rumblings of new talks involving two or more of the major European houses.

Against this background the ITT move into the field of mainframe manufacturing may come as something of a surprise. ITT's strategy over the past 11 years has emphasized growth from the outside rather than the potential growth from within the organization. Its acquisition of some 200 businesses to create a multi-product giant and the increase in business from less than $800 million 10 years ago to more than $5.4 billion last year reflect the change from basically telecommunications interests.

Basis for the computer drive rests with the group of telecommunications companies that have always provided the bulk of their revenue from selling equipment to telecommunications administrations. This has involved a multinational business that once provided the majority share of ITT's revenue.

Old business, new twist

Computer development is not new to the corporation's activity. In the late '50s, when only a few hundred commercial and scientific machines had been installed in the U.S. and Europe, one of the first generation machines emerged from ITT laboratories and others were on the drawing board. But shortly before Harold S. Geneen became president and started to restructure the company, a decision was made to halt attempts to enter a field in which so many were struggling. Events of past months show the shakeout of the computer industry is far from complete. This raises the speculation that, at last, ITT has found a formula for success, utilizing the same insight that kept the company out of the computers during the '60s.

Nevertheless, the company has not been entirely out of the computer business — only commercial data processing. The corporation has fostered a steady development program of certain types of other computer systems and electronic switching installations in the U.S., Europe, and in some Latin American countries and Australia. These include control of telephone exchanges, message switching networks, and the handling of information for a medical data proc-

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The one thing they all have in common is that a computer is used to control a large or small communication network of some sort. And this in a nutshell is what ITT's computer activities are all about. It is the adoption of computers by the telecommunications groups as the latest technology in the long chain of developments involving landlines, submarine cables, radio, and so on.

The basis for attack

ITT sees its role as much more distinctive than that of the computer companies which have grown up from the business machines industry. The distinction lies in the difference between data processing systems and communication-oriented computers.

It is the latter which naturally form the basis for ITT's attack. As far as applications go, these can be split into three groups: control of telephone exchanges and message switching; provision of the communications element in large real-time systems; the main part of environmental control systems, such as traffic control and industrial control.

The first two present a huge potential in Europe with the national telecommunications authorities all moving towards stored program control for public telephone exchanges and national data networks.

Belgium's PTT has been the first to act by putting a local public telephone exchange under computer control. The system, built by the Bell Telephone Mfg. Co., the Belgian subsidiary of ITT, incorporates an ITT 1600 machine — one of a series designed for telephone switching. On the basis of two years' operational experience, the Belgian administration has given ITT a contract to extend computer methods to trunk exchanges and to introduce facilities for automatic billing and other services to the telephone subscriber.

In building from local exchanges to trunk routes, a larger machine, the ITT 3200, was developed and built in France by Laboratoire Central de Telecommunication, an ITT central r&d laboratory, and Le Materiel Telephonique, one of the group's manufacturing companies in France.

But work on the telephone exchanges has been preceded by some years by experience in developing and installing other forms of message and data switching systems. Fifteen years ago Standard Telephones and Cables in the U.K. made STRAD — a wired logic store and forward equipment with a drum file. It was adopted by some air traffic control installations, and was followed in the U.S. by the 465L for Strategic Air Command's command and control network. The latter progressed to a full-blooded stored program control with a PDP-1 at the heart of the network.

Switching for the switch

Collaboration between the development teams in the U.S. and the U.K. produced the first computer-based message switching installation in Europe with the ADX 7300. With the accumulated experience, several of ITT's operating companies offered systems design and software services on a turnkey basis, buying the most suitable processors for each job on an oem basis. Initially, the main target still was message switching for air traffic control, telecommunications authorities, and defense. Commercial customers followed. Reuters news agency uses a system to switch the messages from its world network of reporters to selected groups of subscribers. The computer system reads the first paragraph of the messages and then passes financial and economic news to the appropriate analysts and political news, for example, to newspaper foreign desks.

Message switching applications have given birth to the series of DS systems made by Compagnie Generale des Constructions Telephonique — another of the manufacturing companies in France. These accept a number of Telex channels, each capable of carrying 256 duplexed lines of 50-200 baud (alternatively 32 lines at 1,200 baud or 16 lines at 2,400 baud).

A totally different application in a Swedish hospital is the distribution of medical records between a data bank and an operating theatre, an X-Ray department, an intensive care unit, and clinical laboratories. This system combines printed text and analog displays. Yet another requirement came from Pan American Airways for concentrating messages from overseas for dispatch to the U.S. This involves two-way traffic about general flight information, crew scheduling, maintenance stores, and so on.

The British Post Office's Giro system is also a concentrator as part of its work to edit a variety of keyed input devices from which data on money orders and checks is entered on mag tape master files for later processing.

The rationale machines

As data switching applications were growing, so were the specs mounting from within the telecommunications administrations in various countries for computer controllers for telephone exchanges. The work distilled into the ITT 1600 and 3200 processors. Both are integrated circuit machines, one with a 16-bit word, the other 32 bits. The 1600 is made in Belgium by Bell Telephone, and the 3200 is made in both France and Belgium. Essentially, they are systems with multiple highways into and out of high-speed registers with one usec supervisory stores. Tapes and discs can be attached for automatic billing records, transmission line testing programs, and so forth.

These are the current "rationale" machines from which ITT's European companies will extend their computer-based telecommunication work. There are 30 companies in Europe, and they compete for the role of development and production centers of various segments of the rationale family of systems. The standard interface to slot these equipments into the various specifications of telecommunications and computer codes abounding in Europe has been provided by the Laboratoire Centrale de Telecommunication in France.

Some of the display techniques have been devised by Standard Radio and Telefon, in Sweden — first for radar information displays for air traffic control, and then for medical data processing. The German ITT company, Standard Elektrik Lorenz, has, among other things, been developing a computer-assisted PABX that enables medium-to-large organizations to distribute all their telephone, Telex, and computer data through one communications system.

—Pearce Wright ■

NEWS SCENE

IBM Adds New Punch to Product Barrage

When will IBM stop? Its barrage of new product announcements this summer and fall has even included a new version of that old standby — the 80-column card keypunch.

Moving to meet the times — and competition from Univac — the company has brought out the 129 series of three machines: a punch verifier, printing punch, and printing punch verifier.

Card handling rates are the same as those for the 029 — 18 columns per second punching and printing, and 20 columns a second punching. Buffer store that can hold 160 columns of data is expected by the company to increase operator performance. The buffer is another of IBM's solid state memories. In this case, it is seven chips of monolithic circuits of the field effect transistor technology variety. In addition to the two cards of data, the storage can hold six card formats.

The 129 market impact is directly against the Univac 1701 verifier punch and the 1710 verifier interpreter punch. And there is no price umbrella. The Univac VP and VIP units rent for $150 and $155 a month, respectively. Rental for the IBM units range from $125-150/mo.

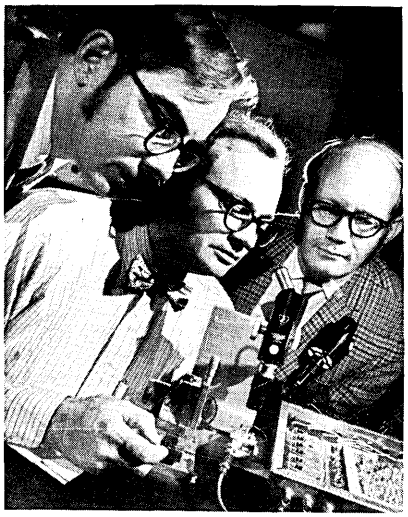
Univac has said it has built 20,000 of the card devices since introducing them in 1968. It too has a 160 column buffer, but it can store only two card formats. However, claims a Univac marketing man, "our verification is better."

He also acknowledges that the market honeymoon is over.

New ICs from GE, Hitachi

The computer business is gone, but GE still has its r&d center in Schenectady, and the latest announcement is a new semiconductor circuit element called a Surface Charge Transistor that can store information on a silicon chip at densities of a million bits per square inch.

It came just after an announcement from Hitachi, Ltd., in which the aggressive Japanese claim the "first major breakthrough in electronics since the introduction of integrated circuits . . . An ultra high-speed, large scale integrated circuit that will cut down the size of computers to one-tenth that of current models and also increase computing speed twenty times."



General Electric Research and Development Center scientists Dr. Richard D. Caertsch, Dr. William E. Engeler, and Dr. Jerome J. Tiemann, admire through a microscope their latest invention, a semiconductor circuit element that can store information on a silicon chip at densities of a million bits per sq. in.

GE's Surface Charge Transistor is based on a new concept for controlling the transfer of electrical charges across the surface of a semiconductor, resulting in high speed and small size. Initial applications are expected in computer memories and readouts, cameras, and analog signal devices. A series of SCTs can be linked to form a shift register by having the circuit elements placed adjoining each other along the surface of a silicon chip, with the receiver electrode on one unit serving as a source electrode of the next. Contact is not made with the silicon surface, except for input or output structures. Shift registers will probably be the first use of SCTs.

The Hitachi LSI boasts an average processing speed of 200 nsec, or five million computations per second. Average propagation delay time at each circuit gate is 1.1 nsec, claimed to be the fastest to date. The new LSIs will be used in a computer presently under development by Hitachi. The circuits are produced through a technique that bonds emitter coupled logic (ECL) i.c. chips onto a multilayer printed substratum. This procedure, called "face-down bonding," has proven sufficiently reliable to enable initial production of 10,000 units monthly. Each unit consists of 10 ECL i.c. chips, 7 registers, 5 data selectors, 3 arithmetic logic units, and a clock driver.

Security Analysts Munch on Peripherals Industry

Even though it was Election Day, there was standing room only at the luncheon gathering of the New York Society of Security Analysts for a discussion on the outlook for the peripheral equipment industry. So the interest is still high even if the stock prices are low. The speakers were Walter Misdom, a vp of International Data Corp., and James Stone, a Quantum Science Corp. vp.

Misdom cited information gleaned from two recent IDC studies. Research has shown that end users perceive such peripherals as tape and disc drives as "integral parts of their mainframe systems" and are much less likely to purchase these units from independents than they are key/tape or COM systems.

In the last two categories, about 80% of the installed equipment is from manufacturers other than the mainframe supplier at given installations. At the other end of the spectrum, of plug-compatible equipment produced in 1969, independents accounted for only 4%, and half of that was sold to oem's. And overseas, according to IDC, end users are even more reluctant to use independents' peripherals.

Unbundling gave impetus to user consideration of independent peripherals, however, and the recession, with its budget tightening, has also helped: the independents' sales pitch of "the same for less" is quite consistent with cost cutting, whereas the typical mainframers' offers of higher performance from higher priced hard-

ware obviously requires increased user outlays.

Speaking of the impact of the 370/145 on the disc drive market, Misdom said the integrated file adapter (IFA) — an integral disc controller — in effect pre-empts a significant portion of the independents' potential sales, since controllers are more expensive than disc drives, accounting for perhaps 30% of the sales dollars of disc systems. And as if this were not serious enough, IBM's pricing of the companion 2319 triple-spindle disc drive is very low, so that it appears there is little room left for the independents to profit.

Other findings of the IDC studies were that bigger users are more likely to use independents' hardware, and the independents rarely find themselves in competition with each other at a given installation. Users who do buy normally take the products of the first independent salesman who arrives. A reluctance on the part of users to deal with more than three vendors was observed; namely, IBM, an independent, and the phone company. Therefore, it would seem advantageous for independents to supply as complete a line of peripherals as possible.

As for competition with IBM, Misdom said that the independents should be able to continue to compete on the basis of technology and price, with a penetration of 25% of the market foreseeable by 1974. New IBM announcements are expected to limit penetration to no more than that percentage, however, and IBM could keep the independents' share lower.

In an example of computer industry market misjudgment, James Stone cited a study his firm recently did of five crt terminal manufacturers which determined that these companies had production capacity exceeding the total market for such terminals by 150%.

Speaking on the "data preparation" market — including key/tape devices — Stone said an excellent example of how good marketing pays off is the continued success of Mohawk Data Sciences: Their products are technologically noncompetitive in today's market, but MDS itself remains competitive through superior marketing. And, surprisingly, Quantum Science has found that Inforex is replacing Computer Machinery Corp. in the eyes of users as the firm thought to be supplying the best data preparation equipment.

During the question and answer period following the presentations, most questions seemed to come from those analysts least familiar with the peripherals business. The problem of IBM's IFA again came to the fore, and Stone warned that many persons make the mistake of viewing IBM as a stationary force. This is dangerous because IBM is always developing new things; when one product is announced, the design of its successor is already under way. Perhaps one ought to be thinking beyond the IFA.

The Viatron Venture Capital Adventure

For those of you who have wondered how Dr. Edward Bennett managed to raise $40 million for his Viatron Computer Systems Corp., you can stop wondering. In a candid talk recently,

Dr. Edward M. Bennett: When raising money, sell risk.

Dr. Bennett, who may well be the computer industry's champion of raising what is commonly called venture capital, revealed his secrets.

Bennett's methods — which he called "hustling a buck" — add up to something of a primer for raising venture capital. His advice will be useful to computer technologists who want to raise money for their fledgling enterprises. Addressing a crowded meeting recently at the Northeast Electronics Research and Engineering Meeting (NEREM) in Boston, Bennett delivered the following hints on raising venture capital:

"Raising money is very much like running for office. You have to put a campaign together.

"The business plan you prepare must be a lie . . . But it must be a detailed and precise lie rather than a vague and general lie.

"If you promise enough risk, loss, and catastrophe, the financier will begin to wonder whether you're hiding something from him.

"Go public as fast as you can.

"It is truly more fun to spend someone else's money than your own.

"You can start small, stay small, and die small . . . Or start big, get big, and die big."

At the time Bennett spoke, Viatron hadn't exactly died, but to many the Bedford, Mass., company appeared to be "in extremis," fending off a host of creditors. Viatron, of course, did indeed start big and was getting very big when the money well ran dry. Bennett was subsequently relieved of his duties and the company struggled to make a comeback.

Bennett's NEREM talk was blunt, straightforward, and, at times, facetious. Some financiers in the room were seen wincing from time to time, particularly when he referred to raising venture capital as "hustling a buck."

Bennett noted that businessmen have been "hustled" regularly by other businessmen with the result that they know the tactics of other businessmen. He suggested that "professional systems men" can have an advantage hustling businessmen, who have never before been approached by systems men.

The former Viatron president — who continued on with the company as a $50,000-a-year consultant — warned against an entrepreneur entering into negotiations with financiers without first assembling a negotiating team. Ideally, the team should consist of the entrepreneur, a systems man, an accountant, and a lawyer, although the team could be added to as different specialists are needed.

The company plan, or prospectus, must be retold and retold by the team until it is refined and, when it is finally told to potential investors in the new enterprise, the team must somehow

be able to communicate that it can walk out of the financiers' office and find someone else to put up backing.

Bennett urged that the team start with small increments — say $15,000 — and work up all the time to larger and larger chunks of backing. At the early stages of forming a company, he suggested that the entrepreneur seek out smaller businessmen like "Chevrolet dealers" who have never tried venture capital investments.

"It's like shooting craps," he said. "Tell them: Here's your chance to lose some money." He noted that people who invest in new companies tend to write off their investment in their heads at the start because of the high risk.

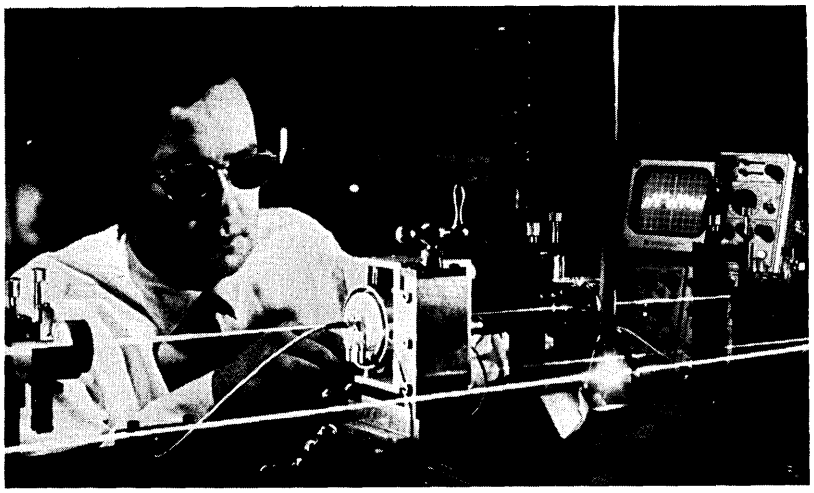
Urging that the founders of the new enterprise commit themselves heavily to the company, Bennett said there should be no "penny stock" for the founders, nor should they propose stock options for themselves at prices the same as or lower than what the financier pays for his stock. He said that "the sweet smell of greed" drives investors away.

Bennett emphasized that one member of the negotiating team be a lawyer. For one thing a good lawyer, he said, will smooth the way to going public. For another thing, a good lawyer well-versed in SEC regulations will help keep a fledgling company out of trouble.

Indeed, at the conclusion of his talk Bennett was asked from the audience whether his lawyer had approved his talk. He answered in the affirmative.

The former Viatron executive also shed some light on his more recent activities. Bennett said he was chairman of the board and chief operating officer of The New Lexington (Mass.) Corp., which he described as a technology "holding company involved in a diversity of new ventures."

Bennett started Viatron with hopes of mass-producing a programmable data management terminal that would lease for $39 a month. The firm ran into a variety of problems and quickly went through most of the $40 million that Bennett raised without generating much in the way of sales or lease revenues. However, the small number of Viatron's terminals that did reach customers earned high marks for reliability, performance, and price from the users.



A gigabit-per-second pulse stream is being impressed onto a laser beam by the optical modulator being adjusted here by its developer, Gerald White of Bell Laboratories. The high speed stream was created by electrical multiplexing of four different streams capable of transmitting 250 million bits of information per second. The gigabit-per-second speed is equivalent to transmission of 200 books per second or a library of 50,000 volumes in about eight minutes.

Doctors Speak Out at Poorly Attended NEREM

As with most conferences held in the second half of 1970, attendance at the Northeast Electronics Research and Engineering Meeting (NEREM) was a disappointment. At 16,500, it was down by 7,000 from last year's turnout of 23,500.

Declining attendance gave a brace of Viatron System 21s — which greeted visitors at the doors of the Boston conference — less to do than had been expected by Registration, Inc., a firm that handles registration activities at a number of shows and conventions throughout the nation. The company used the 21s to record attendance and prepare a complete count and master list of attendees in zip code sequence, as well as a demographic profile of each visitor.

NEREM attributed the drop to the poor economy in general and in particular to drops in r&d contracts in the Boston area.

Digital Equipment Corp. and Wang Laboratories had the largest computer displays at the exhibit, which primarily was a display of components and instruments.

The seminar program, on the other hand, had topics of interest to computer people. One was titled "Technology and Medicine — Closing the Gap." The speakers did not mince their words.

Dr. Mitchell T. Rabkin of Beth Israel Hospital in Boston was highly critical of "The Technologist" who, moved largely by motives of profit, has sold unsafe and unsatisfactory equipment to hospitals. Said Dr. Rabkin: "The mushrooming of companies possessing 'think tank' leaders, futuristic logos on their letterheads, and Buck Rogers names have flooded the unwitting managers of American hospitals with, in large measure, an outrageous, expensive, unsafe, and useless collection of junk."

To Dr. Oliver Fein, of Health Policy Advisory in New York City, much of the blame rests with the medical profession itself. Introduction of computers to U.S. hospitals, he said, has often tended to benefit not the patient but the physician and hospitals who gain because the patient is more efficiently dunned for his bill.

"From the outset," said Dr. Fein, "the aim of the health industry is not to promote the general health and well-being (that would be self-defeating), but to exploit existing profitable markets and to create new ones. The emphasis, then, is not on products and services which would improve basic health care for the great mass of consumers, but on what are essentially luxury items; not computerized equipment for intensive cardiac care units, hyperbaric chambers, etc.... Under present conditions in medicine in America, technology will be applied in a frankly conservative if not right-wing fashion." *(Continued on page 64)*

We have the right combination. The 6155 Dual-Processor.

Another combination of unique features from *The System Builders!* The 6155 Dual-Processor Computer System . . . offers complete big system concepts and capabilities for the medium-scale computer market. In spite of today's mounting costs, we offer this highly sophisticated dual system for the same price that often accompanies a single computer from our competitors.

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EMR COMPUTER
the system builders

CIRCLE 34 ON READER CARD

EMR Division of Weston Instruments, Inc., A Schlumberger Company

Dr. Fein noted that a computer network in New York is a repository for the records of patients in all state psychiatric institutions in six northeastern states. "The potential politically repressive use of such a system is staggering," he said.

Dr. Jerome H. Grossman, of the Massachusetts General Hospital in Boston, said the application of computers to patient care has been "extremely slow and painful." He listed several reasons for the problems, including reliability. "If the computer is the only place where patient data is stored, it must be available at all times. The amount of tolerable downtime is measured in minutes, not hours or days." Use of computer systems in direct patient care, he said, is minimal, and he looks with hope for the successful installation of systems currently underwritten by the government as the most likely way of introducing computer systems to patient care.

Election Woes Again in Maladroit Detroit

All the trouble-spotted cities that had made plans to overcome their computerized election problems (Nov. 1, p. 48) came through in fine style on general election day, except one. Even usually unreliable Fresno had only a minor initial distress when someone loaded the first ballot cards backwards and upside down (that sounds kind've hard to do) and there was a half-hour delay (compared to several days in the primary—that's some kind of improvement).

But Detroit experienced a sad repeat of its primary woes, which once again seemed to be people-prompted, although there is at least one opinion that skulduggery might have been afoot. Write-in and absentee ballots had to be put on punched cards and that slowed down precinct workers, who already were having trouble with voters who were having trouble figuring out how to vote. Some of them took so long, there still were lines waiting when the polls closed at 8 p.m. This caused a delay at the three computer centers, where some precinct workers got so tired waiting to have their ballots checked in, they just went home, taking their ballots with them. True devotion.

Then, there were damaged cards that had to be repunched and, most puzzling of all, what the Detroit newspapers are referring to as the riddle of the mystery punch. The problem revolves around a control area of the ballot card supplied by Datamedia Computer Service, Inc., Dallas, the firm that supplied the system and equipment for the election. This control area, called the M20, should not have been punched but apparently was in some cases during the election. In Dallas, Thomas L. Schoen, president and board chairman of Datamedia, said the only mystery involved was: Who did the unwanted punching and why.

"Certain people — about 3,000 of them — punched out that area of the card by hand after they had balloted," he stated. "There is no other way. In fact, some of the M20 control areas were punched with a *round hole,* indicating a hand punch had been used on them."

Schoen confirmed that his staff people — some 18 programmers, systems analysts, and consultants at the computer centers — were bluntly told they must leave the computer room for "legal" reasons during the vote tally.

"We later found there was no legal reason for our not being present," Schoen said. "Someone was just out to louse up the election."

The M20 control area is a device used in pretesting the election system. (It was protected against punching during the actual election by a plastic blank in the voting machines, claims Datamedia.) If, during the computer tally in an actual election, an M20 hole is punched, the computer automatically stops. It then becomes necessary for an election judge to examine the ballot in question, make sure it is registered properly, and restart the computer. Since the Datamedia personnel had been asked to leave the computer room, this hardware stoppage by the 3,000 or so M20 punched cards was dealt with by people unfamiliar with the system.

"We were continually harrassed by challengers at the polling places and at the computer locations. Someone definitely did not want the election to go smoothly and made sure there was no way it could go smoothly," charged Schoen. "Following the election, all boxes were sealed in the normal procedure; but the minute the vote is certified, we intend to go back into the ballots and isolate those with the M20 punch. This will lead us to the precincts from which the tampered votes came."

Schoen noted that vote counting in the other nine cities in which Datamedia punch card systems were used went smoothly. Detroit will now take back the 3,300 lever-type machines it originally sold to Datamedia as a condition of the contract. Sic tamper gloria Detroit.

CDC, General Telephone Form Brokerage Utility

Two big guns of the computer and communications industries are teaming up to provide computer services for securities brokers.

Control Data Corp. and General Telephone and Electronics last month formed Brokerage Transaction Services, Inc. (BTSI), and their first transaction was to buy up a company which has a program to perform the services BTSI will offer to large brokerage houses.

The new company said it will provide front office services with a message switching and order routing package which CDC has built around its 3300 computer. Back office service will be provided through VISTA, a package the new company received when it acquired Wall Street Information Services last month from John Diebold, Inc.

VISTA (Viewing Instantly Security Transactions Automatically) originally had been written by Programming Methods, a GT&E subsidiary. Wall Street had installed the package in-house at E.F. Hutton & Co. The BTSI service will be offered on-line at charges ranging from 60-80¢ per transaction, depending on quantity. BTSI said a charge of 80¢ will be made on daily volumes of 1,000 or fewer. A 60¢/ execution charge will be levied on daily volumes of 25,000 or more.

CDC's 3300 will be installed in centers in New York, Chicago, Dallas, and San Francisco. One of two centers in New York is operational. Ultronic Systems Corp., another subsidiary of GT&E, will provide terminals and communications facilities. Ul-

The Computer Liberation Movement

The whole thing started when people began to realize they weren't getting the most out of their computers.

Their computers kept getting more powerful. More expensive. But, strangely, the work kept falling behind. Not the pure computing work. But the other things such as printing they were asking the computer to do. Chores, that were wasting capability. Actually choking the computer.

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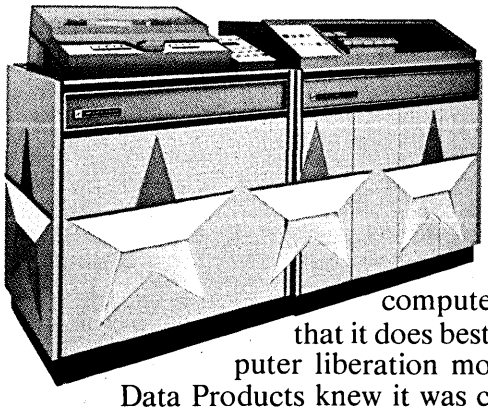

Computer managers, knowing the meaning of productivity, had started to ask questions. Simple, direct questions like: "Why don't we just give our computer the jobs to do that it does best?" And the computer liberation movement was on.

Data Products knew it was coming. We were making computer-liberating equipment long before the need for such equipment became a full-fledged movement.

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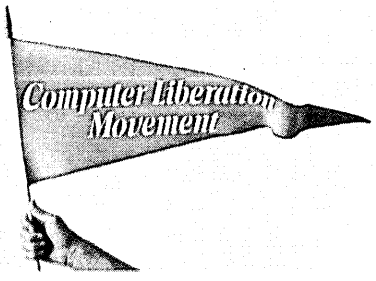

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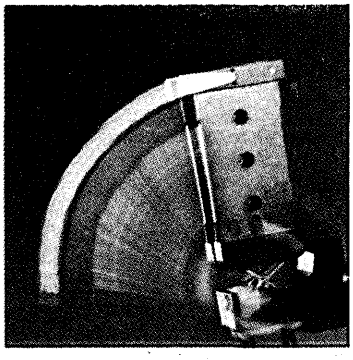
This is what makes it reliable: Our exclusive friction-free hammer. These print the industry's straightest, cleanest lines at speeds over 1500 lines a minute. Without reprogramming. Little wonder, then, that the Satellite is way out front in number of installations.



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The Satellite Printer is just one of our ideas for computer liberation. Our disc memories, core memories and data communications equipment all have a place in the movement. They're on your side.

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The Other Computer Company:

Honeywell

CIRCLE 23 ON READER CARD

tronic operates a 100,000-mile international stock and commodity quotation network with some 18,000 terminals. It operates 56 service centers and will supply the sales muscle for BTSI. Its former manager of brokerage sales, John Byren, was named president of the new company.

CDC to Offer Census Data Massage Service

Censtat Program, a program for massaging census data, will be offered on-line across the nation through the Control Data Corp. Cybernet system.

Users will pay the regular Cybernet tariff (approximately 25¢/system second for 24-hour turnaround time), plus a 20% surcharge. Fifteen percent of the surcharge will go to Westat Research, Inc., Rockville, Md., which developed Censtat.

It is reported to be the first special-purpose package for census users to be offered through a commercial service bureau network. Another novelty is that the Cybernet/Censtat user won't have to pay the set-up, membership, or data-storage charges frequently levied by organizations that specialize in the processing of census data.

Censtat retrieves, processes, and displays the items in published and unpublished census tables. Users' specified criteria and/or statistical constraints — means, medians, and percentages — can control the retrieval operation. The program also reaggregates data to conform within specified geographic boundaries, and it includes a multiple regression model based on the 1960 census, since updated to provide quicker, more detailed estimates of family income than are available from the census data distributed by the government.

IBM Offers GSA Discounts-in-Effect

IBM has granted federal dp users two special options that will significantly reduce the cost of purchasing leased 360 systems and 1401 peripherals in FY'71. The options were written into the FY'71 Federal Supply Schedule contract IBM recently signed with the General Services Administration.

One option gives the feds an extra six months of basic monthly rental credit on any leased 360 system, cpu, or peripheral purchased before June 15, 1971, which has been rented continously since before Dec. 31, '69. The estimated value of this concession is $5 million. GSA officials say the cost of purchasing leased 360 hardware in FY'71 will be reduced 7-13% as a result.

Under the other option, the government can purchase specified quantities of certain currently leased 1401 peripherals by continuing to lease them during the first 11 months of FY'71 and then paying one more month's rent. Eligible peripherals are the 729 tape drive, 1402 card reader/punch, 1403 printer, and 1406 core storage unit. Up to 170 of them can be bought under this option. GSA estimates the saving per unit at "more than 25% of its original purchase cost."

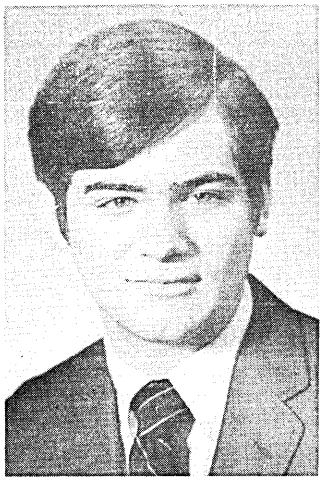
Asked about the impact of these two options on the market for independently made peripherals, a GSA official said the 1401 units to be purchased aren't eligible for replacement by non-IBM plug-compatible units. The special purchase option for leased 360 equipment "may" impact the independents' market, but if a non-IBMer offers a more cost-effective alternative, "he'll get a contract despite the option."

The new supply schedule contract includes the same increased charges for maintenance calls that were imposed on commercial users in July '69, but for federal users the increases are retroactive only to Jan. 1 of this year.

Another change requires agencies leasing some 30 types of punched card equipment from IBM to notify GSA before renewing their contracts. Five independent leasing outfits have contracted with GSA to lease/sell these same types of equipment at 5-50% below IBM's prices. GSA intends to transfer as many IBM leases to independent suppliers as possible.

Claims AT&T Restricts Non-Bell Modem Market

A manufacturer of modems thinks AT&T uses its monopoly control of the telephone system to restrict the market for independently made terminal devices.



Roy N. Ferguson, 18-year old Dallas youth has identified the 21st, 22nd and 23rd perfect numbers (Nov. 15, p. 139). Ferguson's theorem was printed incorrectly. It should have read: $\sum_{P=1}^{N} (2^P-1)=(2^N-1) \quad (2^N-1)$

OK?

General DataComm Industries, of Norwalk, Conn., has sent letters to state regulatory agencies and to the Federal Communications Commission contending that Bell plans to charge users of the 103A data set only $10/month if they use the device for originate-only service. The regular rate for the 103A, which has both originating and answering capabilities, is $25-32/month, the company claims.

If these tariff changes are approved, General DataComm contends, "Bell Telephone subscribers would be effectively subsidizing originate-only data service." By this, it means that the Bell system had not correctly anticipated what data customers needed and designed and made data sets with features that exceeded these needs. "If allowed," it adds, "the subsidy would enable Bell-operated companies to unfairly compete with independent data set manufacturers."

General DataComm has also charged in the same letter that the monthly charge for Bell's data access arrangement (DAA) has been inflated to reduce the appeal of independently made data sets.

Data access arrangements are required with independently made data sets and must be obtained from the telephone company. General DataComm says that since the DAA charge must be added to the price of

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We're winning by introducing three new Nova-line 16-bit mini computers that go faster and cost less than the competition.

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In just 2½ short years we've introduced a complete line of mini computers, software and peripherals, and we've grown from a total newcomer to one of the big three.

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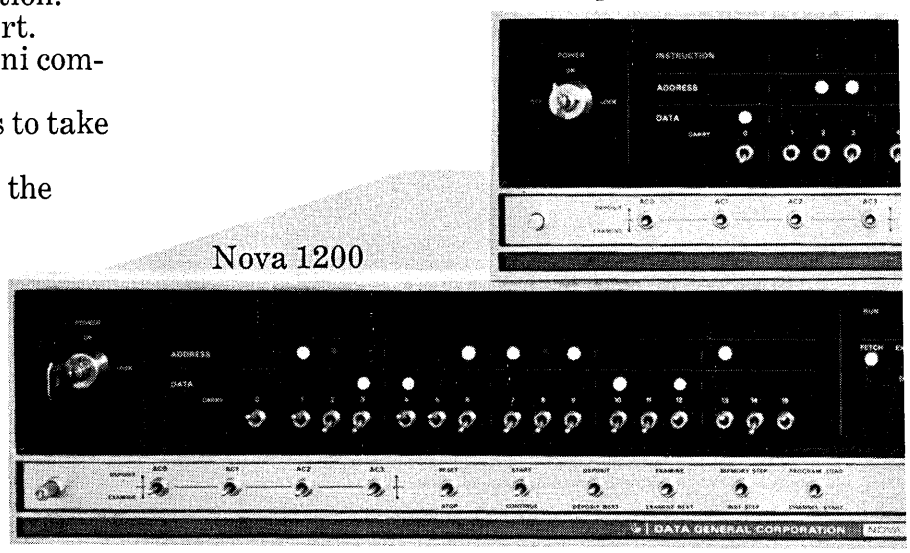
NOVA 800:

A new machine that offers even more speed and performance than the Nova 1200 for the guy who needs it. At a price he can afford.

Supernova SC



The first mini computer with all monolithic memory: SUPERNOVA SC.

There's only one real reason to build a machine around a monolithic memory: speed.

Not just cycle-time speed.

Real speed, that can only be measured in terms of instruction execution.

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It overlaps the instruction execution cycle with the fetch of the next instruction.

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No machine has used it as effectively as the Nova 1200.

We've combined LSI with a high degree of medium-scale integration.

Not just so we could say we did.

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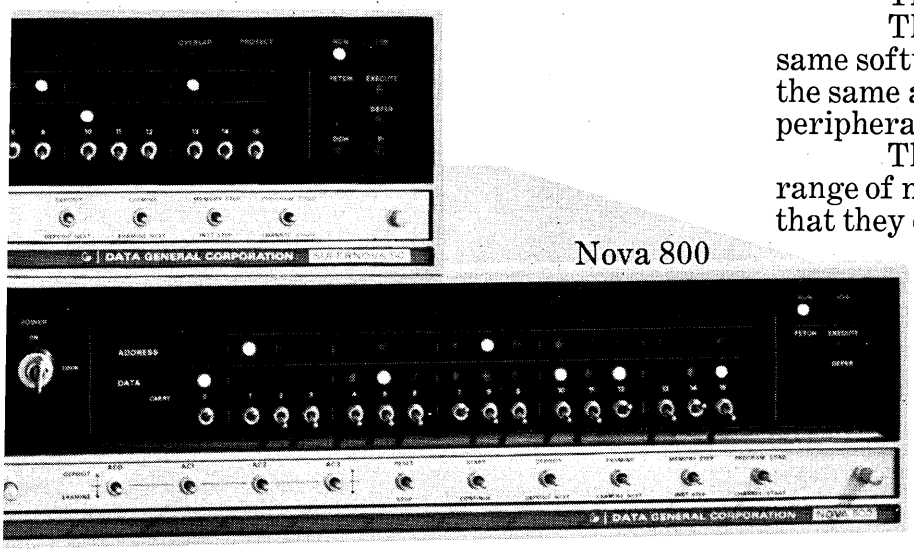
CIRCLE 20 ON READER CARD

WINNING PUTER WAR.



Nova 800

faster than its predecessor, the Nova.

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Organization _____

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CIRCLE 30 ON READER CARD

independently made units, Bell can make its own data sets more competitive by imposing the excessive charge for the DAA.

A DAA (the model F 58118) rents for $4-6.25/month, according to General DataComm. This represents an annual rate of return on the Western Electric selling price of 150-253%. Western Electric is the AT&T manufacturing arm. By comparison, Bell charges for the 103A and 113A data sets produce far lower rates of return of 78% and 70%, respectively.

General DataComm has asked all state regulatory agencies to investigate Bell tariff filings that cover data sets and data access arrangements and to prescribe compensatory rates. It's also asked the FCC, in conjunction with the states, to make Bell data sets and DAA tariffs more accessible to independents and to give these firms more time to object. Today, the objection period is within 30 days of filing. The company wants it increased to 60 or 90 days.

NYC-D.C. Microwaves

Western Union applied to FCC for permission to offer digital service between NYC and Washington, D.C., and announced plans to do likewise between NYC and Chicago. Both facilities would be "overbuilt" onto existing analog microwave systems. The NYC-Washington link would be in service to Philadelphia late next year and to Washington by early '72. Interdata Communications, Inc., which has filed for a competing NYC-Washington service, probably will object to WU's application, says a knowledgeable source. "Interdata has already applied for this route, and its application deserves to be considered first," he explained. Earlier, Western Union asked FCC approval to build a hybrid digital-analog microwave system between Atlanta and Cincinnati. Two MCI carriers have objected to this proposal.

Satellites Way Out

FCC chairman Dean Burch indicated it would be some time before any U.S. domestic satellite systems are authorized. The unresolved questions include: (1) whether technical efforts to

develop the 12, 18, and 30 GHz portion of the radio spectrum are successful, thereby expanding the limited number of orbital slots available; (2) whether the broadcast networks put up their own system or lease space from a carrier. A network-operated system, he suggests, would tend to reduce the potential market for common carrier-provided satellite services, and reduce the number of licensees that would be authorized; (3) what facilities are provided for local distribution of satellite signals. This question involves "such factors and the role of CATV as a local outlet for (non-tv) services, whether satellite applicants should build new intracity distribution facilities making partial use of microwaves, and whether there should be interconnections with the existing or new facilities of . . . the telephone companies." Burch spoke at an electronic and aerospace systems conference in Washington sponsored by IEEE.

Vanguard Goes, and Datascribe Goes North

The Datascribe key-to-tape recorder was hailed by users as an outstanding system. In less than 2½ years of production, Vanguard Data Systems of Irvine, Calif., had installed 150 of them valued at close to $2.5 million.

Last fall when Tally Corp., of Kent, Wash., was considering acquiring Vanguard's assets, it checked with virtually every user of Datascribe and determined that what it heard of the machine's high quality was indeed shared by users.

Today, Vanguard is no more — Datascribe production is being moved to Kent; Tally is in the key-to-tape business; and some 80 Vanguard employees, including president and founder Alexander M. Bradley, are out of work.

In a cash bind through most of its two years of business, Vanguard's troubles worsened early this summer when current expenses exceeded lease revenues and the firm's accounts payable mounted to $654,000. It filed for reorganization under Chapter 11 of the Bankruptcy Act. "Our inability to secure a third-party leasing arrangement was the chief cause of our trouble," Bradley said recently. Tally leases its equipment through an

If you don't think pictures are the best way to communicate, go home and watch your radio.

No, we don't make TV sets. We make Interactive Graphic Terminals. One big difference? You can talk back to our terminal. Directly. Right on the screen itself using a light-pen, keyboard or a number of accessories. And, most important, any computer can talk to it too. (That's right, *any* computer.) To a computer, our terminal is a high-speed peripheral. To more and more computer owners, it's a fast, economical way to visualize problems in process control, NC programming, computer-aided design and simulation. The price? $19,800 with OEM discounts available. We think we have the best price/performance ratio you can get. Make us prove it to you.

Right now we have interfaces for these computers. CDC 1700; DIGITAL SCIENTIFIC META™ 4; HP2114B, 2115A, 2116B; REDCOR RC 70, RC 77; VARIAN 620/i. If you don't see yours, contact us . . . chances are we're working on it.

VECTOR GENERAL

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Phone (213) 346-3410

CIRCLE 11 ON READER CARD

arrangement with Transamerica Computer Co.

Tally, a manufacturer of data communications systems and peripherals, paid $1.1 million for Vanguard's business, consisting of 66,000 shares of stock and $147,000 in cash. Then it announced it would move all production to its headquarters in Kent and invite "a few engineers" from Vanguard to come along.

NEWS BRIEFS

Going, Going . . . ?

Maybe the luck of the Irish will do it, and it'll take at least that to keep ailing Scientific Control Corp. going.

The trouble-plagued Dallas company, which literally went "from the frying pan . . ." when it was bailed out of bankruptcy by Penn Central affiliate Great Southwest Corp., was down to about a dozen employees in "a holding pattern" last month, all waiting to see if Richard Kelly could pull them out. The elusive Mr. K, who made it big in cosmetics then branched into oil and real estate, would have made Scientific Control his entree into the computer industry if an agreement in principle he reached with Great Southwest for its 50.9% interest had been consummated within an agreed time period. It wasn't, so Kelly is just one of "several interested parties." The others were described by SCC president John Boness as venture capital and electronics prople.

But at press time Kelly was still rated the most active of the potential buyers and Boness said "some encouraging progress" was being made. In addition to the $1/4 million purchase price, Kelly must come up with enough working capital to "get the firm going under a workable plan of operation." Maybe he can do it.

Software Gets the Call

Informatics, Inc., Canoga Park, Calif., software firm which lays claim to being the catalyst in a current federal government push toward more centralized software procurement, already is benefiting from same.

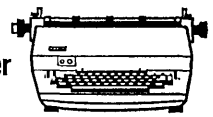
The firm is selling software to government agencies without agency-by-agency negotiation and its accompanying competitive bidding, and it says it's because government finally "has recognized software packages as products." Informatics received the first CALL contract issued by the government for a general-purpose software product and has sold some 12 installations of its Mark IV file management system under the contract which sets a standard procurement base by which any government agency can acquire the system. Conditions and prices set forth in the contract make Mark IV cheaper to government agencies than to commercial customers. It also cuts time of selling an agency from some four months to "a week or two."

Plenty of Time

Organizers of the "Counter Conference" in Boulder, Colo., next August received generous press coverage

This unit makes the output typewriter in the Facit 3851 — the conventional typewriter with input/output. It is also available in two other versions — output only and input only. All three provide full utilization of the 7-bits code.

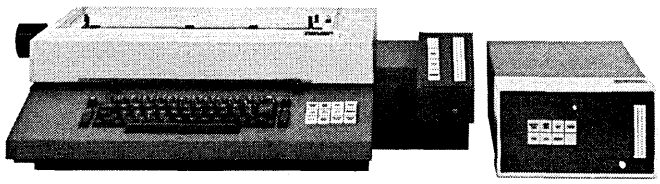
There is further interesting information on the new Facit 3851 in this publication.



Facit 3851 - the conventional typewriter with input/output

For further information, contact
in US: Facit-Odhner Inc., 501 Winsor Drive, SECAUCUS, New Jersey
outside US: Facit AB, Albygatan 102, 171 84 Solna, Sweden

CIRCLE 15 ON READER CARD



It's the complete business data communication terminal — it can also be used as a regular electric typewriter—as a high-speed interoffice teletypewriter — as an automatic letter writer. It's the versatile Novar 5-51 System.

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CIRCLE 45 ON READER CARD

the real $39 a month CRT terminal from the real real-time people

Somebody promised you a $39 computer terminal. Bunker-Ramo delivers — the 2210.

It breaks the $$$ barrier for on-line terminals at bank teller stations, factory assembly points, hospital wards, credit departments, utilities, warehouses and countless other locations.

The 2210 has all the necessary features: tab, fixed format, skip, computer-call, variable lay-out, conversational mode, plus a special block keyboard for easy operation by non-typists. Interfaces with present data processing systems without costly modifications.

Price includes maintenance by Bunker-Ramo's nationwide field service staff.

Before you install any — or buy more — CRT's, contact us for complete information on the economical, easy-to-use 2210.

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YOUR UTILITY SERVICE IS THE BEST BARGAIN TODAY!

OPTICAL SPEED READING

new answers to the challenges of costly data conversion, paper work and errors

Until now, the time and money saving benefits of Optical Character Readers could only be enjoyed by big businesses . . . special users like banks . . . or those who could justify a major initial investment. But Control Data believes everyone should be able to enjoy OCR speed and accuracy. So now CDC offers an entire family of OCR systems to fit any budget.

The day of the versatile, multi-purpose OCR is here

For anyone wanting to speed input from a wide variety of sources, Control Data announces the CDC® 955 . . . our newest family member. It's actually two machines in one . . . a page *and* document reader in one versatile system. High resolution optics enable the "955" to read material from typewriters, high-speed line printers, and journal tapes from cash registers and adding machines. It also recognizes degraded print from carbons, poorly inked credit card copies . . . even handprint! And it accepts up to nine different upper and lower case fonts at 750 characters per second.

Insurance firms, utilities and banks now can process a range of material and avoid bottlenecks. Service bureaus, credit card concerns and other large volume users can drastically reduce headaches in billing and accounting. And because of the upper and lower case option on the "955" graphic arts people can set type directly from typewritten copy.

Reads 90,000 documents an hour

The CDC® 936 Document Reader is an extremely efficient, high-resolution OCR with a brain. Not only does it convert information into computer-ready form quickly, it also edits, audits and formats the data for your business.

Because it's a stand-alone unit, data input is instantly recorded on its own magnetic tape transport. No need to tie up your central system.

A single reader can replace up to 90 keypunch stations

For businesses large and small, the CDC® 915 Page Reader is the low-cost answer for direct data conversion. The "915" eliminates time-consuming keypunching and related expenses, saves main-frame computer processing time and costs. Assures greater accuracy too. Any typist can prepare your computer input.

What's more, you don't need a Control Data installation to take advantage of a CDC optical reader. The "915" adapts to any computer system with compatible magnetic tape.

At last: an OCR that keeps pace with large-scale computers

The CDC® Super-Scale OCR system can supply all the necessary input for a data base of 50 million records! It's already satisfying supercomputer data appetites in the world's largest bank.

An entirely new optical scanning system is so fast, it can read and store information from a 1,000-page novel in a mere six minutes! But speed is just part of the story. It can also be programmed to read only specific areas of a document, while ignoring nonpertinent portions. Yet it provides a price/performance ratio three times better than the next most powerful OCR system . . . and at a lower cost per record than anything else.

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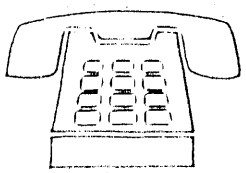
No one offers more extensive experience in both the number and variety of optical reader installations than Control Data. One of our family members is ideally suited to your needs. Plus CDC offers fully developed software and a highly specialized sales and analyst support team to help you achieve fast, efficient data conversion . . . eliminate costly keypunching errors. To discuss your application, call our HOT LINE collect.



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CONTROL DATA
CORPORATION

CIRCLE 17 ON READER CARD

last fall in, of all places, *Communications of the ACM.* The group of ACM mavericks, objecting to the selection of Chicago as site of the ACM '71 conference, decided to hold their own version of the society's 26th annual meeting. The ACM journal printed a 200-word announcement of the Counter Conference's call for papers — with only one slip. Inadvertently, it is thought, it misprinted the paper deadline as Feb. 1, 19971.

ADR Receives Patent

The first software patent (Aug. 1, p. 63) has been delivered to Applied Data Research, Inc., Princeton, N.J. Numbered 3,533,086, it protects the firm's Autoflow automatic flowcharting system, and is believed to be the first patent granted to any company for a software product that is actually being marketed. The patent is about 130 pages of small type.

NEW COMPANIES

Launching a brand new company isn't the in thing in this closing month of a difficult business year, but it's still being done by a daring few. Ian Ebel, a man with a plan, got **International Minicomputer Applications, Inc.,** going to serve the software and marketing strategy needs of minicomputer manufacturers, and his optimism was matched by the goals of his plan to have eventually 60 offices throughout the country.... **ACI Systems Corp.** was founded in Chicago to offer what it describes as "a new generation of automatic transportation equipment identification scanners and label-decoding processors." The new company's president, W. H. Thompson, formerly operations vp and general manager, Illinois Central Railroad, said the firm's equipment and systems are extensions on the Automatic Car Identification (ACI) system adopted by the Association of American Railroads in 1967 which resulted from collaborative efforts of Intermodal Transportation Systems, Inc., Hoboken, N. J., and Computer Identics Corp., Westwood, Mass.... **Cogar Corp.** has established a wholly owned German subsidiary in Frankfurt. Initially the company will market the Cogar MOS memory line.... **Computer Payroll Co.,** new Garden Grove, Calif., firm, claims it has found the "way to go"—concentrate on one application. In this case it's a multicompany payroll system.... Aerojet General Corp. branched out with formation of the **Aerojet Electrosystems Co.** in Azusa, Calif., to provide electronic sensor and data systems for military and space requirements....**Facit-Odhner, Inc.,** Secaucus, N. J., formed two new operations to serve the oem market, the OEM Components Dept. and the Data Products Systems Dept.... **Digital Equipment Corp.** moved into the West with establishment of a new service group, DEC Computer Special Systems Group, Anaheim, Calif.

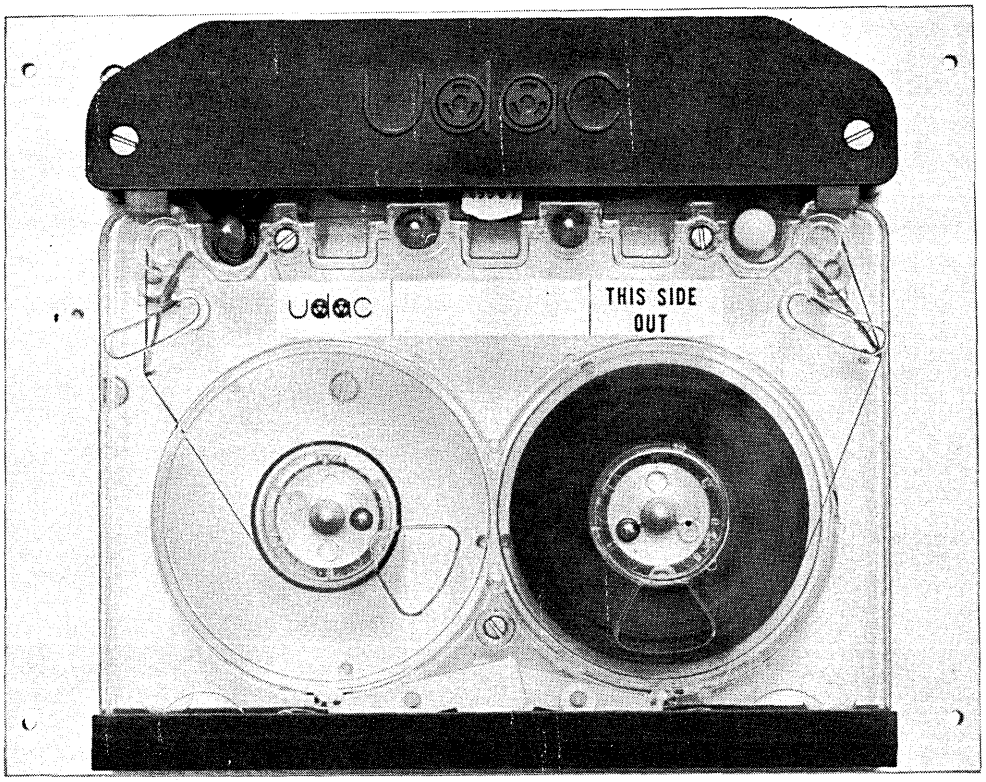
MERGERS, ACQUISITIONS

Two years ago **California Computer Products, Inc.,** the Anaheim maker of computer graphics equipment, decided to put up $1 million to get a fledging disc drive manufacturer into business. It was a brilliant move. That new company—**Century Data Systems** — in two years has become a major force in the IBM 360 plug-compatible market with a successful line of IBM 2311 and 2314 replacement disc drives and with orders from other mainframe manufacturers. Early last month, CalComp, which had a 65% interest in Century, exercised an option to acquire the remaining 35% to take full control of the company. It was a good move, too, for George M. Canova, Century Data's president and chairman, and for other owners of the company. They received $15 million in CalComp stock through the transaction.... Other hardware firms were on the merger path last month. **Certron Corp.,** Anaheim, Calif., manufacturer of audio tapes and related equipment, moved into the computer field by swapping 125,000 shares of stock for the magnetic computer tape business of **MAC Panel Co.** of High Point, N. C.... In Mountain View, Calif., **Magnecomp, Inc.,** which used to buy memory discs from outside sources and plate them, acquired **Jensen Munro,** a manufacturer of discs, and thus emerged as a source of discs made from raw material through plating.... In **Docutel Corp.,** the Dallas systems house which sold financial systems products and an automated baggage- handling system, **Recognition Equipment Inc.** had a good investment; but cash problems made it difficult to fully exploit Docutel's capabilities. Last month REI unloaded its 53% interest to **Information Processing Corp.,** a privately owned facilities management firm. It still retains 5% of the action....

SHORTLINES

Now it's official! RCA has finally announced what the industry has known for some time, that it will move its Information Systems Group and its Computer Systems Div. from Cherry Hill, N.J., to Marlboro, Mass., where it will erect a $16 million building to house them adjacent to its $22 million peripheral production and engineering and design facility. Management, administrative, marketing, and financial functions will begin the move next year. Some support functions, including field engineering and systems programming, will remain in Cherry Hill ... A pause in an overseas phone call may cost the caller but it won't tie up a circuit when a new computer controlled system developed by Bell Laboratories is put into operation monitoring calls to increase the capacity and reliability of overseas circuits. If a speaker pauses, the system switches his circuit to another speaker with neither being the wiser and it continually tests for defective circuits too ... Photon, Inc., and Autologic, Inc., a subsidiary of Alphanumeric, Inc., have signed an agreement giving Photon exclusive marketing rights to a new phototypesetting system using crt and computer techniques developed by Autologic ... The Minnesota Mutual Life Insurance Co., St. Paul, is developing a $6 million information system which it is beginning to implement this month with installation of a 360/50. A 370/155 will be added next year. Target date for complete implementation is late '72.... The telephone interconnect industry, born of the 1968 Carterfone decision, has its own voice in the form of the new North American Telephone Association, headed up by none other than Thomas F. Carter, president of TeleFone Communications Inc. ■

Computer Expander



UDAC's Model 160 Tape Deck

Imagine a compact unit so versatile and flexible it can "double in brass" as a: Buffer Storage Device, a Data Collection Device for Audit Trail purposes, a Memory Augmentation Unit for Terminal and Mini-Computers and as a Replacement for Paper Tape Punches and High-Speed Readers. That's UDAC's new Model 160 Tape Deck. It gives data faster . . . more reliably . . . and at lower cost, too!

USES CARTRIDGES —

Up to 1,440,000 characters at 400 bpi are stored in UDAC's "snap-in/pop-out", 5″ x 7″ cartridges. There's no threading, no reel locking, and any format consistent with bit density can be used: RZ, NRZ, NRZI or RB. Accepted data returns by a record status line to external equipment.

OPERATES IN FOUR MODES —

I. Record and playback on command by character.
II. Record on command by character and playback slew rate with no blocking.
III. Record and playback slew (block command).
IV. Record and playback, 8-level code by character.

REPLACES P/T PUNCH AND HI-SPEED READER —

Two available options, a Read Pre-amp/Write-Erase Driver Card and a Data Dispatch Card can be interfaced, permitting the basic deck to function as a Paper Tape Punch and High-Speed P/T Reading unit.

GIVES OEM'S A COMPETITIVE EDGE —

If you are a Computer OEM, the Model 160 Tape Deck can add both utility and versatility to your line regardless of size. Result: more sales to more markets in less time.

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udac

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puts it all together.

UBC is a *total* communications company.

Data communication systems and products *plus* on-premise voice communication systems and products from one single source, United Business Communications puts it all together.

Although we opened our doors for business in January, 1970, we were really born two years earlier. That's when we set out to build an alert, fast moving *total* communications organization. A company designed to meet the demands of business communications in the seventies.

Our parent, United Utilities, Incorporated, a billion dollar plus corporation, is a holding company whose properties are almost entirely communication oriented. They operate the third largest telephone system in the nation.

Our people—a select, hand-picked group—have a remarkable background in design and application of data and voice communication systems.

Supporting UBC are communication equipment manufacturers that date back more than 80 years.

North Electric, one of the nation's original manufacturers of telecommunications equipment, supplies our customers with an advanced line of quality PBX systems.

Expanding our PBX line is Fujitsu, a major Japanese manufacturer known the world over for its communication equipment.

Rixon Electronics supplies data transmission expertise and equipment like data sets and multiplexers.

Rounding out our product line is GDI, Inc., supplying computer and terminal peripheral equipment, including card punches, card readers and card transmitters.

Total communications in one company, UBC.

With sales and service offices in principal U.S. cities, Canada and Europe.

Backed-up by in-depth systems and application engineering support.

And expert installation, training and service.

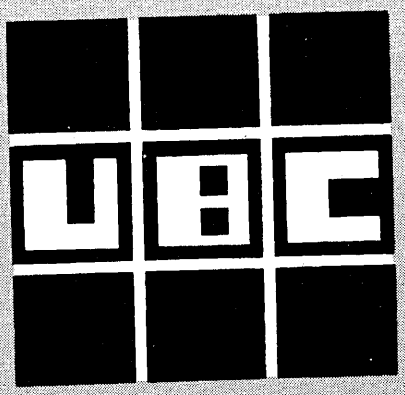
At UBC, in putting everything together, we took one more important step. We offer you the choice of purchase, rental or lease plans.

Today, UBC makes it possible for you to take maximum advantage of the most sophisticated, commercially available data and voice communication equipment; interconnect with the nation's telephone system; and benefit from the utmost efficiency and economy in your communications system.

Now you know a little about us. If you want to know more, please write.

Tell us about your communication needs and problems. We'll tell you if we can help you *and* we'll tell you if we can't.

At the very least, you'll know we've put it all together in one single source.



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Today's fast moving communications need a total communications company.

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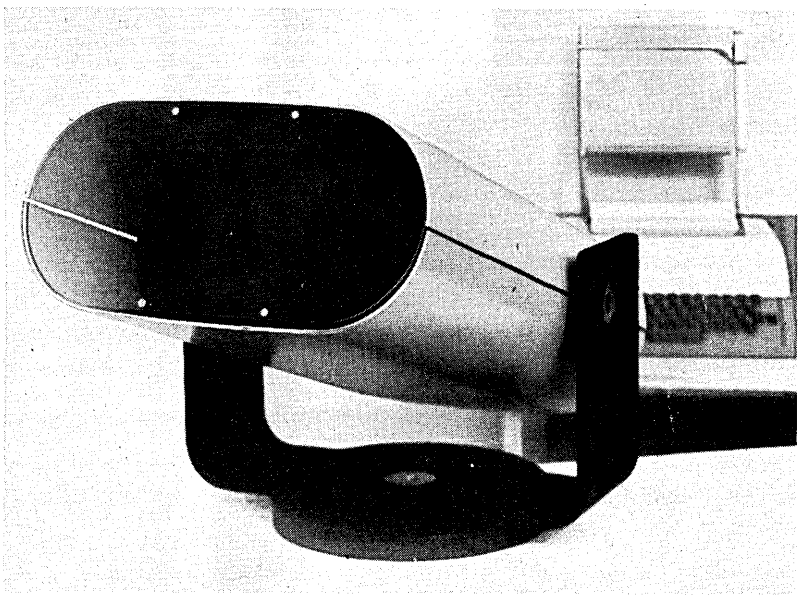
CIRCLE 43 ON READER CARD

Optical Data Link

What looked like a one-off custom designed optical transmission system in January (p. 125) has been developed into a product line consisting of three members. The OCL 300, 310, and 400 digital and analog communications links use infrared light to allow a customer to save money on phone bills, microwave links, FCC licensing, and cable runs, it is claimed. This system might be very useful for a company that is spread around a complex where remote terminals are within five miles of the computer.

One might think this approach to data transmission would be inherent-

PRODUCT SPOTLIGHT



ly error prone, but error rates of one bit in 10^8 for the units is said to be 100 times better than phone lines. Automatic gain control helps compensate for variations in path loss due to adverse weather, and an optional front glass heater is available for "all-weather" operation. That probably includes rainstorms but precludes snowstorms.

The OCL 300 is for synchronous operation at 2-50 kilobaud, or asynchronous operation up to 5 kilobaud, with a range up to five miles at 50 kilobaud in clear weather. The OCL 310 has a maximum range of one mile for 350 KB to 3 megabit transmission rates, and the OCL 400 has an analog bandwidth of 60 Hz to 4.5 MHz and a range up to five miles. The vendor claims the OCL series interfaces with standard data sets. A system including two data sets and a pair of the optical transmit/receive devices is priced at $6K. UNIVERSITY INSTRUMENTS CORP., Boulder, Colo. For information:

CIRCLE 371 ON READER CARD

Document Scanner

The Model 220 document entry/systems terminal sounds like a digitizer masquerading as an ocr unit. Intermixed documents up to 8½ × 14 inches containing printed, written, or graphic information are scanned with a standard resolution of 120 points/inch, and converted into serial data for either on- or off-line computer usage. There is only one moving assembly in the 220—the document transport platen. The unit is designed for business office use something like a copier. The operator can control the scan rate from a document every few minutes up to one each two seconds. A standard unit transmits at one kilobaud up to one megabaud, with two megabaud optionally available (as is resolution to 300 points/inch).

Available early next year, the 220 is priced starting at $12K. DEST DATA CORP., Sunnyvale, Calif. For information:

CIRCLE 372 ON READER CARD

Data Entry

Information is recorded simultaneously on magnetic tape using the 220 Typescribe which consists of a standard IBM Selectric typewriter and deskside magnetic tape unit. A search feature allows the typist to access specific pages, lines, and characters on the IBM-compatible cartridge unit for corrections. When finished preparing the data, the operator can either hand-carry the tape to the vendor's tape pooler for consolidation on standard ½-inch tape, or process directly from an IBM 2495 tape cartridge reader.

Options include the ability to type out the recorded data on the Selectric, an English character display to

assist in correction of errors on the tape, and a page counter.

Less the Selectric, the unit is priced at $3675, or can be leased for $90/month including maintenance. DATA ACTION CORP. Minneapolis, Minn. For information:

CIRCLE 373 ON READER CARD

Line Printer

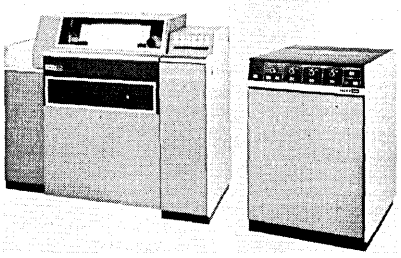
A 600-lpm printer with interface and software for the Nova and Supernova computers is housed in a sound deadening enclosure and features a 64 character set, 132 columns per line, and 10 characters per inch spacing. The printer can accommodate paper widths of 3½ to 19½ inches, and includes an 8-channel vertical format control unit. Options are special characters and a 12-channel vertical format control unit. Single units are priced at $11,500. Delivery requires 60 days ARO. SYSTEMS EQUIPMENT CORP., Atlanta, Ga. For information:

CIRCLE 381 ON READER CARD

Printer/Controller

Give and take is the theme of the 5403 train printer and 5821 printer control unit. The system is said to give 10% more printing speed than the IBM 1403/2821 combo it is intended to replace and take approximately 12% less money on a one-year lease contract. The 5821 can control up to three 5403 printers and a 2540 reader/punch, and is plug-to-plug compatible (replacement equivalent) with all 360 systems above the model 20 and with the 370 series.

The printer is rated at 1200 lpm for a 64-character train, 1500 lpm for a 36-character train, and up to 2500 lpm in a burst mode using a "somewhat limited" 16-character set. Off-



line or concurrent on-line/off-line operation capabilities are attributed to the printing system.

An interesting feature is the built-in memory which remembers the forms-control loop after one cycle, enabling printing to continue even if the tape loop should break. Options include a power stacker, increased line skip speeds, console indicators signalling top of forms point and unlatched train gate, and an operator-interchangeable 288-character array.

The microprogrammed 5821 controller also contains storage capability, in this case for self-contained diagnostics and field modification to any of five versions to accommodate a variety of configurations. In the future this might include making the unit into a disc controller. The 5821 controller rents for approximately $805/month, and the 5403 for approximately $910/month on a one-year contract. Longer lease arrangements, as well as purchase agreements, are also available. TELEX COMPUTER PRODUCTS, Tulsa, Okla. For information:

CIRCLE 375 ON READER CARD

Typesetting Terminal

The model 185 terminal allows a user to process unjustified paper tape from a remote site using either dial-up or dedicated lines. Capable of handling either 6-level advanced feed hole or 8-level paper tape, the device plugs into existing reader and punch connectors on either IBM 1130 or DEC PDP-8 computers. Data transmission of 100 cps over Bell 202C or D or equivalent data sets is accommodated by the 185 terminal, which the computer treats as just another paper tape reader/punch that might be in the same room. No hardware or software changes are required to put the 185 on the air.

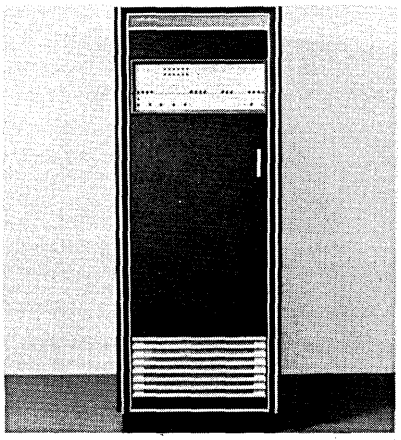
The 185 is priced at $6800 for the multipurpose model, $4400 for the input-only model which includes a built-in photoelectric paper tape reader, $5900 for a remote-only, and $5700 for the local-only model. These are full-duplex models; half-duplex models are slightly higher in price. Delivery is 60 days ARO. VISTATYPE CORP., Santa Ana, Calif. For information:

CIRCLE 376 ON READER CARD

Midicomputer

While the majority of computers have roughly similar ways of doing things, the MACROPROCESSOR doesn't go along with the crowd much at all. It processes operations from a macro library in parallel; while accomplishing a byte-by-byte multiply in 375 nsec, it can be doing up to nine other operations as well. The basic machine cycle is 125 nsec. And though it is described as a general-purpose computer, the vendor touts its best applications as data analysis, signal processing and conditioning, convolution, spectral decomposition, Fourier analysis, speech analysis and synthesis, and "similar tasks which require extensive computation in real- or near real-time and are characterized by short word lengths."

Up to 64K of 1-usec core can be amassed of 4K increments starting from the basic 16K. Word sizes here are 18 bits (two bytes plus two parity bits), while in the 64-word scratchpad, expandable to 256 words, the size is 16 bits. The word size in the 64-word capacity instruction pad is 28 bits. Perhaps this is why the



vendor doesn't feel many programmers will write their own packages using the "primitive instruction" manual.

There are 24 hardware index registers for program control, and they are of different lengths, too. The ASCII code machine (EBCDIC is also available) does 2's-complement and sign magnitude arithmetic. I/O is through a single channel with 16 positions and a maximum available transfer rate of 8 MHz; there is one priority interrupt level, but no direct memory access capability.

The manufacturer will provide a turnkey installation ranging from the hardware described above as a stand-alone processing system, to an add-on installation for a customer's present configuration.

The basic MACROPROCESSOR is available 90-120 days ARO for something under $100K. CULLER-HARRISON, INC., Goleta, Calif. For information:

CIRCLE 377 ON READER CARD

Modem

The 2200/20 modem operates over either dial-up or dedicated phone lines at 2,000 bps, and is compatible with Bell 201A type data sets. When operating over dial-up lines, it uses either manual or automatic-answering Data Access Arrangements. The price is $2,450. INTERNATIONAL COMMUNICATION CORP., Miami, Fla. For information:

CIRCLE 388 ON READER CARD

(Continued on page 83)

George wanted to build a 3,000 mile wide computer

That may sound crazy, but Dr. George Feeney's crazy like a fox. Because he got his way-that computer exists.

I'll never forget that day I walked into his office and he said: "I want a central file you can access from anywhere in the country—or Europe, or the whole world."

(Sure, George, who's going to lay a new transatlantic cable for us?)

"And" he continued, "I only want the customer to have to pay for a local call."

(That had to be a put-on, but he's the boss. Did he have *any* ideas on how we pull this off?)

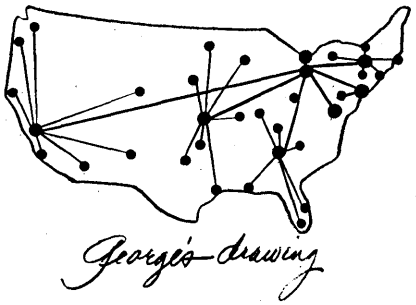
He did.

"Look," he said, "we've already developed the world's best communications system for our Mark II, using a GEPAC-4020 central concentrator hooked to the GE-635. Let's take the 8 remote concentrators that tie into that central concentrator and deploy them across the entire country.

Then, fan out a whole bunch of multiplexers from each one, so our customers can call a single system with a local telephone number from every major metropolitan area."

"You get it?", he said. As a matter of fact we didn't.

So he drew this diagram.



George's drawing

Then he said, "Do it. And use a satellite to get to Europe. It'll be the Time-sharing system that only EDP people can love."

We did. And they do.

Oh, yes — we call it General Electric Network Service.

And EDP men across the country have really taken it to their hearts. They're using it for inventory control—all kinds—from auto parts to reservations.

They're using it for capital budgeting—with multi-location input.

They're using it for nationwide sales reports.

What else can it do?

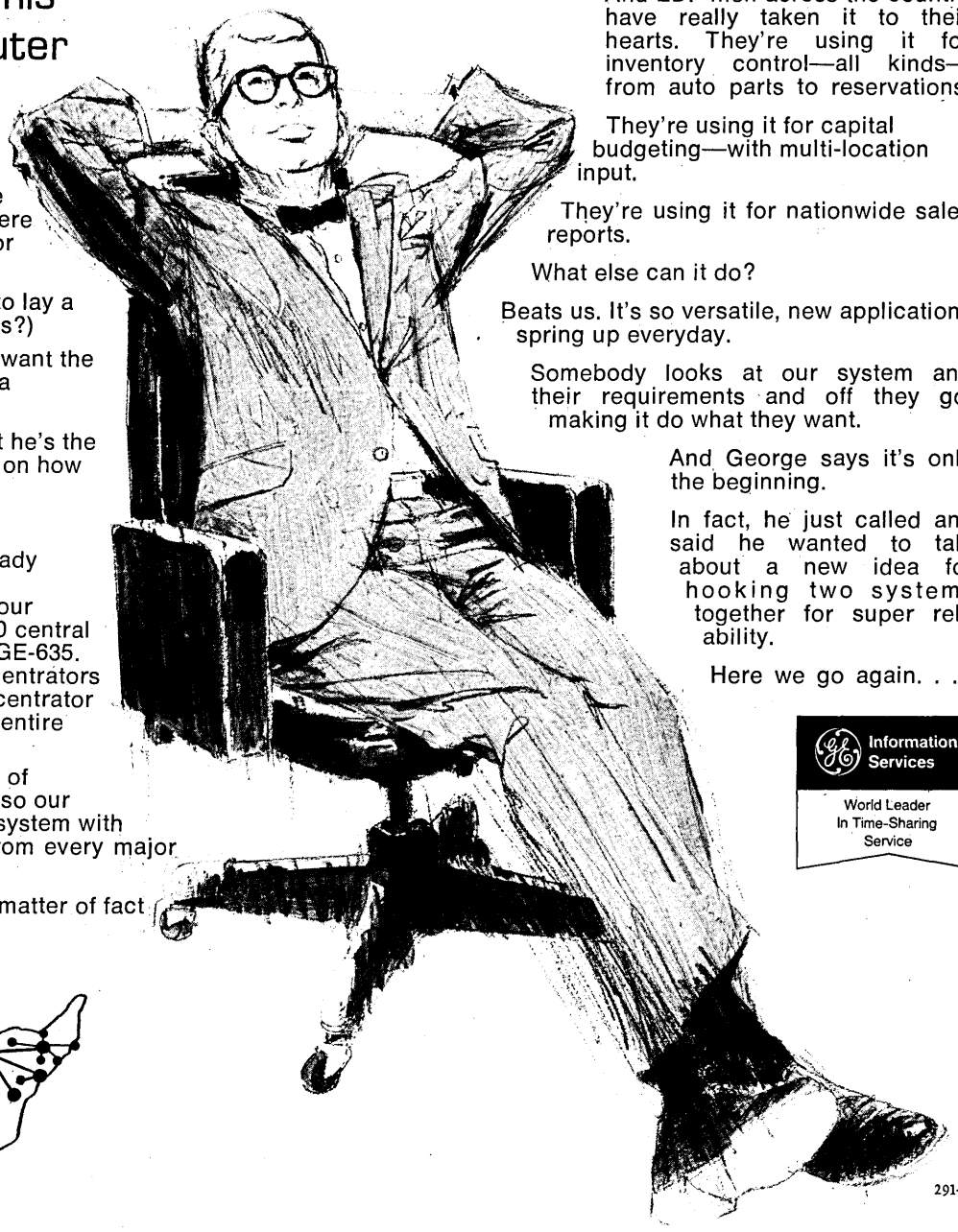
Beats us. It's so versatile, new applications spring up everyday.

Somebody looks at our system and their requirements and off they go, making it do what they want.

And George says it's only the beginning.

In fact, he just called and said he wanted to talk about a new idea for hooking two systems together for super reliability.

Here we go again. . . .



Information Services

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291-69

GENERAL ELECTRIC

PDP-12 Second Processor

This floating-point arithmetic processor not only gives the PDP-12 a dual processor capability, but it also enables the machine to perform calculations up to 39 times faster than an unassisted PDP-12 while still maintaining seven-digit accuracy. Called the FPP-12, the unit can calculate a three-word, 36-point multiply in 28 usec, vs. the 1.1 msec that was required using software alone and the 500 usec needed for the PDP-12 and an extended arithmetic element to get the job done.

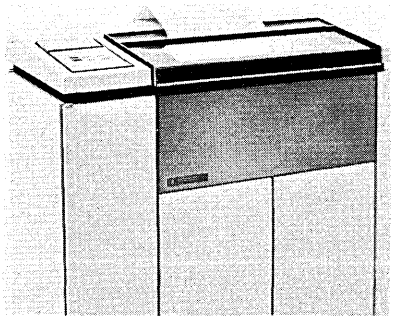
The "secret" is that the calculation is transferred from the central processor to the floating-point processor while the cpu continues its program. In addition, the FPP-12 simplifies programming by allowing direct access to 32K of core, and also by eliminating the paging steps usually required with the PDP-12. All time-saving features considered, a PDP-12 equipped with an FPP-12 can execute application programs 100 times faster than they could be done with software alone, according to the vendor.

The hardware allows indexing over 4K floating-point or double-precision numbers located sequentially beginning at any point in core. Once activated, the FPP-12 fetches instructions and stores results in memory via the data break facility, behaving very much as a parallel cpu. In operation the FPP-12 steals a maximum of 50% of the available memory cycles. Deliveries begin this month with unit prices set at $7500. DIGITAL EQUIPMENT CORP., Maynard, Mass. For information:

CIRCLE 378 ON READER CARD

OEM Line Printer

Compare the price of IBM's recently announced model 3211 line printer (2,500 lpm with a 36-character train) costing $129K with this vendor's model 2470 drum printer. A 36-character set on this printer yields a printing rate of 1,800 lpm for full 132-character lines, and the 2470 is priced at $13K (in oem quantities of 150 to be fair). Available in the first quarter of next year, the 2470 can print 64-character sets at 1,250 lpm, or 96-character fonts at 880 lpm across 136 print positions.



Up to six copies can be printed on the 2470, and the device can even be set up to perform OCR printing. DATA PRODUCTS CORP., Woodland Hills, Calif. For information:

CIRCLE 395 ON READER CARD

(Continued on page 84)

A Book For Those Who Provide - Or Plan To Provide - Computer Services:

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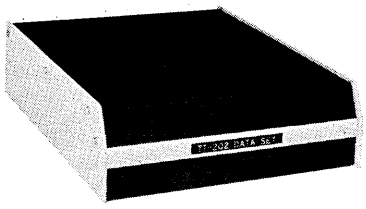


11810 Parklawn Dr.,
Rockville, Md. 20852
(301) 933-8170
TEL-TECH CORP.
In Canada: Canteltech, Ltd.

CIRCLE 64 ON READER CARD

Minicomputer

A general-purpose 12-bit, 2-usec minicomputer from an unlikely source—a firm which previously confined itself to scientific work and learned computer technology through necessity—also incorporates some unlikely features.

At $8400, the basic 4K unit with Teletype includes 16 memory reference instructions, double accumulators with individual subaccumulators, and hardware multiply and divide. In addition to relative and indirect addressing, up to 8K words may be directly addressed using two-word instructions, which should be handy for inexperienced programmers.

Called the ND 812, the unit features I/O capability of four-level priority interrupt as standard. Level selection is programmable, and for each level, priorities are determined by the sequence in which devices are connected. The 812 is compatible with 1-, 2- or 3-byte oriented I/O peripherals.

A total of 256 I/O commands are possible with single-word instructions at 3 usec per instruction, and a total of 4K I/O commands are possible with two-word instructions at 5 usec per instruction.

The cpu consists entirely of i.c.'s, all mounted on a single wire-wrapped socket board, for easier servicing—which the vendor claims its staff of FES will be able to provide both in America and some European countries. Interfacing and operating software is available for most common peripherals, including Teletypes, magnetic tape units, cassettes, disc drives, printers, A/D and D/A converters, crt's, plotters, etc., which may be supplied with the cpu.

Presently available software includes a higher level language of the vendor's own design called NUTRAN (similar to FOCAL), plus an assembler, editor, and diagnostics for cpu and peripherals. FORTRAN will be available in about five months, but will require 8K core. Delivery of the 812 requires 30-60 days ARO for a basic machine with Teletype. NUCLEAR DATA, INC., Palatine, Ill. For information:

CIRCLE 382 ON READER CARD

OEM Keyboard

If the primary criteria used in selecting a keyboard are reliability and life expectancy, then consider that the proprietary electrostatic impulse keyboard prototype is still going strong at 30 million key strokes. The coding is generated under each key, so no diode coding matrix is used.

The keyboards have three encoding levels, and according to the vendor there is no limit to the number of keys (within reason, of course). These noncontacting keyboards are available 90 days ARO for approximately $100 each based on an order of 1,000 or more. COLORADO INSTRUMENTS, INC., Broomfield, Colo. For information:

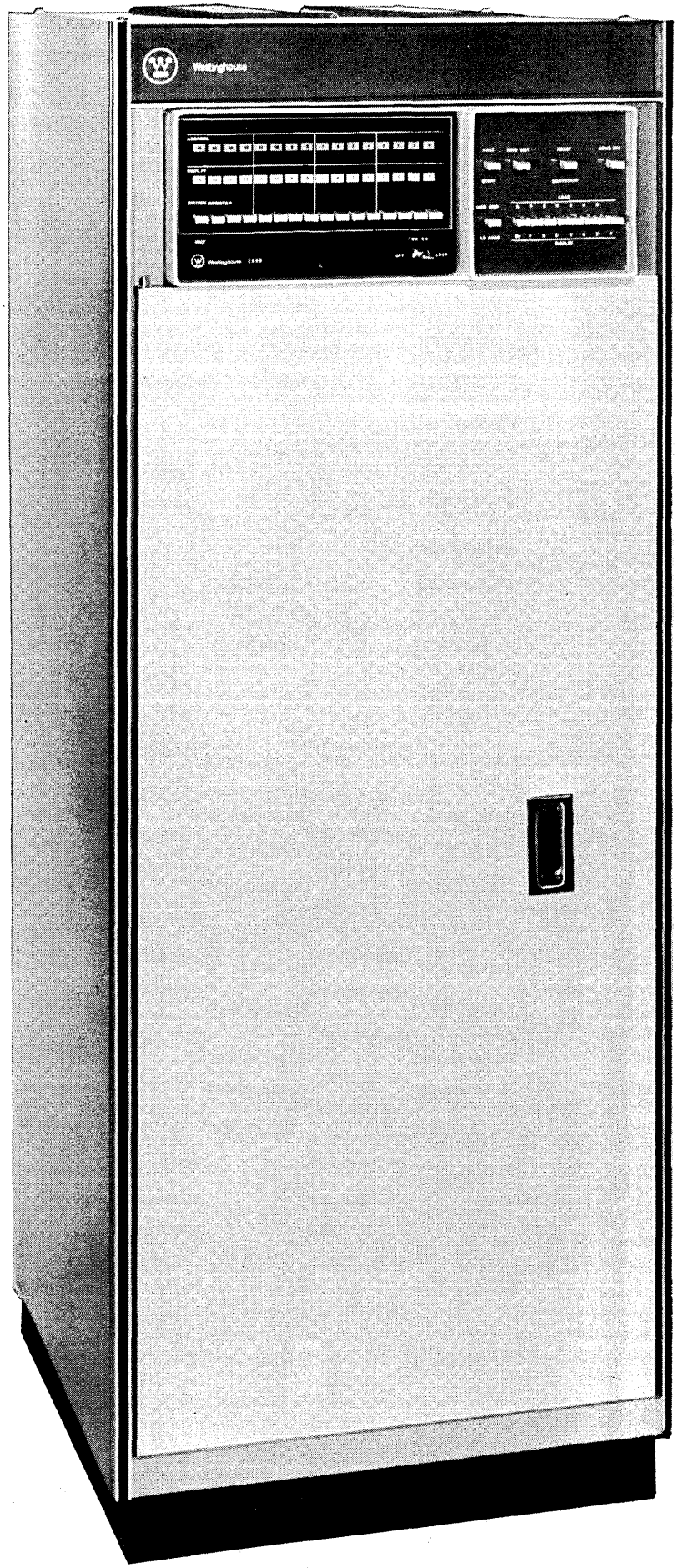
CIRCLE 379 ON READER CARD

1401 Emulator

The Compatibility Processor-1 presents a new alternative to traditional software emulation of IBM 1400 series logic on System/360 mainframes. When connected to a selector or multiplexor channel of a 360, the CP-1 allows 1400 series programs to be executed as off-line peripheral functions, using its own logic and 8K or 16K memory, plus an optional control console that provides 1401 control functions. Since the CP-1 does the 1401 processing, it uses only about 8-12K of 360 core and does not require the 360 to be dedicated to emulation; third generation programs may be run concurrently. Tests conducted by the vendor are said to have resulted in throughput improvements of 50% over standard IBM software emulation.

Prices range from $19-30K. A typical CP-1 with 16K and a console, for use on a 360/30 under DOS, is $27K, including $2500 for the console. For OS, add $3K. A 1440 instruction set is available for $1500. Delivery requires three months ARO. POLYDATA CORP., Elmsford, N.Y. For information:

CIRCLE 396 ON READER CARD ■



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CIRCLE 5 ON READER CARD

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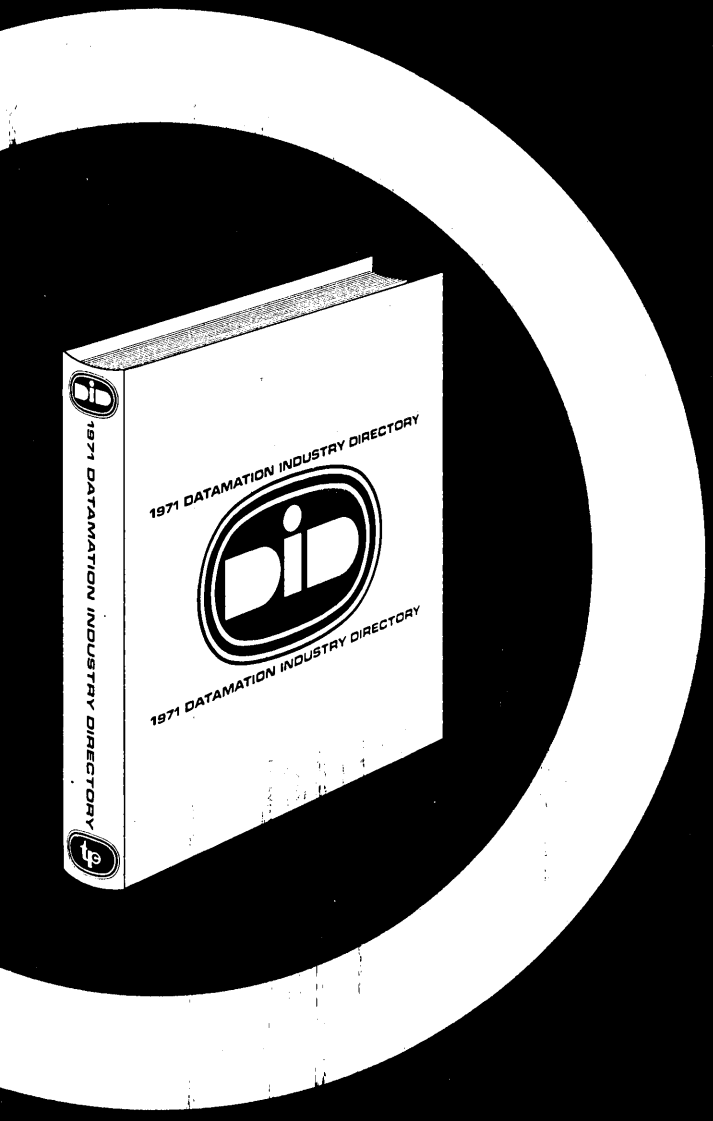

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Turn to one of these categories to find names of supplying companies. Reference to the Master Alphabetical Vendor List will quickly provide company address, and other basic information, including regional sales/service coverage.

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PL/I Compiler

PLAGO is a PL/I compiler oriented towards the scientific user, with features needed by almost any student program being supported, according to the vendor. Completely resident in 30K bytes of core in PCP, MFT-II, and MVT configurations with or without HASP, PLAGO requires a maximum of three control cards for running under OS. PLAGO can run in either regular core or in an LCS unit, with run times being reduced by accounting routines to make the job appear to the user as if it were running in regular core, it is claimed.

Trial copies of PLAGO are available for evaluation before a decision to purchase is made. If the package is accepted, a one-time charge of $500 is asked. Future updates and new versions will be sent at no additional charge as they become available. The package will be sent on distribution tape reels, so it is not necessary for a prospective customer to send a tape. A newsletter is also part of the PLAGO package, but source listings are not as yet. POLYTECHNIC INSTITUTE OF BROOKLYN, Brooklyn, N.Y. For information:

CIRCLE 361 ON READER CARD

DOS Programming Aid

CONTROL/360 acts like a monitor in a 24K partition and makes the procedures library containing card images of the DOS JCL and source programs disc resident. In a program testing environment, a source program would be stored in the PROCLIB. Once there, programmers use a procedure to add or delete statements or parts of statements from the file ranging up to a complete reorganization of the logic. To compile and execute the program, job control procedures stored in the library are combined with the source program to form a job stream. No software changes are necessary to implement CONTROL/360, which is not resident during program execution.

Operators can switch between the job streaming monitor and DOS mode. When using the monitor, entire job control routines, which are identified by short procedure names, are called from the library and written on the DOS direct-access SYSIN for execution. At that time, changes, such as the insertion of I/O assignments, may be made.

CONTROL/360 is priced at $2500 for the first cpu, and $500 for each additional DOS/360 configuration. The package includes both the PL/I source and object programs, a user's guide, installation and educational assistance, and program maintenance for three years. SOFTWARE EXCHANGE CO., Long Beach, Calif. For information:

CIRCLE 362 ON READER CARD

Brailler

The Vertical Brailler permits the blind programmer to "see" entire lines of printout as they are actually formatted. This is accomplished by printing lines vertically; a normal 132-character line requires five vertical pages. The program also prints horizontally, producing 40 characters per line, thus requiring up to four lines to represent a single 132-character line. The braille is produced by the period on the print chain of a 1403 printer that is loaded with a soft backing material to cause perforation of the paper; the braille is actually read from the back of the sheet on which it is printed.

Input to the program may include records of any length, from either tape or disc. A truncation feature prevents the repetition of any character more than three times, eliminating long gaps in the braille, making it easier for the fingers to follow as well as facilitating faster printing. To permit the counting of spaces, periods may be inserted in all blank spaces. The developers believe it is the most comprehensive brailler yet developed. The Vertical Brailler requires 9K bytes of core and a series 2400 mtu or 2314 disc, and operates under DOS/360 Version 21. It is available free, including documentation. BRADFORD COMPUTER AND SYSTEMS, New York, N.Y. For information:

CIRCLE 363 ON READER CARD

Text Processing

Text-editing software, previously available only as a service, is now offered for sale. The package, called VIPCOM '71, is the result of four years' work on extending, modifying, and debugging ATS/360 and related IBM software, according to the developer. These modifications fall into three groups: first are changes to improve reliability and eliminate errors which the vendor claims exist in the standard IBM software; second are additions to improve data center operations by providing usage statistics and improved monitoring of communications facilities; and third are additions to provide extended capabilities for terminal users, including on-line, remote batch, and photocomposition features. VIPCOM '71's price is $25K plus $500/month for maintenance. Rental is $2495/month, with credit towards purchase. VIP SYSTEMS, Washington, D.C. For information:

CIRCLE 364 ON READER CARD

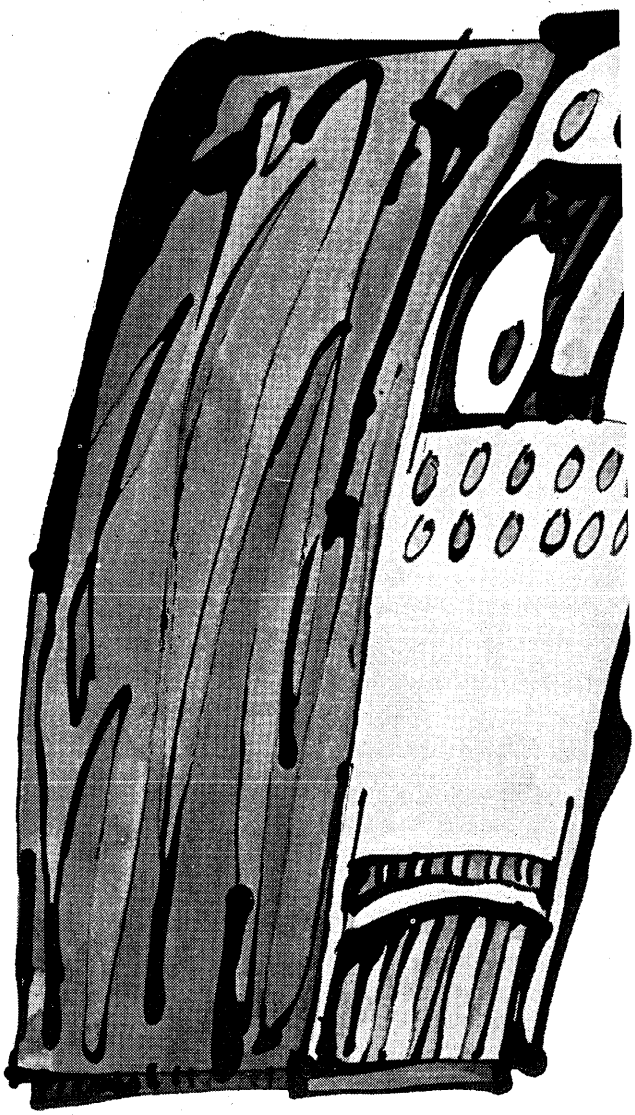
360 Time-Sharing

Billed as the first "totally compatible" time-sharing software system for the System/360, ALPHA reportedly provides the flexibility and ease of use of a conversational t-s system while being able to handle any job that can run under OS 360/MVT. ALPHA allows the user to define his terminal as an I/O device, which is claimed to be a unique feature. The package includes a command language, the ability to run remote or local batch jobs, a file security system, and dynamic resource allocation and job scheduling. The system requires use of a multiplexor, which may be either the vendor's C40 communications computer or an IBM 27XX. The system supports two FORTRAN compilers, and IBM level G and WATFOR which have been modified to optionally accept free-form input source statements and multiple statements on a single line. License fee is $80K for one year, $120K for two years, and $140K for a permanent license. An additional $20K initiation fee is charged per cpu. COMPUTER NETWORK CORP., Washington, D.C. For information:

CIRCLE 365 ON READER CARD

(Continued on page 90)

Between you and an IBM is an RCA computer



The reason most people have to move to a bigger computer is that their workload outgrows their computer's memory.

To get more memory from IBM, you have to go all the way to a processor that's much bigger, more powerful, and more expensive than you may need.

RCA's new family of computers is designed with a proper balance between memories and processors.

RCA 2. RCA 3. RCA 6. RCA 7.

So, when you outgrow your 360/30, 40 or 50, you can make a smooth, logical step to the RCA system in the size you need.

Instead of being forced to jump to an IBM computer that's too big.

Why pay for power you don't need?

Here's an example. Say you have a 360/30 with the maximum memory size (65K) and you've outgrown it.

IBM would like to move you up to the 370/145. With a memory not even double yours (114K). But the processor is eight times as powerful as yours.

Do you need eight times the power?

We don't believe you do. Between the 360/30 and the 370/145 is an RCA computer that just fits.

The RCA 2. It doubles your present memory and more than triples your present power—the right amount of both. And it's $41,000 a year less than the 370/145.

You do have one other choice, of course—the 360/40.

But it's not a new computer, and it's a big jump up in price. The RCA 2 has half again the power of a 360/40 and costs $15,000 a year less.

Bigger real memory. Unlimited virtual memory. More memory for less money.

Balancing memories with processors sensibly isn't the only way we work things to fit you.

Virtual memory is even more dramatic.

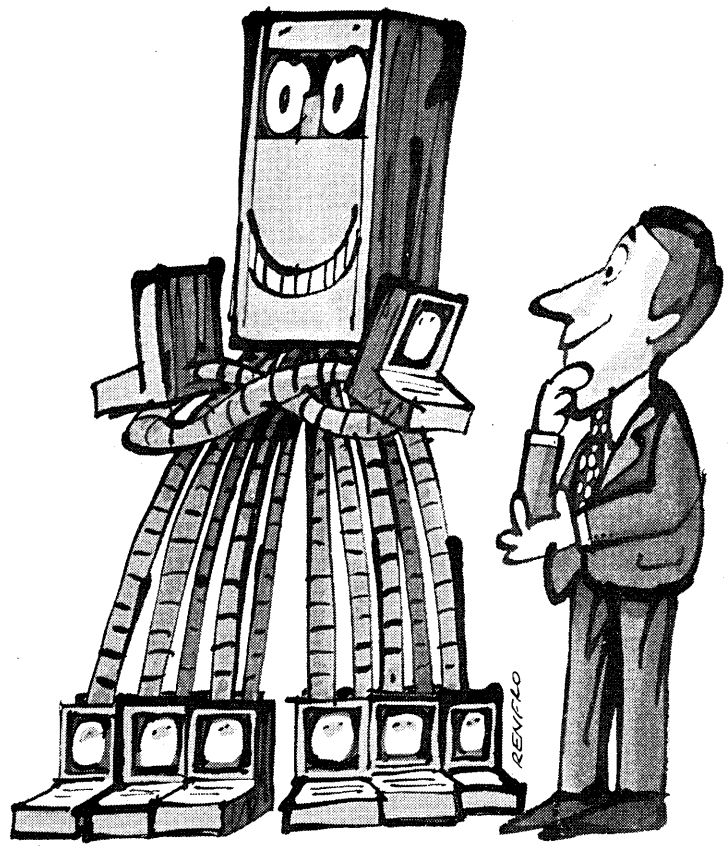
Virtual memory makes a computer work as though its main memory were unlimited in size.

Which means it's hard to outgrow.

And talk about a computer that just fits.

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

computer that's too big, that just fits.



The only new computers that have virtual memory are RCA 3 and RCA 7.

360 Mode of Operation and Guaranteed Conversion cut risk.

We don't want you all excited by our new computers, but scared of switching.

So each of our new computers can include 360 Mode of Operation. It runs most DOS programs, to protect your software investment.

And, for 360/30, 40 and 50 DOS users who qualify, we'll switch you over. And guarantee results.

We'll convert your present applications for an agreed fee, by an agreed date.

The guarantee provides for penalty payments by RCA if we don't perform, and other appropriate provisions to protect both parties.

Only RCA offers you Guaranteed Conversion.

RCA is also the only major computer maker to let you choose how you pay for systems support—either bundled or unbundled.

IBM can only offer you computers unbundled, and it's costing a lot of companies a lot more money than they expected.

Also exclusive is our new Flexible Accrued Equity Plan. You pay up to 15% less than standard equipment rentals, and own the computer after 72 months.

Three unique policies that make it easy for you to get what you want.

Three weeks after announcing our new computers, we'd sold 2½ times our 1970 forecast.

And 75% of our new customers are IBM users. Maybe it's because our new computers are the only ones with what IBM users asked for.

The right size. The right price. The right service. Making them not just a step up, but the right step up.

We're out to win you over. And we only win when you win.

RCA COMPUTERS

Accounts Receivable

Usually an A/R program is run once a week or so with the printout distributed somewhat behind the true "balance of payments" status. OLAR, for On-Line Accounts Receivable, might give a truer picture of things since it provides crt terminal access to receivables, inventory, billing, and supplier purchase order status. The FORTRAN IV package is capable of doing all arithmetic and typing of invoices and statements, automatic updating of files, and can handle 30-, 60-, and 90-day aging, according to the vendor.

Some of the information that could be displayed on a crt includes customer histories, delinquent accounts, overall credit report, information on specific invoices, year-to-date totals, and others. The price of $15K includes maintenance and start-up programs, installation, conversion, training, source listings, flow charts, and systems and user's manuals. OLAR is made up of 11 programs, none of which exceed 32K bytes under DOS or OS/360. COMPUTING CORPORATION INTERNATIONAL, INC., Englewood, Colo. For information:

CIRCLE 366 ON READER CARD

Curve Fitting

A universal curve fitting package called Unicurve is designed to eliminate the programming necessary in situations requiring that a curve be fit to data. It fits any curve to a set of points, fits any collection of curves to a set of points, and examines the effect on curve fit of the addition or deletion of points from a set. It requires about 2K of memory and a matrix inversion subroutine, supplied with the package. The price is $500. SYSTEMS RDI CORP., New York, N.Y. For information:

CIRCLE 367 ON READER CARD

Nova Business Language

A business-oriented higher level language called MICOS has been developed by a small firm which specializes in hardware/software systems using Data General equipment. The new language allows the programmer to specify many common business data handling functions without requiring that these be coded in Nova assembly language. The software consists of a set of subroutines which handle business functions, and includes a facility that permits the use of the word-oriented memory of the Nova as a character memory.

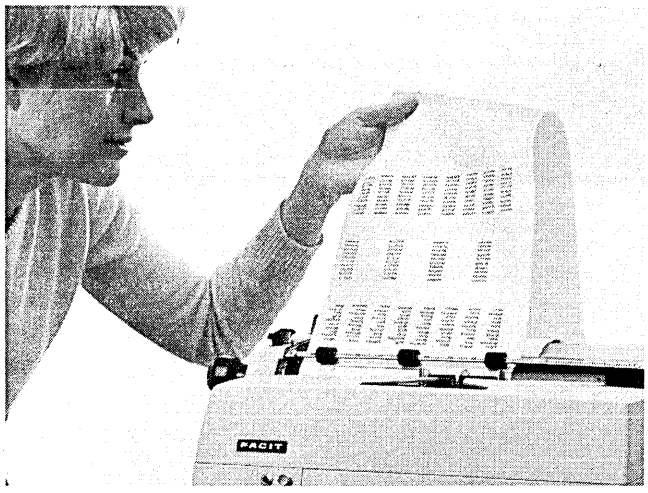
Functions handled include conversion of data, editing for output format, placing decimal points and dollar signs, etc., as well as accumulating summary totals, doing business arithmetic, and moving records back and forth between outside storage and the computer. MICOS operates on either the Nova or Supernova. The language is modular and can occupy from less than 1K to as much as 4K words of memory. The price is about $10K. MINI-COMPUTER SYSTEMS, INC., Scarsdale, N.Y. For information:

CIRCLE 370 ON READER CARD ■

If you could see the people CARE feeds...

...you wouldn't need coaxing. Mail a check.

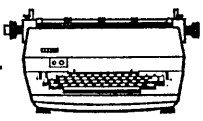
CARE Food Crusade, New York, N.Y. 10016



The Facit 3851 input/output typewriter is provided with remote controlled tabulation.

The tab stops can be set and cleared by remote control. This permits changing the column configuration while the machine is in operation.

There is further interesting information on the new Facit 3851 in this publication.



Facit 3851 – the conventional typewriter with input/output

For further information, contact
in US: Facit-Odhner Inc., 501 Winsor Drive, SECAUCUS, New Jersey
outside US: Facit AB, Albygatan 102, 171 84 Solna, Sweden

CIRCLE 16 ON READER CARD

EIA SUPPORTS US ROLE IN TRIPARTITE SCHEME

An EIA decision to support U.S. participation in some kind of international standards and certification scheme has thrown the ball back in the government's court on the European tripartite arrangement question. Some U.S. aides think little progress can be gained, however, through official negotiations until a suitable U.S. certification body exists. Politicking has begun in that direction. ANSI is making a bid to become the official body in conjunction with a gov't. agency. It set up a new industry-gov't. relations committee in September that includes international policy. This move reportedly had Commerce Dept. backing. Other associations, however, are uneasy about ANSI's filling that role. Working out the right combination will probably take months at least. Only a combined industry-gov't. group would be acceptable to the Europeans. NBS will probably have a part of it. Commerce stresses that the U.S. group will have to work out some arrangement for Pentagon specs, which will be very complicated. U.S. officials see the European agreement taking over two years to implement. If the U.S. knocks and is ready with its own group, they say, the Europeans will probably have to open the door. Refusal would bring U.S. retaliation.

HOUSE GROUP PUSHES GOV'T. RESEARCH DATA BANKS

The House Subcommittee on Science, Research and Development has called for the establishment or strengthening of two government-wide information banks. One would be a real-time management information system providing fiscal and technical information on all research projects throughout the federal gov't., including in-house programs and contractor-operated projects. This would be available to Congress and top management of all departments and agencies. The second program would be a beefed-up science information system, centralizing the existing ones in the agencies. The committee has no preference about locating the management system but sees the Smithsonian Institution as the logical place for the other. Next step would be a task force study of these and other recommendations with an end-1971 deadline. Congress is now considering the idea.

CAPITOL BRIEFS

Automation Technology has sold most of its interest in Aries Corp. to Long Lane Development Corp. Ed Dombalagian remains (as vp-finance), but president Chris Clark has been succeeded by Joe Burke. Cliff Healy, while continuing as president of North American Computer Corp., will also be Aries' vp for planning and marketing...EDP Technology finally won its long court battle to purchase Cornell Aeronautical Laboratory. The only difficulty is that it doesn't have enough money to complete the deal...Frank Wagner says ATARCSI expects to sign contracts with "4 or 5 airlines within the next six months, otherwise we'll be out of business."...Phil Fellows, president of ATARCSI's chief rival, Telemax Corp., is now working for CDC's airline reservation division in Atlanta ...Raytheon wants to buy Comcet but Don Herman & Co. are willing to sell only a part interest.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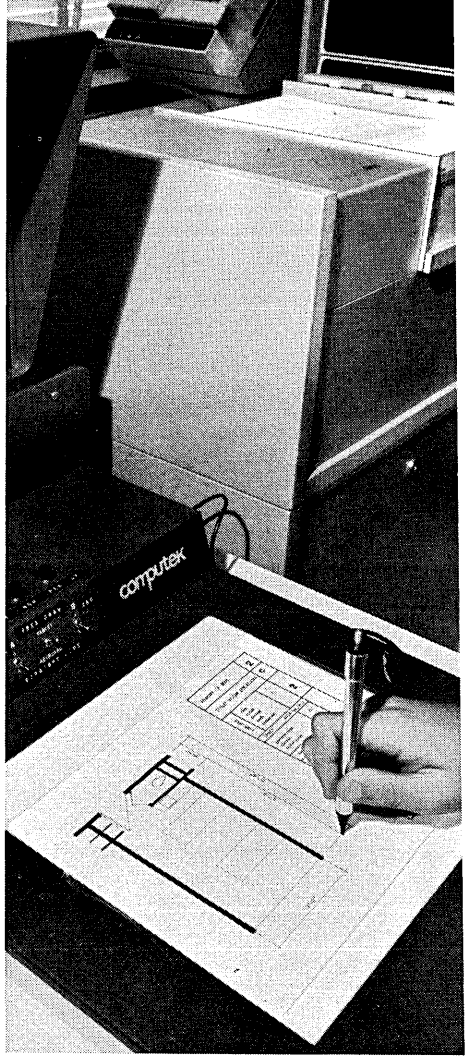
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The computer system, called the ARK/TWO was developed by Perry, Dean and Stewart Architects and Planners and programmed by Design Systems, Inc. It includes an Autrotrol digitizer, a DEC PDP 15/20 (16K), 500K Disk, two Computek CRT's with a keyboard and tablet. Ultimately, it's felt this advanced system will reduce the critical path in large construction projects by 4 to 6 months.

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PEOPLE

A research man who has proved his executive worth has become president of Inter-Computer Electronics, Inc., a Lansdale, Pa., firm that makes multiplexors and computer interface equipment. **James J. Connolly,** who actually has been performing presidential duties for some months, was a cofounder of I-CE in 1968. Before that he worked in high-speed digital signal processing—especially hydroacoustic and seismic—research for General Atronics, and before that in data handling research for Philco. He also did graduate work in electronics at the Univ. of Pennsylvania's famed Moore School. He succeeds **Kenneth Zieger,** who will remain as board chairman. . . . For more than a year **A. Joseph Quackenbush,** vp of corporate planning at McDonnell Douglas Corp., conducted a study to form a computer services company division that would combine the dp organizations at its aircraft and astronautics facilities with the original automation company. Now that it is officially launched as McDonnell Douglas Automation Co., Quackenbush has gone over to be exec vp for internal business servicing. Responsibility for commercial/external business has gone to **Robert L. Harmon,** also titled exec vp. President of the entire spread, which comes with some 3,000 readymade employees, is **William R. Orthwein, Jr.,** who continues from being in charge of the original automation setup started ten years ago. The network now has 1,900 clients with 1,000 terminals in over 300 cities, is aiming for $100 million sales in 1971. . . . Recently named president of Litton Industries data systems division (tactical command/control systems, digital computers and displays) is **Dr. Nicholas A. Begovich,** formerly a vp at Hughes Aircraft Co. **James R. Mellor** remains head of the parent information systems group. . . . A 17-year IBM regional manager and marketing man, **C. K. (Chet) Quimby** has gone to Computer Assistance, Inc., as NYC vp/manager. He will develop services in systems and programming, software packages, and facilities management. He is especially conversant with printing and publishing. . . . Directorship of the government's formidable new National Technical Information Service went to **William T. Knox,** an appointee with quality credentials as president of the Information Industry Association and a vp at McGraw-Hill. He also served as chairman of COSATI (Committee on Scientific and Technical Information). . . . **John I. Becker** has been elected president at Syner-Data, Inc., peripherals maker of Beverly, Mass.; he's only been with the company since October '69, was previously in another industry. He succeeds **Byron D. Smith,** who goes on to be board chairman. . . . The former manager of GE's time-sharing service in the Southeast, **George C. Hawkins,** has joined Systems Equipment Corp., Atlanta, as vp of engineering and product development. He will develop SEC's line of minicomputers. . . . In education, **John J. Jensen** has been appointed president of the Computer and Business Skills Institute, a division of Statistical Tabulating Corp. in Chicago that operates a network of schools in the Midwest and markets home study computer courses for executives. . . . And Northwestern Univ. has given a vote of confidence to **Gilbert Krulee,** already director of its computer center, to head up its new department of computer sciences. . . . In overseas ventures: **Douglas C. Cornwall** has been named president of Telex International Computer Products; **Olie Swanky** has been elected president of Greyhound Computer of Canada, Ltd.; and **Victor J. Cowley** has been promoted to president of Computer Machinery Corp. International, with companies in England and France. . . . Minneapolis' National Computer Systems Inc., which provides dp systems and services to schools, has selected **Charles W. Oswald** to be chairman and chief exec, succeeding **Harlan R. Ward,** who continues as president. Oswald has been involved with schools previously, as president of a company supplying class rings and yearbooks. . . . **Donald E. Eckdahl** is taking over broadened responsibilities at National Cash Register as vp of manufacturing operations, which will include the dp division he formerly headed, as well as the data terminals and international manufacturing and military divisions. **Carl F. Rench** becomes vp of r&d. Both men are more or less succeeding **Robert G. Chollar,** who formerly wore both hats. He leaves NCR to be president and chief exec. of the C. F. Kettering Foundation. Taking Eckdahl's place will be **Henry L. Tinker,** who has come up through the plants since 1961. ■

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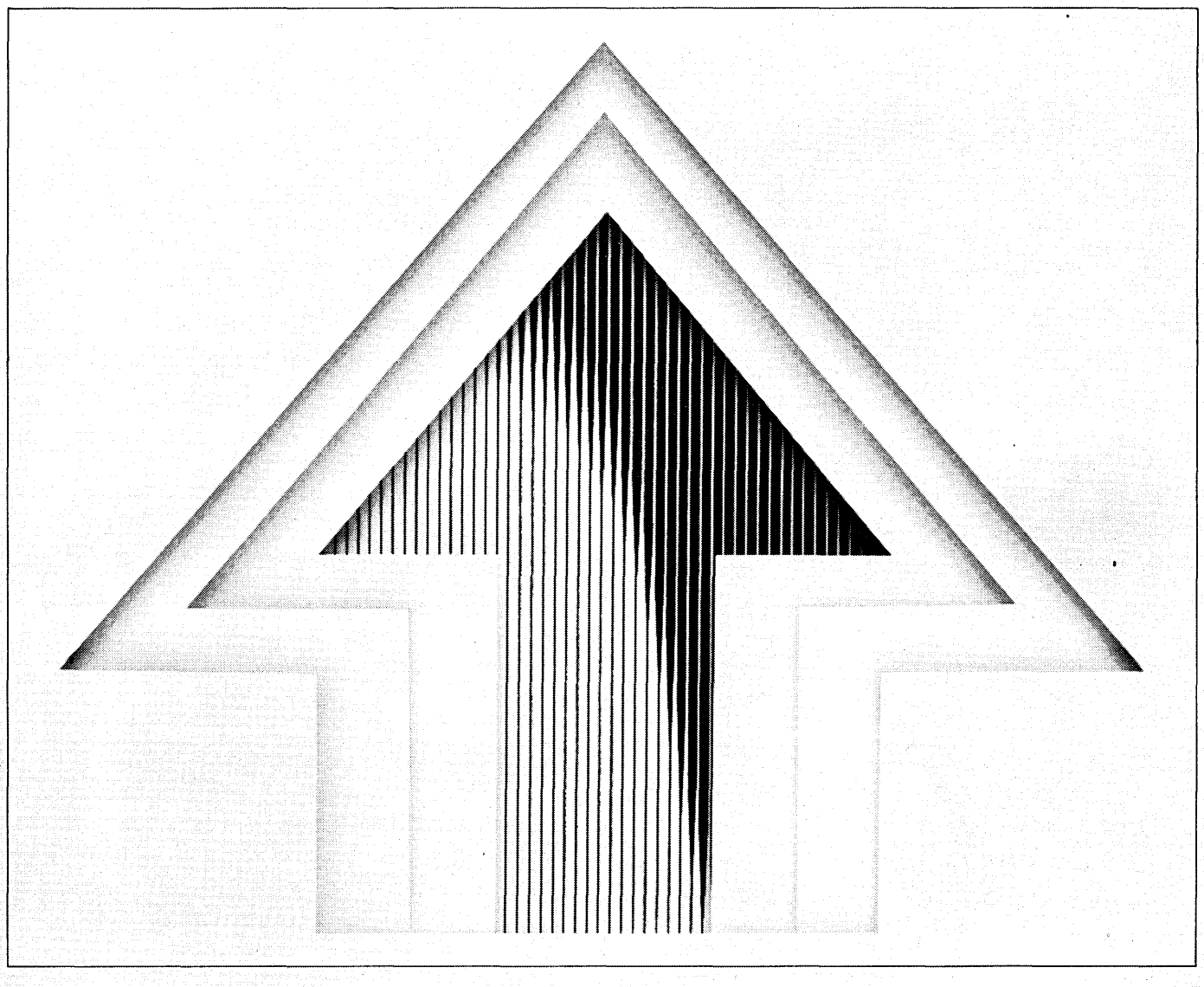

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THE FORUM

The Forum is offered for readers who want to express their opinion on any aspect of information processing. Your contributions are invited.

Misleading Mythologist?

"Throughput Myth," by George Harmon of Information International, Inc. (Oct. 1, 1970), stated that advertised speeds of COM were misleading to prospective users of these devices. I personally believe Mr. Harmon's article to be somewhat misleading itself.

Some important points NOT emphasized were that the FR-80 is manufactured by Mr. Harmon's company, and it was a coincidence, of course, that this particular machine was used in the illustration. There also was mention of camera change time. Other devices, such as a UCC 300-3, are equipped with a multiformat camera, which handle 16, 35, 70 and 105mm film, and do not require a camera change. The FR-80 is said to produce 1.1 frames per second. The 300 takes advantage of micromation mode, which the FR-80 does not possess. The 300-3 can produce three frames per second utilizing line printer format. Also, no time is required to load a program; this is handled through a code plug, which takes approximately 3/10 of a second and is as easy as inserting a plug into a wall socket.

The fallacy in Mr. Harmon's article can be established simply by giving the benefit of the doubt to him and using his 288 minute day and multiplying that figure by 180 frames per minute. This would make UCC's 300-3 produce over 50,000 frames during Mr. Harmon's 288 minute production period, as opposed to 32,000 frames by the FR-80, with both machines using line printer mode. Using micromation mode, we can produce up to five frames per second, and that would put us in the 80,000 frame category for the quoted production period. I don't feel it is quite fair to UCC or other manufacturers of high speed COM devices to be saddled with production figures from the FR-80. In the past, the FR-80 has been a leader in quality output microfilm, but its speed and price range has been a hindrance to its success. New methods of character generation have been and are being developed in our industry without reduction of speed.

In conclusion, it would appear to me that Mr. Harmon was trying to accomplish one of two things by his comments: either to advertise the FR-80 with a reverse psychological twist, or to plead with his company to increase the speed of its equipment.

Any prospective user should demand a demonstration of the particular unit being selected, and therefore reduce to a minimum the possibility of being misled or confused about the production capabilities of a machine.

—Daniel J. Oakes

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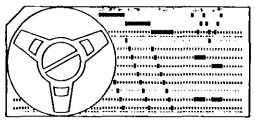

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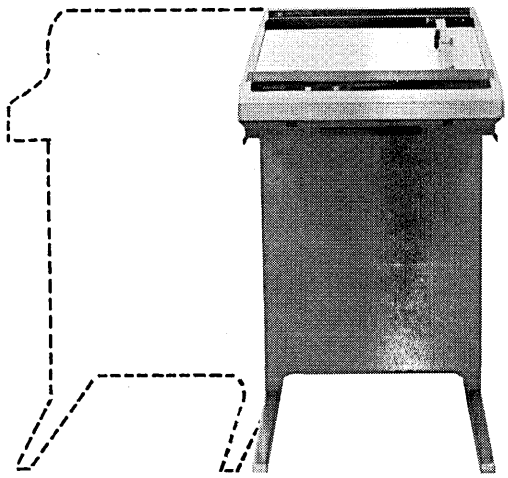

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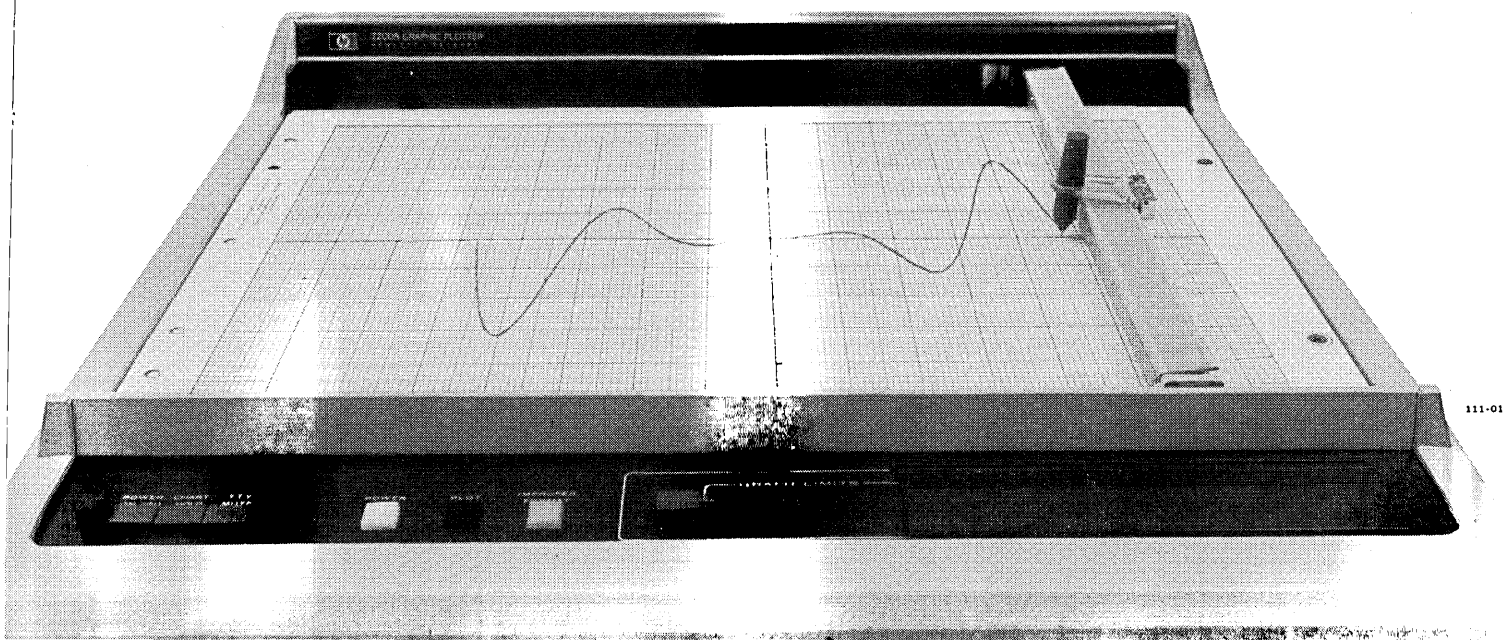

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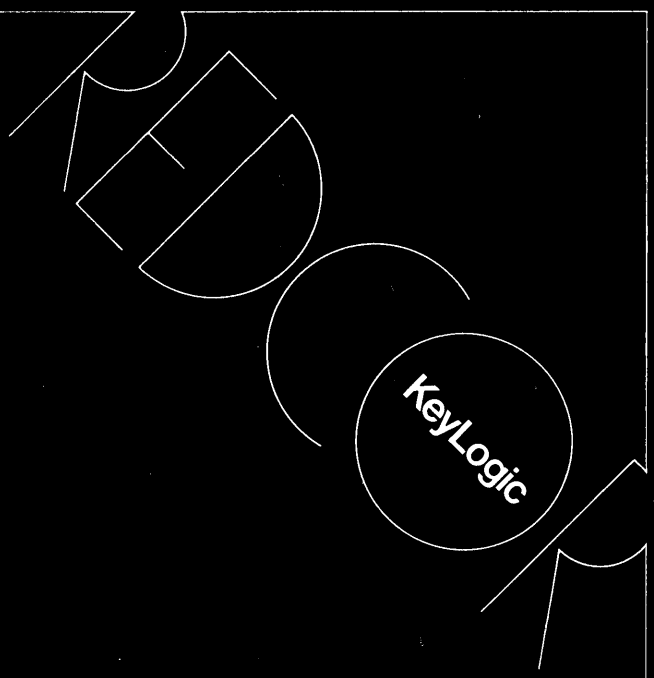

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