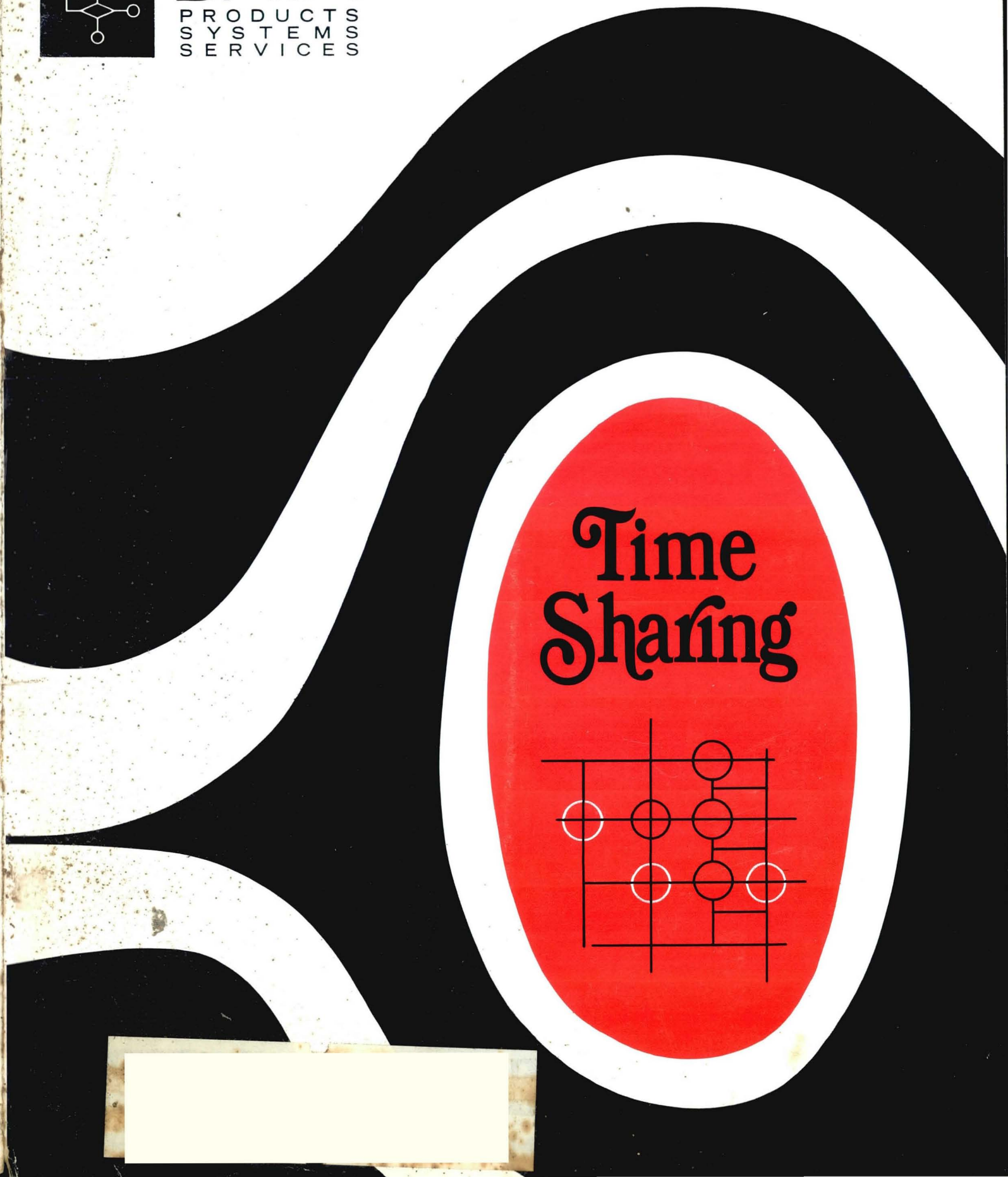
FEBRUARY 1970

MODERN DATA

PRODUCTS
SYSTEMS
SERVICES



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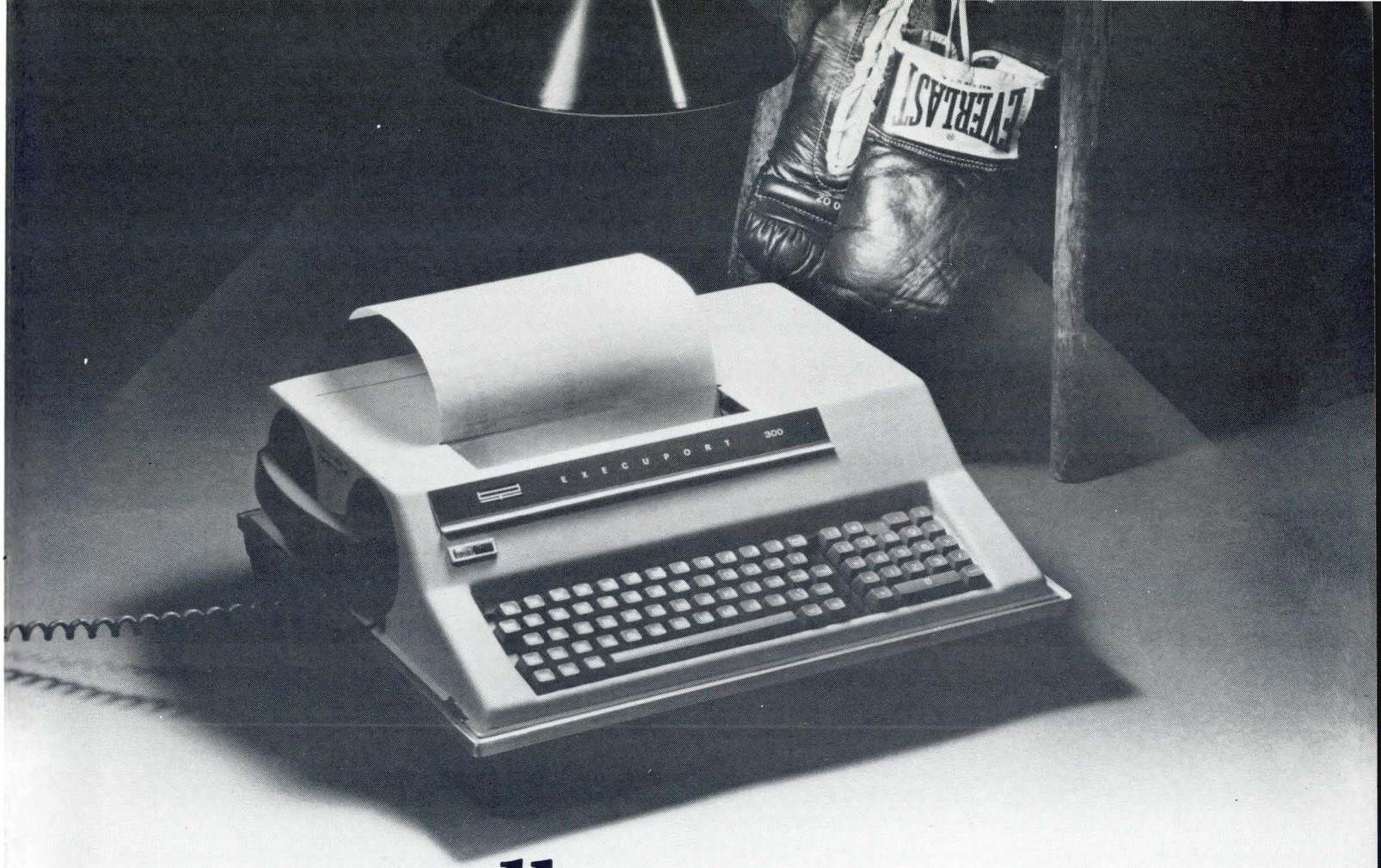

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DRUM AND DISK MEMORIES – CONTROLLERS

CIRCLE NO. 3 ON INQUIRY CARD

MODERN DATA
PRODUCTS SYSTEMS SERVICES

FEBRUARY 1970 ■ VOLUME 3 ■ NO. 2

58 THE VIABILITY OF COMPUTER COMPLEXES
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64 THE WANG 3300 BASIC SYSTEM

The highly-successful Wang Laboratories enters the computer field with a 16-terminal in-house time-sharing system.

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Many new time-sharing vendors have entered the field since our last survey in the July 1969 issue. Is it time for a shakeout? Here's an up-to-date look at where the interaction is.

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New communications switching system is a model "turnkey" operation — in which Informatics assumes total responsibility for overall design, hardware, software, and maintenance.

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COVER BY WILLIAM KWIATKOWSKI

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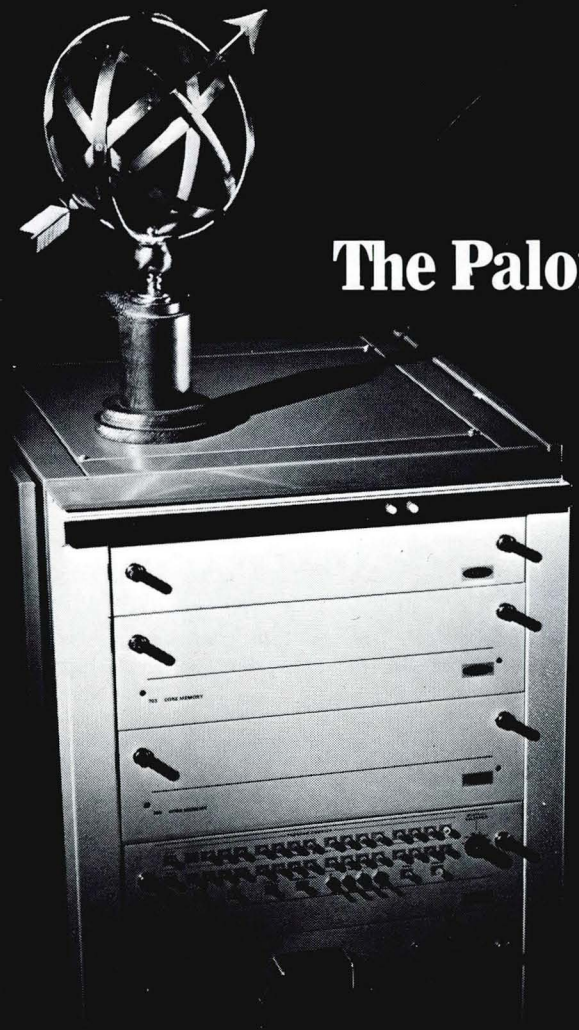

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SALES MANAGER: ROBERT J. BANDINI

All correspondence regarding circulation, advertising, and editorial should be addressed to the publication offices at:

MODERN DATA
3 LOCKLAND AVENUE
FRAMINGHAM, MASS. 01701
(617) 872-4824

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SUBSCRIPTIONS: Circulated without charge by name and title to U.S.-based corporate and technical management, systems engineers, systems analysts, EDP managers, software specialists, and other personnel who qualify under our qualification procedures. Available to others at the rate of $18.00 per year; single issues $1.75. Subscription rate for all foreign subscriptions is $25.00 per year (12 issues). POSTMASTER: **Send Form 3579 to:** Circulation Dept., Modern Data, 120 Brighton Road, Clifton, N.J. 07012. Controlled circulation postage paid at Boston, Mass.

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LETTERS TO THE EDITOR

To the Editor:

Re Dan Bowers' speech to the BoB Conference: Dan makes a point of mentioning all the problems presently faced in-house by systems vendors so there is no point in elaborating on them here. What bothers me is: 1. Who is going to design the black boxes (interfaces)?; 2. How will any future system enhancements be incorporated when multiple vendors are involved?; and 3. Who in their right mind would consent to become the "whipping boy" (prime contractor) for someone else's unproven design?

Walter H. Schmitt
UNIVAC, Federal Systems Div.
Atlanta, Ga.

The author's reply: Mr. Schmitt's interest in my recommendations and his taking the time to question the above three aspects are sincerely appreciated. Herewith my comments on his questions:

1. Who is going to design the black boxes? Designers of interfaces and control units probably constitute the most numerous kind of digital engineers available in the industry. Every major systems manufacturer has departments which specialize in marrying separately-designed equipments (since they presently live with this problem), and many sophisticated users have interface design departments to marry equipment purchased from different vendors. Most vendors of non-free-standing equipment supply this kind of engineering as an aid to selling their equipment. Also, there are many medium-to-small computer engineering houses which are actively interested in this kind of engineering, primarily because it is a low-capital route to building a going business. Finally, if a procurement procedure such as I have recommended were adopted, there would be pressures toward standardization of interfaces. The definite long-range result would be greater compatibility and a consequently reduced need for "black boxes."

2. How will future system enhancements be incorporated? The procurement procedure which I have proposed gives greater opportunity for new system enhancement than does the present one-vendor method. First, independent systems houses assisting the government will make their own suggestions, a benefit which does not exist presently. Secondly, the major system vendor is still in the position of proposing his best ideas as before. Thirdly, the best features of many proposals can be combined into the final specification. In my opinion, there is no way that the benefit to the user can be less than at present, since, in the least case, the user can still buy one vendor's proposal.

3. Who would consent to be the "whipping boy"? Businessmen, since the time of camel caravans across Asia have resold items purchased from smaller vendors or subcontractors and taken responsibility for them. All computer manufacturers, Univac included, are doing this today. My suggested procurement procedure differs from present everyday practice only in that it gives all vendors a chance at what is now available only to the major systems manufacturers and their preferred suppliers and subcontractors. Large companies, in fact, will compete just as energetically to be the "whipping boys" as they do now.

Dan M. Bowers
Chief Editorial Consultant

To the Editor:

In reference to the Nim game described in the "What Hath Babbage Wrought Dept." *in the December 1969 issue of* MODERN DATA, *there is either an error in the writer's description of that particular variation of Nim or in his selection of a starting number. In order to insure that the computer will win the game as described, the computer must take the first move if the starting number is something other than a multiple of three. The player must move first if the starting value is a multiple of three. Starting with 13, the computer moves first and selects one and at each successive turn selects the number not chosen by the player. In this way the computer can be assured that it will be able to take the last number.*

The writer may be confused with another variation of Nim in which the object is to force the opponent to take the last number. In this variation, starting with 13, the player making the first move can always be forced to take the last number.

These comments, of course, take nothing away from the point of the writer's anecdote that since the computer is the scorekeeper it always has the last say, no matter who actually wins.

P. D. Bullock and
F. A. Sorensen,
U. S. Steel Corp.,
Appl. Res. Lab. — Math. Div.
Monroeville, Pa.

To the Editor:

I enjoyed your story in the December issue about the number game which the computer "always won". I would like to have seen the programmer's face when the computer typed 3 - 2 is 0.

However, I would like to challenge his logic. I say that if the player starts with a 1 and then always chooses the number opposite to that which the computer chose, the player will win. Also, if the computer goes first and starts with 1, it will win.

Who is right?

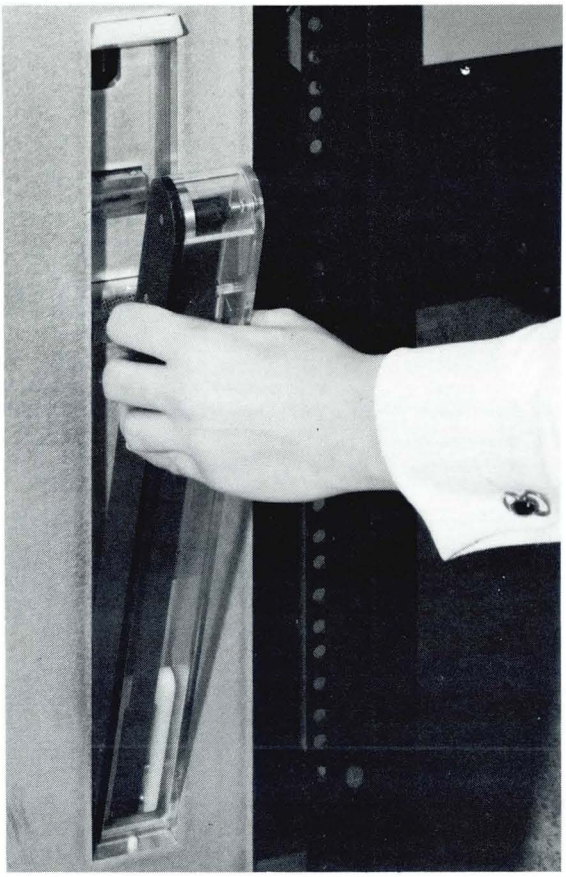
J. C. Bradshaw, Manager
Software Development
Anaconda Aluminum Co.
Jacksonville, Fla.

Editor's reply: You are.

To the Editor:

I would like to congratulate you on the article System/3 — The Generation Gap. The comparison of the "glossy brochure" and the real world was skillfully done. I would shudder to think of the repercussions if another manufacturer were to introduce a new product line with so little technical support.

R. H. Beazley, Systems Analyst,
Disk Software,
General Electric Co.,
Oklahoma City, Okla.



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Letters To Editor.....Cont'd

To the Editor:

Your December Technology Profile update on key-to-tape input systems certainly provided a striking measure of market potential — from 18 manufacturers listed in January 1969, to 33 by December! This proliferation makes it understandably difficult to keep track of who's got what, and since you have established yourself as an authoritative source of this information, I'd like to take this opportunity to update your records on the MAI 100 Data Transcriber. I know your readers expect, and usually get, the most accurate, recent information available. In past issues, you have gone out of your way to rectify omissions, oversights, errors, etc., and I trust this policy remains in force.

On page 71 of the December issue, you have conveniently tabulated key performance profile data for each product, with MAI listed on the first line. Your readers should be informed of the following, in order to utilize this valuable summary most effectively:

1. Record Length — Variable up to 200 characters

2. Programability — Yes

3. Type of Display — Column display standard; Full-record CRT optional

4. Data Pooling — Yes — optional

5. Purchase Price — 7 Track (Standard) — $5,800; 9 Track (Standard) — $6,400

6. Monthly Rental — With Maintenance — 7 Track (Standard) — $145; 9 Track (Standard) — $160

Thank you in advance for insuring that your readers continue to be fully informed in a timely fashion.

Robert Greiff
MAI Equipment Corp.
New York, N. Y.

To the Editor:

This letter is in regard to your December Technology Profile Update, Keyboard-to-Tape Input Systems. Having been involved with the very first Key-to-Tape device, made by Mohawk Data Sciences in 1964, I found your article most educational. With an industry as fast growing as the Key-to-Tape industry is, it is extremely difficult to keep abreast with new products from existing companies and new entries into the market. The information you have provided represents, I am sure, a significant amount of research by your staff. However, there has been a slight misinterpretation of some figures quoted related to my company's equipment.

The Model No. and Computer Compatibility headings were correct, but Record Length should be corrected to 20 — 240 characters. Operating Modes were correct, however, the Programmable heading should be corrected to Automatic and Manual. The Type of Display, Hard Copy Output, and Communications Options were correct. The Data Pooling should be changed from NO to YES. This option was announced the same time the Communications Option was announced. Our purchase prices on the DS7100 and DS9100 start at $7640 and $8200 respectively, so the Approximate Purchase Price heading is not that far from being correct. However, the true intent of this letter is to point out that the Approximate Monthly Rental Price **with maintenance** *is $158. Your article states $158* **less maintenance.** *Under the Remarks heading, perhaps you might include: much desktop work area; line printer available; personal effects drawer; all check digits available; or 7-9 or 9-7 pooling available.*

Sangamo is always pleased to have its name mentioned in an objective article in a quality trade journal such as yours. Thank you for considering the above-mentioned information.

A. J. Paoni, Dir. of Education
Sangamo Electric, Inf. Sys. Div.
Springfield, Ill.

.....

To the Editor:

While we have no desire to comment on the tone or the opinions expressed in Mr. DeMarco's article on IBM System/3 (October issue), the article contains a number of factual errors that may have misled your readers.

The article states, "There is no assembler announced so far . . ." A Basic Assembler Program for System/3 was announced simultaneously with the system. It is available for a monthly charge of $75.

The article states, ". . . IBM has given no indication of what the system looks like internally." The facts are that a manual for the assembler program is available, as are manuals for both card and disk versions of the RPG II compiler. They give programmers and others clear indications of the system's internal organization.

The article states, "System/3, as announced, has no peripherals available than card unit, disk, and printer." This is incorrect. The following peripherals for System/3 were announced simultaneously with the system; 5471 printer-keyboard; 5375 data entry keyboard; 1255 magnetic character reader; 5486 card sorter; and 5496 data recorder.

The article states that ". . . RPG is non-compatible." System/3 source programs are compatible with System/360 RPG if the expanded functions within RPG II are not required.

It should also be pointed out that for less than $100 a month, the data entry keyboard can be attached to the system and used, in conjunction with the MFCU, for on-line data recording. If a customer elected to do this, he might not require the off-line data recorder.

We would appreciate your bringing these corrections to the attention of your readers.

M. L. Mann
Director of Basic Systems-Marketing
International Business Machines
White Plains, N.Y.

The author's reply: I will not argue with Mr. Mann's statement that there was an assembler, announced at the outset (although it was not mentioned in the press kit and an official spokesman stated otherwise). IBM at the time was reluctant to provide information regarding what the machine looked like internally. Even the manuals referred to by Mr. Mann leave out such vital data as: (a) Number of registers and their size; (b) Data and sign conventions; (c) Interrupt structure; (d) Addressing scheme; (e) I/O operation. By the way, the assembler manual only recently has become available, and my request for one still has not been filled.

The RPG is not compatible with 360 RPG. Of course, the user can limit himself to a subset of System/3 RPG and he can then run his program elsewhere. But that is not what compatibility means. The RPG II manual does not even make it clear which are the expanded functions.

I wish Mr. Mann had addressed himself to the central point of my article, which was to chide IBM for what seems to be change for the sake of change. While System/3 has some very considerable virtues, its designers have ignored every opportunity to respect established standards. It isn't clear that any of the abandoned standards were sacrificed for true progress.

Thomas DeMarco
Contributing Editor
The Systems Scene

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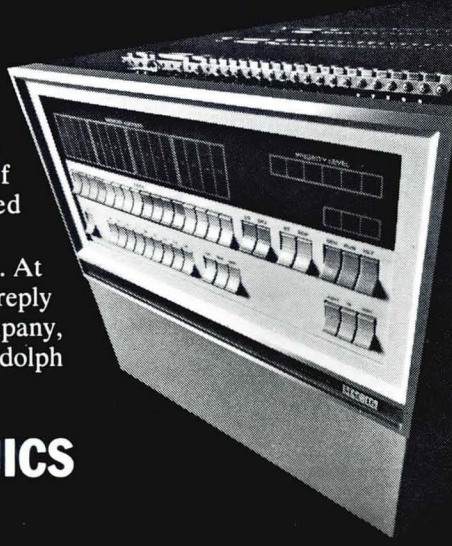

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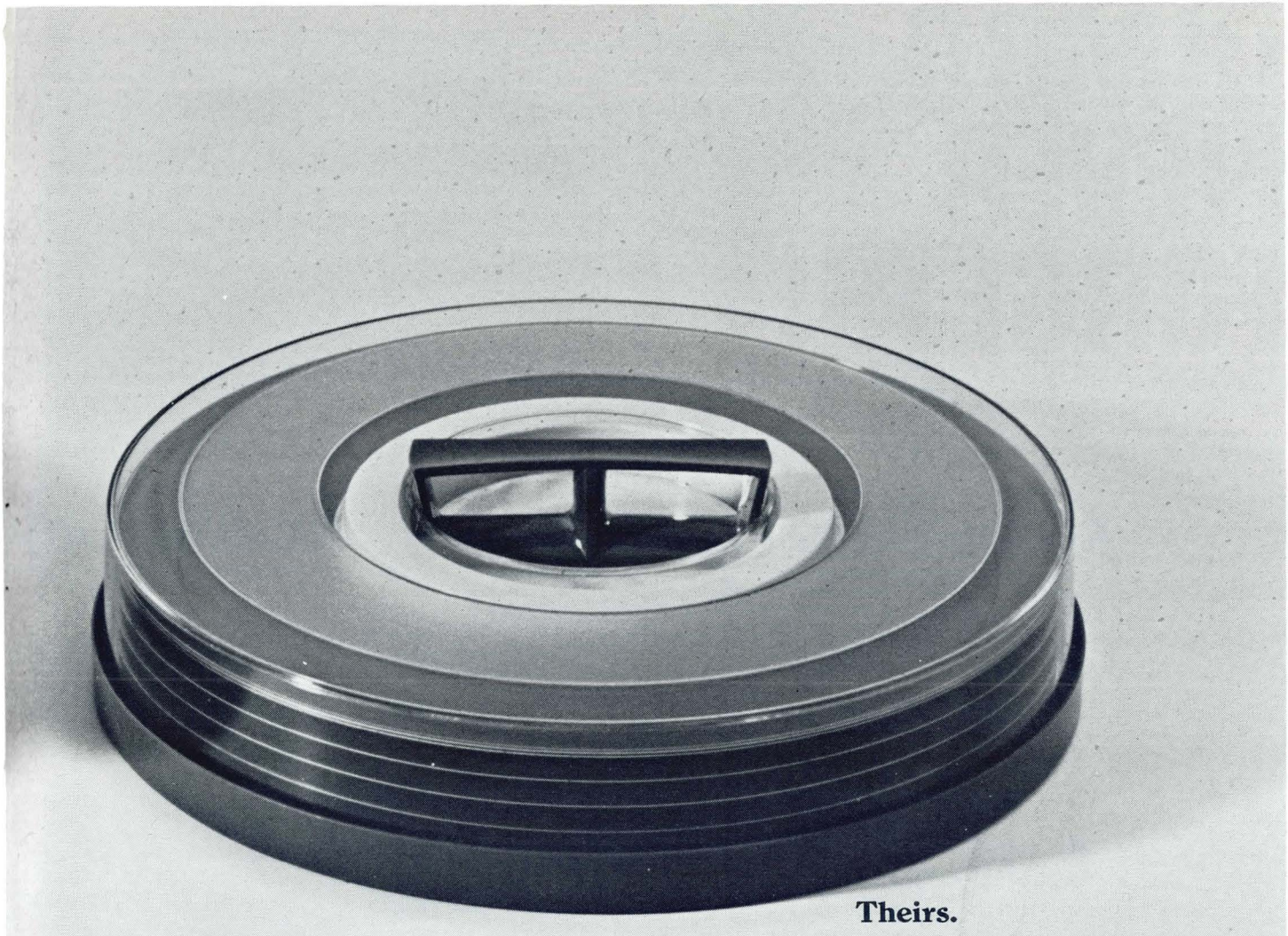
Our disk pack.



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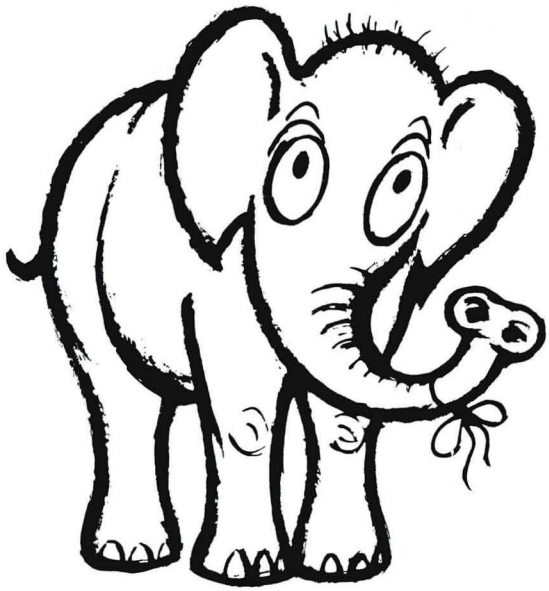

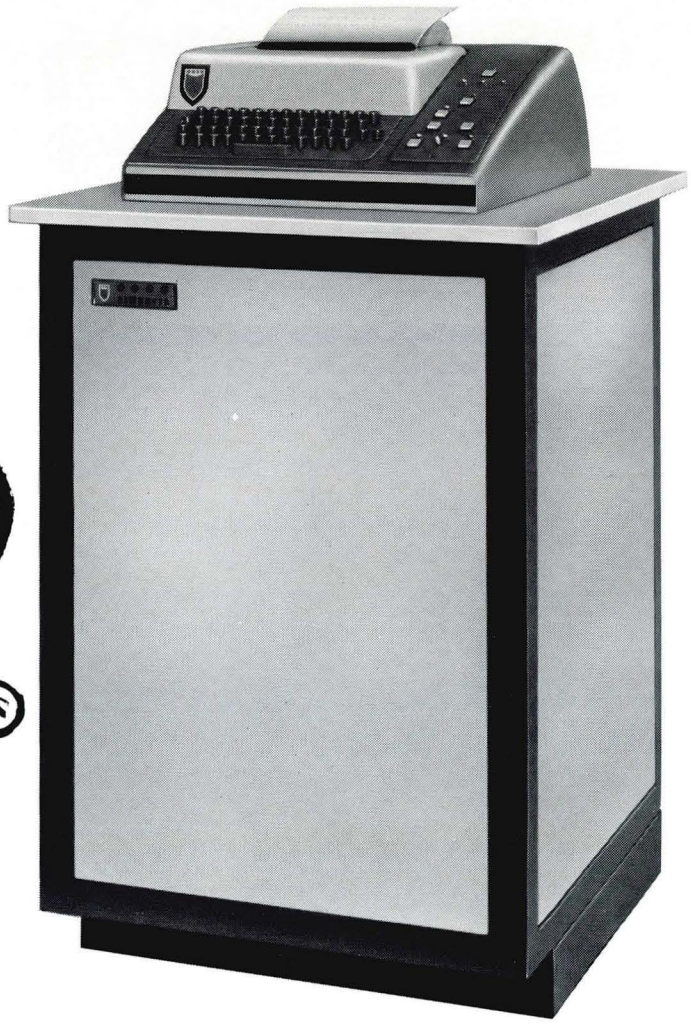

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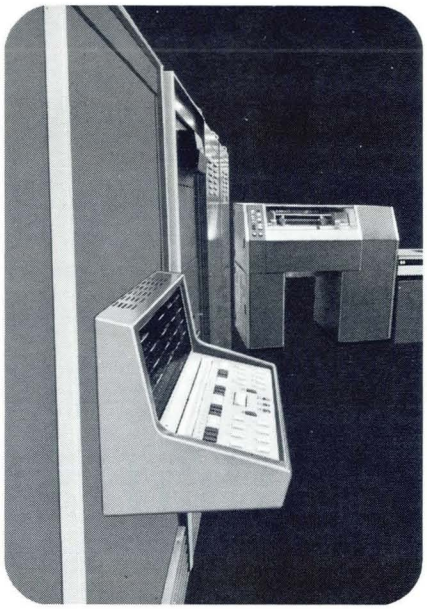

Datacraft is now delivering the fastest 24-bit general purpose Digital Computer available today. Our DC 6024 overshadows many 32-bit machines that limp along behind fancy gingerbread control panels. We take advantage of the simplicity of our 24-bit CPU design and our superspeed memory to run circles around several of our larger cousins, both price-wise and throughput-wise.

Datacraft's DC 6024 is the computer with 600 NSEC full cycle time. This is the processor with 120 generic types of hard-wired instructions and more than 500 operation codes. Ours is the CPU that can give you up to 72 levels of priority interrupt and the capability to handle up to 448 different I/O units. With a transfer rate of 40 bits per microsecond, you'll be kept plenty busy feeding our DC 6024.

Datacraft is in full production of DC 6024 Digital Computers, and your deliveries can begin 60 days from date of order. Price for the basic unit, without main frame options, is $53,900.

Today The World
(24 bits at a time).
Tomorrow Someplace Else
(24 bits at a time).

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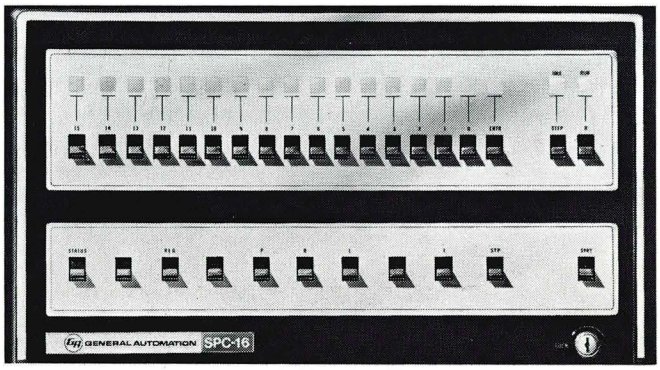
SPEED LIMIT 960

And that's fast for a 16 bit machine ...for less than $10,000

and Much Less in OEM Quantities



SPC-16 is a powerful new 16-bit machine . . . 960 nanoseconds fast . . . expandable 4K memory.

It's organized to provide for efficient handling of bits, bytes and words in read/write and macroprogramming in ROM . . . and ready-to-use GA productized software reduces programming time, effort and cost to a minimum.

SPC-16 gives you big computing power, accuracy, reliability and programming simplicity . . . and flexibility in interfacing with peripherals through the GA family of mini-controllers . . . and the SPC-16 is supported by expert consultation, systems engineering, programming and customer training services.

You'll be surprised just how fast you can add the SPC-16 to your product or system . . . so find out today.

Ask about other low-cost computers in the GA family. The SPC-12 for less than $5000. System 18/30 for under $20,000.

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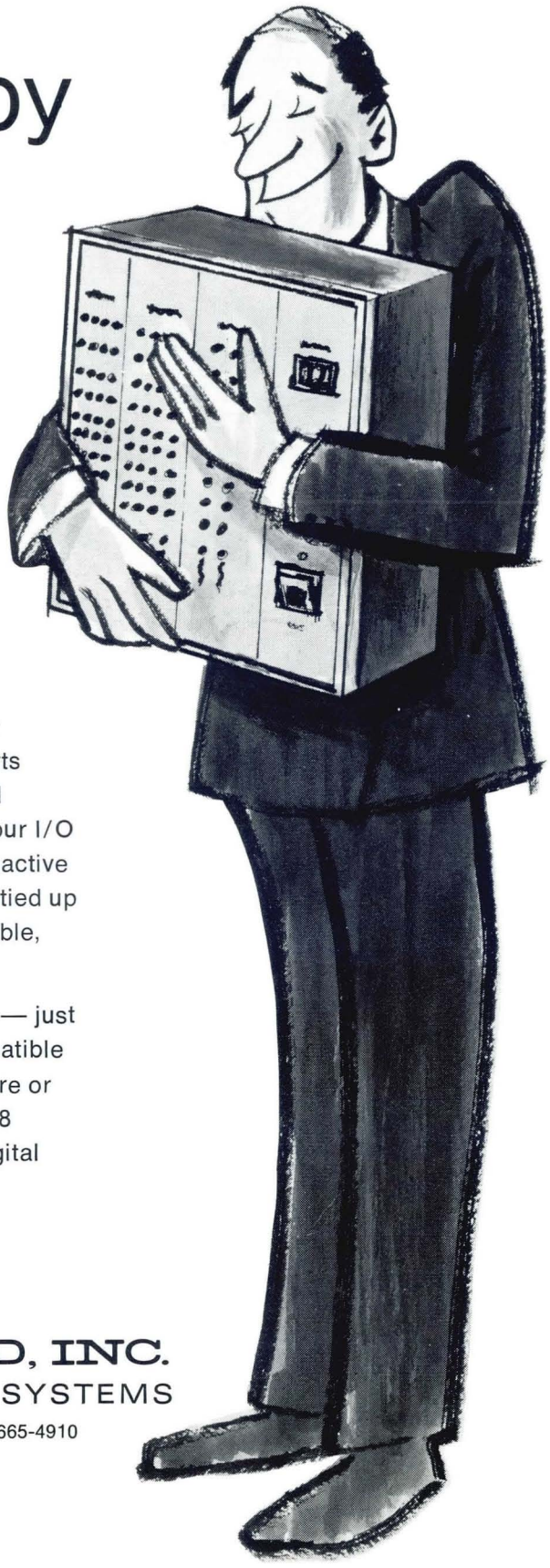
How to be a rich and happy time share computer manager...



PICK UP a Technitrend Computer Port Selector

Off the shelf NOW . . . Technitrend's new *high-speed switching* AS-1000S Automatic Computer Port Selector, that floats all connecting computer ports between in-calling terminals. What follows? — added profits . . . as the AS-1000S automatically keeps all your I/O ports fully loaded during peak demand — never an inactive port while customers are queuing! Ports need not be tied up by dedication to any incoming lines . . . but are available, when inactive, for use by local or distant customers.

The AS-1000S is easy to install, requires no adapters — just plug in line and port connectors . . . completely compatible with all time share computers. No changes in hardware or software . . . accommodates any size system up to 128 lines for 64 ports. Even has an optional, automatic digital answer back when all ports are busy.

Write or phone for literature.

TECHNITREND, INC.
DATA COMMUNICATIONS SYSTEMS

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CIRCLE NO. 11 ON INQUIRY CARD

When you plug in

THE QUIET ONE

You can un-plug your ears

Our new stand-alone VST/1000 CRT Data Terminal for Time-Sharing gives you everything a teletype does... except distracting racket

No clickety-clack. No rattle. No bells. No roar. Nothing to distract you. Yet the quiet little VST/1000 handles your computer communications more effectively than a teletype—without any hardware or software modifications at all.

It's easy to install: just plug it in. It's easy to operate. It has the standard typewriter keyboard secretaries are accustomed to—plus a 10-key adding machine keyboard for faster entry of numerical data.

It's easy to read, too. The VST/1000 has a CRT screen which can display 18 lines with 36 characters in each line on a single display page. When the last line of the first page on the screen fills up, the page is automatically put in storage and a second page comes on the screen. Each number and character you see on the screen is distinctly formed, stable and legible as the type on this page. And when you want to revise, correct or delete a character, you simply use the keyboard cursor.

The unit is completely self-contained, with keyboard, CRT, electronics, and power supply. A result of advanced solid-state technology, the VST/1000 is ideal for time-sharing companies, large and small. And our nation-wide network of service centers keeps it that way.

The cost? Astonishingly iess than other CRT data terminals. But then, you wouldn't expect a quiet little machine like this to have a great big noisy price, would you?

Attention: Leasing Companies
VST/1000 is the most leasable, reliable, and economical CRT terminal you can stock.

Check the performance features of our stand-alone Terminal VST/1000

1. SCREEN SIZE	Standard 12 inch Tube (80 sq. in.)
2. CAPACITY	Two Pages, One on the Screen, One in Storage, (1296 Characters)
3. DISPLAY PAGE	36 Characters/Line—18 Lines/Page (Folded logical 72 character line)
4. CHARACTER SIZE	0.25″ x 0.17″
5. CODE	ASCII—8 level Start/Stop Code
6. REFRESH RATE	60Hz
7. DISPLAY	64 Characters
8. PARITY CHECKING	Even
9. KEYBOARD	Teletype Model 33TZ, plus standard 10 key adding machine, plus ten control keys
10. CURSOR	Cursor Home Control Up/Down or Left/Right Cursor may be moved one space at a time or slewed. Non Destructive Cursor
11. BAUD RATE	Input/Output rates of 110, 150, or 300 baud are available
12. OUTPUT HARD COPY	Information may be printed with a model 33, 35, or 37 Teletype, NCR-ETM2 or other compatible printer
13. COMMUNICATION MODE	Full or Half Duplex (Switch Selectable)
14. COMMUNICATION INTERFACE	RS232B, and/or TTY
15. MAGNETIC TAPE	(Optional)
16. POWER	120 Watts
17. SIZE	18″ x 18″ x 18″
18. WEIGHT	55 Pounds

19. STANDARD FEATURES
Totally self contained
The Page on the screen may be:
1. Written on and transmitted simultaneously
2. Written on and stored until desired
The page in storage may be recalled for modifications
EIA interfacing is provided including a 25 pin standard EIA connector
The unit is directly interchangeable with a Model 33 Teletype
Automatic Answer-back of a WRU character
High Reliability obtained by extensive use of Complex integrated circuitry, meaning fewer parts and easier maintenance.
Remote Monitor Capability

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It is estimated that there will be over 30,000 time sharing terminals in use by the end of this year. Yours may be one of them. If so, you will be called upon to make objective recommendations involving over 200 companies offering time sharing services. You'll need comprehensive, objective facts. And you'll need them in a hurry.

Where will you get them? Commercial time sharing is growing at such a phenomenal rate that information over three months old is already obsolete! The fact of the matter is: there just hasn't been an unbiased, in-depth study available on time sharing. Until now.

AUERBACH Time Sharing Reports now answers your need to know. It puts at arm's reach all the facts you need to be your own time sharing expert. This unprecedented service not only acquaints you with every major aspect of time sharing but keeps you up to date through quarterly supplements. It's a user's guide, reference source, and evaluation tool—all superbly edited and organized in a single two-volume set.

The basic reports detail each commercial time sharing service offered, describing system characteristics, user support, applications and languages, terminals and service fees. Also included are AUERBACH's world acclaimed comparison charts to aid you in performing your own evaluation on the basis of cost-performance and service data.

Try matching these exclusive *Reports* features against any periodical or hardbound publication in the field:

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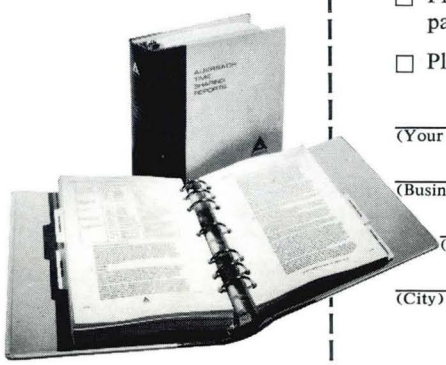
- A tutorial on time sharing
- State-of-the-art reports
- A review of the economics of time sharing
- Business and computational application systems
- Libraries available for time sharing
- Time sharing evaluation techniques
- Interface equipment and terminals

Take the first step toward becoming a time sharing expert. Fill out the coupon and be "in the know" on the fastest growing development in computer technology.



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Most computers start and end with a mainframe. The Honeywell 316 just starts there.

For example, you get one of the widest choices of peripherals and subsystems offered today. The latest: A Data Acquisition and Control Subsystem that lets laboratory operators link the computer to remote sensors, control elements, and instrumentation. And new peripherals are being continually introduced. What's more, with over 400 μ-PAC logic modules available, you can design and build your own special interfaces. That's Ultramation . . . the ultimate in automation by Honeywell computers.

Series 16 computers have been used in hundreds of applications: Data concentration in reservation systems for almost a dozen airlines. Automated medical research and intensive care systems. Seismic studies, industrial control, and weather forecasting in severe environments. Time-sharing . . . simulation . . . data conversion . . . and many more. They're probably right for you, too.

Need computers outside the U.S.A.? We build them in the United Kingdom, too, and deliver from there.

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CIRCLE NO. 14 ON INQUIRY CARD

You can spend 3 weeks programming your next test. Or you can spend 3 days.

When you run a complicated test, your computer controls the instruments and keeps up with the data they generate. But programming the computer can take up much more time than most of us can afford.

To save you this valuable time Hewlett-Packard developed DACE—a data acquisition and control executive designed to get your computer system on the air in minutes.

With DACE you can direct your system from task to task in clock-controlled real time, scheduling the parameters you want measured, converted, computed, compared, displayed, stored or controlled—in the order you want. You can also query a value or change a parameter through the keyboard, without recompiling your program.

DACE is another example of the total systems support you get from Hewlett-Packard. Ask your HP field engineer how DACE can shorten your test procedures. Or write for our DACE bulletin. Hewlett-Packard, Palo Alto, California 94304; Europe: 1217 Meyrin-Geneva, Switzerland.

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DATA ACQUISITION SYSTEMS

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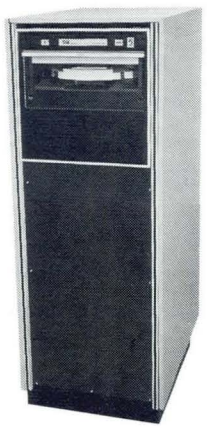
Now, a Disk Memory Drive, less than $3,000.*



A good Disk Memory Drive doesn't have to be expensive.

We're producing and delivering single-disk, removable-media, disk drives to major computer manufacturers at prices that are an industry breakthrough.

These disk drives, which utilize the IBM 2315 disk cartridge or equivalent, are built to meet the needs of the mini-, small-, and medium-size computer manufacturer. Conservative design and rigorous testing ensure ultra-reliable and consistent performance.

So if you spend more than $3,000 for a single-disk memory drive, you'll spend too much... a Disk Memory Drive doesn't have to be expensive to be good.

For further information and complete specifications, contact Jim Flynn at Computer Memory Devices, Inc., 5170 West Bethany Home Road, Glendale, Arizona 85301. Phone (602) 939-9444.

* In OEM quantities.

Computer Memory Devices, Inc.

5170 West Bethany Home Road, Glendale, Arizona 85301

Moore New Ideas for Data Processing

Improve order service; get completed shipping labels as bonus

When shipments require multiple containers, labeling those containers becomes a major bottleneck. A source of errors, too. Moore has a simple system that generates a 21-label batch as a by-product of preparing the shipping documents. System is so inexpensive, you can afford to throw away the unused labels. Ask about Idea #301.

Keep parts lists current and error-free

Where parts are both manufactured and bought from outside vendors, record keeping can be a nightmare. Especially with design changes and new models being introduced. Moore has a way to turn this task over to your computer so it is done quicker, more accurately, and at far less cost. It even lets you determine at a glance which parts come from outside vendors. Ask about Idea #302.

Update outgoing bills by hand and still retain record of new data

The sooner customers get billed, the sooner you get your cash. When purchases are made after bills are prepared, you usually have to wait for next billing cycle. This can tie up needed cash. Moore has a way to get these last-minute items added to statements after the computer run. The additional data is automatically included in your file copies. Ask about Idea #303.

Cut detaching costs from $5 per M to pennies

Moore's Imprinter-Detacher can do in a few minutes what would take hours by hand. It detaches, removes margins, imprints, sorts. Lets you make better use of clerical help. Ask about it.

If it's new, Moore knows about it. If you can use it, Moore will tell you

Moore's 2600 representatives constantly hear about new ideas and weigh their usefulness to the people they call on. That's why it pays to keep in touch with your Moore man. He's a specialist in ideas that speed business transactions and keep the records straight. One Moore idea may be what you need.

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Over 675 offices and plants, 2618 salesmen in North America

CIRCLE NO. 17 ON INQUIRY CARD

New Data Multiplexer

AVAILABLE **NOW**/IMMEDIATE DELIVERY

FULL PANEL DISPLAY. At all times the status of each remote data terminal is displayed on the front panel with color-coded lights. Automatic continuous diagnostics — power, telephone line error rate, complete overall system status — are up front, telling it like it is.

MODULAR — FOR EASY SYSTEM GROWTH. The ADS-660 provides the happy combination of minimum cost per terminal/channel plus really easy system expansion — just plug in another card for each new terminal. The Multiplexer interfaces with data terminals, telegraph lines, CRT devices, and/or dial-up data sets.

MINIMIZE TELEPHONE COMMUNICATIONS COSTS. Put from one to 45 remote customers on line to a central computer anywhere in the USA — whenever they want time on the computer. Equipment costs are lower because the ADS-660 uses state-of-the-art solid state design to provide a basic character-interleaved multiplexer capable of handling virtually any combination of inputs without accessory interface equipment.

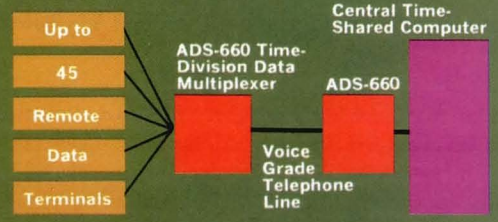
MIX BAUD RATES. The ADS-660 allows intermixing of up to three different baud rates, and operating through any high speed synchronous modem at transmission rates from 2000 to 9600 bps. (Naturally, we recommend the ADS-448 automatically equalized modem, operating at 4800 bits per second.)

MULTI-DROP. Place customer terminals in several cities along the telephone route and make your time share system even more efficient with additional ADS-660 units.

LOW COST. Purchase or lease plans, low operating cost and low growth cost will delight your controller. Send for full details. Better yet, telephone. The ADS-660 is in stock, in quantity, immediately available.

DATA MODEMS/DATA MULTIPLEXERS/DATA TERMINALS/DATA SYSTEMS

For Computer Time-Share Systems



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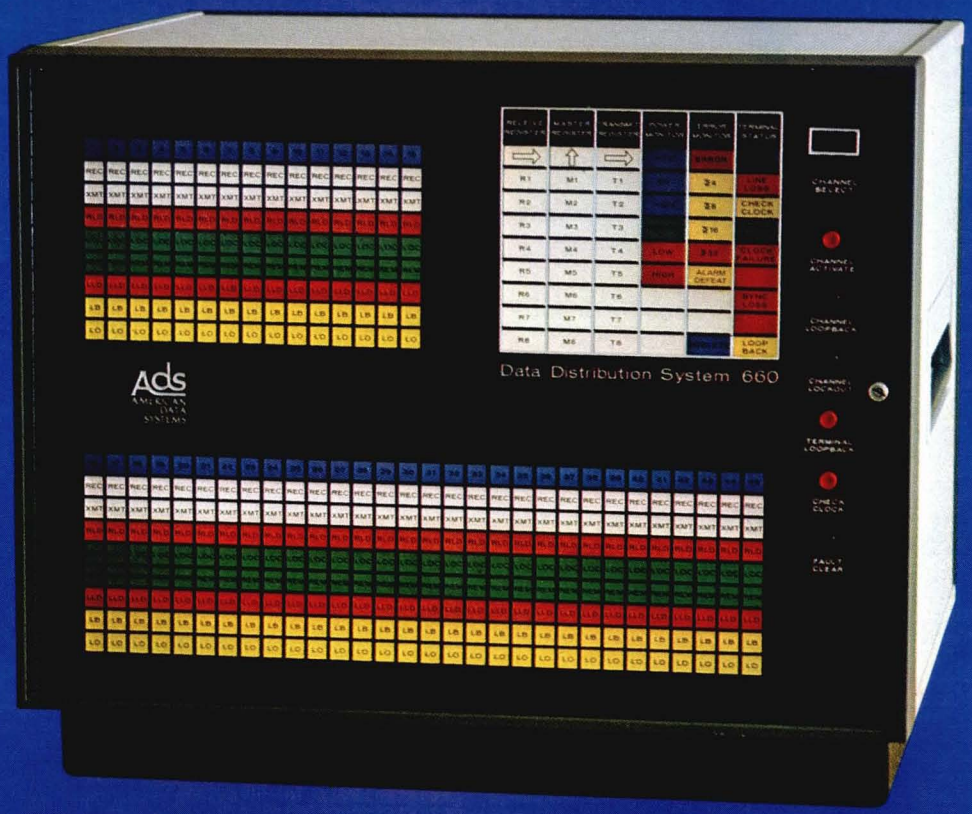

NEWS ROUNDUP

IIA PROPOSES NEW FCC STUDY

The Information Industry Association (IIA) called on the Federal Communications Commission to create a separate study of the potential of community antenna systems (CATV) and related broadband communications technologies for low-cost delivery of information products and services. These technologies, according to IIA's filing in the FCC CATV inquiry, offer the prospect that within the decade the cost of delivering information at a page per second will be competitive with current postal rates. The IIA filing came in response to a series of questions raised by the FCC in its current CATV inquiry into development of communications technology and services and into the future configuration of information services to the home, school, and office. In its filing, the IIA contended the economic and social implications of modern information services *vis a vis* broadband communications involve issues significantly different from those involved in other FCC proceedings.

Among other filings made in the proceeding cited by the IIA were comments submitted late last year by the Industrial Electronics Division/Electronics Industries Association on "The Future of Broadband Communications." The IIA comments dealt with: (1) Distinctions between computer switching services in communications networks and applications of computer technologies in pre-processing, searching, and retrieving information products from automated storage systems; (2) Information products and services which will be profoundly affected by broadband delivery capabilities; (3) Requirements for compatibility of television display and facsimile recording systems; (4) Format and resolution considerations involved in interfacing current and foreseeable information techniques with low-cost facsimile recording devices; (5) Traffic and marketing problems in broadband communications; (6) Need for two-way communications services; (7) Needs for privacy; (8) Equipment standards; (9) The nature of the regulatory environment and the need for proprietary rights concepts suited to these technologies.

Copies of the IIA filing can be obtained from the **Information Industry Association, 1025 15th St., N.W., Washington, D.C. 20005** for $5 per copy.

NEW HONEYWELL RESEARCH CENTER

An Information Sciences Center is being established in Cambridge, Mass. by Honeywell Inc. to conduct basic research in advanced computer systems. Named to head the center's research staff was Dr. Ugo O. Gagliardi, most recently a v.p. of engineering and technical director of Interactive Sciences Corp.

DEC ANNOUNCES 16-BIT COMPUTER

Details on its new family of 16-bit computers (first described in MODERN DATA last February), plans for the development of a lower-cost PDP-8 and the availability of three new small computer peripherals were announced last month by Digital Equipment Corp. Two models in the PDP-11 family will be offered initially: the PDP-11/10, a dedicated controller equipped with central processor, 1,024 words of read-only memory, and 128 words of standard memory; and the PDP-11/20, a general-purpose computer with central processor, 4,096 words of standard core memory expandable to 32,768 words, a programmer's control panel, and Teletype. Price of the PDP-11/10 is $7,700, while the base price of the PDP-11/20 is $10,800. Both prices include software, automatic power fail protection and restart, full priority interrupt, direct memory access, and customer familiarization training. Quantity discounts are available.

According to Nick J. Mazzarese, vice president in charge of both the PDP-8 and PDP-11 product lines, "the new PDP-8 will be a completely re-designed version of existing models but [illegible]ch will be program- and interface-compatible. [illegible]ipherals, which were designed for the PDP-8 but [illegible] be made available for several of DEC's other computer lines, include an optical card reader, a high-speed disk storage unit, and a low-cost line printer. Mazzarese pointed out that the PDP-11 will not replace the company's PDP-8 small computer family. "The PDP-11 gives us a 16-bit, byte-oriented computer that complements the 12-bit PDP-8 line," he said.

GOVT. REGULATIONS OF PHONE COMPANIES?

"Phone companies must either close the gap between their performance and the business communities' accelerating demand for service, or risk more government control and even the loss of their monopoly position," said Richard W. Sonnenfeldt, president of Digitronics Corp. "Today the transmission of business information over phone lines is not only faster, but actually cheaper than by mail. But the telephone companies have failed to anticipate the demand adequately. Unless there is a marked improvement in service and delivery of line interface hardware during the coming year, there will be increased pressure for government action," he said. Mr. Sonnenfeldt sees the Carterfone decision as a progressive step intended to speed expansion of data transmission services. "However, the phone companies still control the rate of installation because they alone furnish the wires to which others must connect," he declared.

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Thinking of going on-line to your computer?

Would your operation be more productive if you used a display terminal designed to...

- edit text
- layout pages and ads
- fit headlines or cutlines
- enter advertising
- schedule production
- check credit
- estimate jobs
- answer customer inquiries
- enter accounting data
- provide management information

You can use the Computer-Optics CO:70 Display Terminal to perform these jobs because it has these features:

- 88 character set • standard typewriter keyboard
- upper/lower case A-Z • numerals 0-9
- 26 symbols for custom design
- 3000 character screen capacity
- built-in editing functions
- software and interfacing for IBM S/360, IBM 1130, PDP 8
- local and remote operation • P31 phosphor
- human factored for ease of operation.

and a price that's hard to beat.

For more information on how CO:70 can go to work with your computer, please contact Mr. E. J. Shaughnessy, Marketing Manager, Computer Optics Inc., Berkshire Industrial Park, Bethel, Conn. 06801 or phone (203) 744-6720.

Specialists in display systems

Computer Optics

ORDERS AND INSTALLATIONS

The U.S. Army Test and Evaluation Command will install a new $16.7 million Univac 1108 multiprocessing system next year at the White Sands Missile Range. The contract calls for five Univac 1108 and seven Univac 418-II computers. Other new Univac revenue: a letter contract authorizing expenditure of $6,155,000 to Univac's Federal Systems Div. for production of microminiature computers for the U.S. Navy's new antisubmarine warfare aircraft, the "P-3C Orion."

Data General Corp. has signed a long-term OEM agreement with Alpha Data Inc. of Tarzana, Cal., for the purchase of magnetic disk memory systems to be used with Data General's Nova series computers. The amount of the initial release was approximately a quarter of a million dollars.

Eastman Kodak has awarded Cubic Corp. a $3.6 million follow-on contract for the continued production of an undisclosed quantity of Kodak KOM-90 Microfilmers. Cubic has been manufacturing the systems since December 1968.

Westinghouse Electric Corp.'s Information Systems Laboratory has been awarded a $488,264 contract by the Dept. of Transportation to design an information network aimed at improving state and national highway safety programs. The contract, let by DoT's National Highway Safety Bureau, calls for the design of a national system which will enable individual states autonomously to compile and exchange information necessary to operate and manage their own highway safety programs.

Award of a $7,193,569 contract to Lockheed Electronics Co. for production of a new highly-accurate shipboard gunfire control system was announced by the U.S. Navy. The contract, announced in Washington by the Naval Ordnance Systems Command, covers production of the Mark 86 computerized radar-controlled gunfire system.

Michigan, Indiana, and Minnesota have signed contracts totaling $655,000 with Aspen Systems Corp. of Pittsburgh, Pa. This brings to 28 the number of states using Aspen Systems for the computerization of their legislative processes, statutory searching, updating, compilations, or publications. Five of these, including Michigan and Indiana, involve full compilation of all their state statutes.

Recognition Equipment Inc. has placed a $1.9 million order with Los Angeles-based Data Products Corp. for computer line printers. Delivery of line printers will begin this year and continue into 1971.

Raytheon has been awarded a $3.8 million contract by Qantas Airways Ltd. for the remote terminal equipment portion of the Australian airline's new automated reservations and departure control system. Under the terms of the contract, Raytheon will supply Qantas with more than 400 DIDS-400 Digital Information Display Systems.

Princeton Time Sharing Services, Inc. is adding an IBM S/360-65 computer, valued in excess of $3 million, to its facilities at Princeton, N.J.

Astrodata, Inc. announced installation of a $1,800,000 high-speed telemetry data acquisition system sold to Control Data Corp. The Astrodata equipment, in conjunction with a CDC-6400 and three CDC-1700 computers, will be used by Grumman Aircraft Engineering Corp., in Bethpage, L.I., to acquire, process, and reduce real-time data during aircraft flight tests.

Computer Sciences Corp., as a member of a team headed by RCA, was awarded an initial increment on a multi-million dollar subcontract to RCA to work on the engineering development of the U.S. Navy's new AEGIS shipboard weapons system. The subcontract is believed to be one of the largest single awards that CSC has yet received.

Tele-Signal Corp. of Woodbury, N.Y., a subsidiary of The Singer Co., has been awarded a contract by Communication Satellite Corporation (COMSAT) for new circuit control and message-switching equipment. This equipment is intended for use at four COMSAT-operated earth stations which serve as U.S. links in the global commercial satellite communications network.

Control Data Corp. has received a $1 million contract from the U.S. Navy to install seven CDC data collection systems at seven Naval Air Rework Facilities (NARF) throughout the country. The systems will provide management with job status information, maintenance and personnel data, and information on machinery utilization.

Management Science Systems, Inc., a consulting and software development firm located in Rockville, Md., has been awarded a contract by Esso Mathematics & Systems, Inc. to develop an advanced mathematical programming system for IBM 360 computers. The new system, to be called EMPS/1, will replace IBM's MPS/360.

Scientific Computer Service Corp. has installed an IBM 1130 BASIC Time-Sharing System — said to be the first time-sharing service in Alaska — at their facilities in Anchorage.

ALCOA Management Information Services, a division of The Aluminum Company of America, has ordered two Comcet 60 and two Comcet 10 Systems, with associated peripheral subsystems, for installation at their central computer site in Pittsburgh. The Comcet Systems will serve as the communications front-end for an IBM 360/65 System and will process communications traffic for the ALCOA Communications Switching Network. The network services 120 sales offices, manufacturing plants, and warehouses in the U.S., Switzerland, Hong Kong, Brazil, and Surinam with expansion planned for Australia and Jamaica. The contract is in excess of $900,000 for leased equipment, software, and maintenance service.

IS HIS MINI COMPUTER ALL THAT GOOD? OR IS IT HIS SALESMANSHIP?

Every knock on the door these days is another mini computer salesman.

Most of the companies you can rule out without even talking with them. But there are three or four of us you really have to talk to.

And four is a lot of mini computer pitches to have to evaluate.

So this is what Data General's going to do.

We're going to send you not just another mini computer salesman. Not just another guy with a shoeshine and a smile who knows only enough about mini computers to tell you just what his company told him to tell you.

We're going to send you a Data General applications engineer who probably knows a lot more about mini computers than anyone in your company. A man who has specific instructions from us to tell you to forget about Data General if our computers aren't right for you.

We'll also tell you enough about our two mini computers right now so you'll know whether we're in your ballpark or not on the basis of this ad alone.

Both our Nova and Supernova have multi-accumulator organizations, 16-bit word length and a simple package design. They're 5¼" high. Their read-only memories are interchangeable with their core memories.

Nova in a basic 4K configuration with Teletype interface goes for $7950.

Supernova has an add time of 800 nanoseconds from core memory, 300 nanoseconds from read-only. In its basic 4K configuration, Supernova goes for $11,700.

If neither of these Data General mini computers sounds like what you're looking for, so long.

It's been nice talking to you.

DATA GENERAL

Makers of Nova and Supernova mini computers.

CIRCLE NO. 24 ON INQUIRY CARD

INTERNATIONAL NEWS

Computer job-hopping is virtually unknown in Japan, according to a team of visiting Japanese EDP specialists, but this has not prevented the development of a serious shortage of computer personnel in that country.

This fact was disclosed during a special program on EDP recruitment held for the Japanese visitors in the New York City offices of Robert Half Personnel Agencies, Inc. The 16-man team, representing as many different Japanese companies, has been visiting data processing companies and computer installations in this country under the auspices of the Japan Productivity Center, Washington, D.C.

"A junior programmer starting on his first job in Japan gets $100 per month," said Robert Half, president of the nationwide firm of financial and EDP specialists, "as compared to the going rate of $10,000 per year in this country. But Japanese benefits include lifelong job security, company housing, vacation homes, automatic bonuses, pension, family allowances, health insurance, and even commuter fares. These go far towards equalizing what might at first appear to be a wide discrepancy in salary scales."

The Japanese visitors said that tradition in their country makes it most likely an individual will spend his career with the company he first joins. While this may be in management's favor, it restricts recruitment almost entirely to in-house activities.

Tradition also makes it virtually impossible to fire an employee; if his performance on a job is not satisfactory, he is re-trained for another. Length of service is a major factor in determining pay raises, and a top EDP specialist may earn about $5,000 a year in salary before taxes. From the date a new man is hired until mandatory retirement at age 55, the typical total cost to a Japanese company per employee is about $140,000.

A nationwide computer record of trading and price ranges in unlisted securities is visualized as an outcome of a recommendation to establish a central agency in Ontario, Canada, to collect daily volume and price statistics in unlisted stocks. The Investment Dealers Association (IDA) has already asked IBM to prepare the necessary programs, according to David S. Beatley, Commissioner of the Ontario Securities Commission. IDA believes it is the first time anywhere in the world that a fully-computerized program of this magnitude has been attempted in the unlisted securities field.

IFIP Congress 71 has issued a call for papers for the fifth global conference in the information sciences, to be held August 23-28, 1971, in Ljubljana, Yugoslavia. For information about the Congress, exhibition, and organized travel arrangements, write to: U.S. Committee for IFIP Congress 71, Box 4197, Grand Central Post Office, New York, N.Y. 10017.

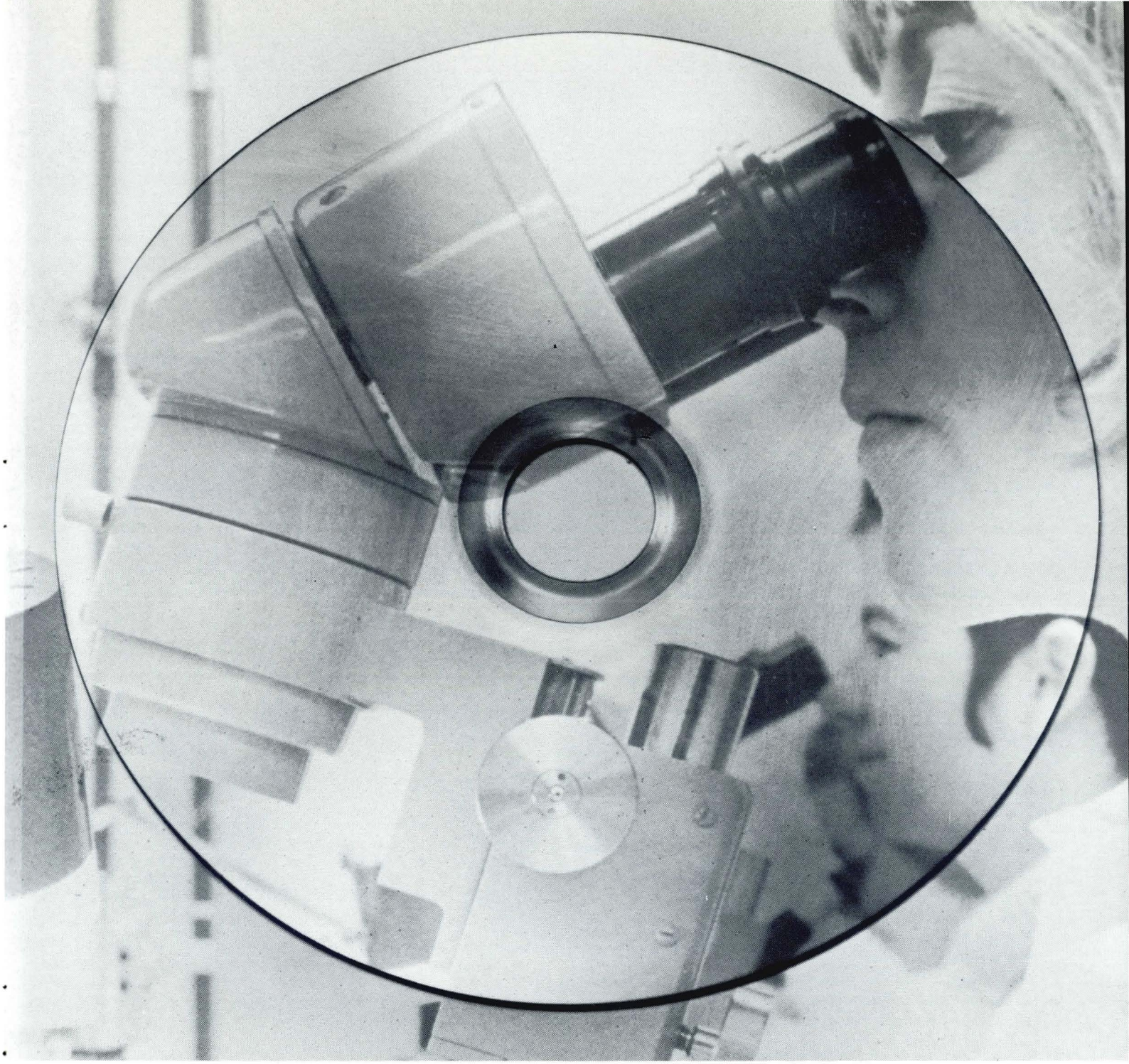
Several Italian shipping companies are experimenting with on-board computers, the long-term objective being to control a fleet of ships from a land-based central computer. The Esquilino was recently equipped with IBM equipment at Genoa, Italy, and a number of other Italian ships are also participating in the experiment. According to Prof. Agostino Capocaccia of Genoa University, "the mission proposes to verify in what manner a ship can be totally controlled, instead of by separate, independent sectors, as is done presently." Signals from artificial satellites will be used by the Esquilino to make automatic corrections in course and speed.

The Canadian Air Force is installing a $3.5 million computerized system at its Primrose Lake Evaluation Range in Alberta. The system will track a plane and simultaneously monitor temperature and wing stress. Designed by the Reeves Instrument Div. of the Dynamics Corp. of America, the system, which uses a Honeywell 516 for data reduction, is a more sophisticated version of one installed in this country by the FAA about five years ago.

The major computer tie-up predicted by National Fund Investments in its pre-listing prospectus materialized recently when NFI and Honeywell, Inc. jointly formed Honeywell Computers South Africa. Honeywell Computers will act as a marketing and servicing organization for all Honeywell EDP equipment. Initial subscribed capital of the company will be $2.8 million, with shares equally held between NFI and Honeywell. Provision has been made for substantial additional capital when required.

Trade contacts see a big increase in the sales of standard computer terminal and other peripheral equipment in Italy over the next two or three years. In the opinion of one widely-quoted trade source, Italy may well be the "best market in Europe" for this kind of equipment, which he estimates could be 20,000 new terminals by 1971. Small- and medium-size firms are expected to take increasing advantage of new time-sharing services recently initiated in Italy. Italian industrial groups (Montedison, Pirelli, Enel, SIR, ENI, FIAT, etc.) are reportedly preparing for major investments in terminal and related equipment. Olivetti, with the completion of a new factory at Ivrea, is expected to produce some 30,000 terminals a year, starting this year.

The U.S. Dept. of Commerce expects the number of computers in Germany to double in the next five years. There were about 4,850 computers in Germany at the start of 1969. A significant factor is the German Science Ministry's five-year, $75 million program that includes installation of data processing equipment in the National Patent Office and in various government agencies for criminal investigation, medical diagnosis, and regional planning. A follow-up program, for 1971-75, is expected to involve about $185 million.



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CIRCLE NO. 25 ON INQUIRY CARD

CORPORATE AND FINANCIAL NEWS

IBM MOVES DIVISION

IBM announced that Atlanta will be the headquarters location of its new General Systems Division, which is responsible for developing and manufacturing most of its smaller-scale data processing equipment. The division's operations will be shifted from its temporary headquarters in White Plains, N.Y. to Atlanta sometime this spring. GSD's principal products include the recently-announced System/3, the 1130 computing system, punched card equipment, card input/output machines, data acquisition and control equipment, and key entry devices other than data transmission terminals.

MERGER ACTIVITY HITS NEW HIGH

Merger activity rose to a new peak in 1969 with 6,132 merger announcements recorded, according to an annual merger survey and analysis by W. T. Grimm & Co., a Chicago-based financial consulting firm specializing in mergers and corporate consolidations. This represents a 37% increase over the 4,462 transactions counted in 1968.

The Grimm study revealed that prices paid by buyers in 1969 declined moderately from 1968. The average price paid for sellers, where such information is available, came to 21.5 times the sellers' most recent earnings. This represents a 13% decline over the 1968 price-earnings ratio of 24.6. While the p/e ratio declined, the premium paid over the sellers' pre-transaction stock value remained at 25%, the same as in 1968.

In analyzing the form of payment for consolidations in 1969, Carl Neumann, Grimm's director of research, stated that 32% of the deals were for cash and debt securities, while 57% were for equity-type securities, and 11% were for a combination of equity and cash or debt. Mr. Neumann commented that the decline in stock prices accounted for the fall in the use of equity-type securities to effect transactions in 1969. In 1968, equity-type securities represented 62% of all transactions and 60% in 1967. Cash and debt deals accounted for 29% of the total transactions in 1968 and 36% the year before. The use of the combination method of payment increased to 11% of all transactions, up from 9% in 1968 and 4% in 1967.

Incentive-type transactions — where the purchase price is based in part on future profits — climbed sharply again during 1969. Last year, 728 incentive payouts were recorded, up from 305 a year earlier. In 1968, incentive payouts were used in 7% of all merger transactions, while in 1969, this type comprised 12% of all mergers. Mr. Neumann pointed out that "the year-to-year growth in the use of contingent pay-

BOX SCORE OF EARNINGS

Company	Period	Revenues	New Earnings (Loss)	Earnings (Loss) per share
Advanced Computer Techniques	6 mos. 9/30/69	1,683,160	30,799	.04
	6 mos. 9/30/68	1,198,758	55,421	.09
Analog Devices	Yr. 11/1/69	8,765,000	616,000	.50
	Yr. 11/1/68	5,750,000	501,000	.44
Anderson Jacobson	6 mos. 9/30/69	2,199,692	260,051	.15
	6 mos. 9/30/68	392,628	30,467	.02
Applied Logic	Yr. 9/30/69	3,090,109	(75,235)	(.04)
	Yr. 9/30/68	1,076,080	90,889	.06
Bresnahan Computer	3 mos. 9/30/69	1,138,000	154,000	.11
	3 mos. 9/30/68	125,000	15,400	.02
California Computer Products	3 mos. 9/28/69	4,585,376	93,780	.04
	3 mos. 9/29/68	4,353,566	234,489	.10
Computer Resources	Yr. 9/30/69	1,029,000	238,772	.58
	Yr. 9/30/68	211,454	25,296	.09
Computing and Software	Yr. 10/31/69	64,420,000	4,155,000	1.11
	Yr. 10/31/68	53,377,000	2,687,000	.73
Dearborn Computer and Marine	Yr. 10/31/69	38,335,000	2,727,000	2.11
	Yr. 10/31/68	10,613,000	1,250,000	1.50
Digitek	6 mos. 10/30/69	948,992	(171,091)	(.19)
	6 mos. 10/30/68	1,233,403	95,939	.11
Information Interscience	Yr. 6/30/69	1,538,204	(692,460)	(–)
	Yr. 6/30/68	1,340,380	(196,280)	(–)
IOA Data	Yr. 9/30/69	3,377,337	163,337	.23
	Yr. 9/30/68	1,565,308	120,124	.24
Leasco Data Proc. Equip.	Yr. 9/30/69	451,940,000	43,928,000	2.71
	Yr. 9/30/68	395,508,000	27,389,000	1.86
Logicon	6 mos. 9/30/69	3,239,794	150,408	.20
	6 mos. 9/30/68	2,480,521	109,037	.15
Management Assistance	Yr. 9/30/69	71,505,000	(9,824,000)	(–)
	Yr. 9/30/68	66,885,000	(19,955,000)	(–)
Modern Data Techniques	Yr. 7/31/69	247,000	(285,000)	(–)
	Yr. 7/31/68	9,000	nil	(–)
Planning Research	3 mos. 9/30/69	14,847,208	731,648	.16
	3 mos. 9/30/68	12,781,900	573,563	.12
Scientific Resources	Yr. 9/30/69	48,716,894	(3,531,559)	(.94)
	Yr. 9/30/68	11,285,558	(4,377,632)	(1.38)
Wang Laboratories	3 mos. 9/30/69	5,466,228	541,188	.14
	3 mos. 9/30/68	4,388,337	416,228	.11

CIRCLE NO. 26 ON INQUIRY CARD

We can make you a winner. All you have to do is run with our new plated-wire stacks.

They'll give your 3rd- and 4th-generation mainframe memories blazing speed: Nondestructive read cycle time, 150 nanoseconds or less. Write cycle time, 300 nanoseconds or less.

And how about vendor reliability and assured delivery dates? You get them because of our revolutionary packaging techniques. We make the unique tunnel structure, with its integral word straps, entirely in-house.

You save space, too. Typical one-plane stack is 12½" by 15½" by ½" thick, packing 72K bits for any standard word/bit configuration. For economy's sake, the organization is compatible with the 2½D techniques of present submicrosecond core memories.

So team up with Lockheed's plated-wire stacks — you'll have the world's fastest mainframe memory running for you. Write to Memory Products, Lockheed Electronics Company, Data Products Division, 6201 East Randolph Street, Los Angeles, California 90022.

Lockheed Electronics
A Division of Lockheed Aircraft Corporation

Break records with your next mainframe memory.

outs demonstrates the increasing sophistication by both buyers and sellers in providing additional future payments based on growth in earnings of the acquired company without causing an immediate dilution of the acquirer's earnings per share."

Tender offers recorded in 1969 were down sharply from 1968. The 149 tender offers recorded for 1969 represent a decrease of 100, or 40%, from a year earlier. High interest rates together with a general reaction against tender offers account for the substantial reduction.

Total sales of corporate divisions or subsidiaries increased in 1969 to 789 from 557 one year earlier. Sales of divisions accounted for approximately 13% of the overall transaction total.

Merger cancellations also increased significantly during the year. A total of 586 cancellations of proposed combinations occurred in 1969, up from 384 cancellations in 1968. This represents a 53% increase in cancellations in 1969, attributed largely to the weakness of the stock market and inability of management to agree on pertinent features of the merger agreement.

RECENT ENTRIES IN THE COMPUTER FIELD: *Arlington Computer Enterprises, Inc.*, a data processing and computer programming company, has been organized and has opened a data processing center in Arlington, Texas . . . *Computers Unlimited, Inc.*, has opened its first computer center in Rochester, N.Y., offering time-sharing, batch processing, and programming services to EDP users in Upstate N.Y. . . . *Control System Industries, Inc.* of Mountain View, Cal. will produce systems for civic and process control applications . . . *Mechanical Technology Inc.* has formed a new subsidiary, Datafile Systems Corp., to enter the computer-based information services market. The new firm will be located in Philadelphia . . . *First-Union Automation Services, Inc.*, a subsidiary of First Union, a holding company formed by First National Bank in St. Louis and St. Louis Union Trust Co., will offer OCR and COM processing services . . . *Information Transfer Corp.*, Santa Monica, Cal. has been organized to develop, produce, and market products and systems in two areas of information: resources investment and management, and continuing education and training . . . *Macro Services*, a Boston-based EDP firm, will provide systems consulting, software development, and computer services . . . *Proprietary Computer Services*, Encino, Cal., will specialize in computer processing of specific and original proprietary programs as well as systems analysis, computer programming, facility management, and consulting . . . *TENET, Inc.*, Palo Alto, Cal., is a new manufacturer of medium-scale (32-bit, 32K memory) time-shared computers. The firm believes it has developed the first "pure" time-shared computer . . . *TOPS On-Line Services, Inc.* will be a direct subsidiary of a new Southern Pacific holding company, and will be headquartered in San Francisco. TOPS will provide on-line, real-time data collection and information systems . . . A new subsidiary, *United Business Communications, Inc.*, has been formed by United Utilities, Inc., to function as a supplier to users of private voice and data communications systems and hardware.

MERGERS AND ACQUISITIONS: *Automatic Data Processing, Inc.* has agreed in principle to acquire *Electronic Data Service, Inc.*, a Chicago-based data processing services firm; signed contracts to acquire *MSM Computer Service* of New York City; and completed the acquisition of *Tamcor, Inc.*, a New York City data processing firm . . . *Brandon Applied Systems, Inc.*, plans to acquire *College Campus Promotions, Inc.*, a marketing, sales promotion, and publishing organization . . . *Calculator-Computer Leasing Corp.* of Pittsburgh has acquired *Caribe Data Processing, Inc.* a computer service center in San Juan, Puerto Rico . . . *Comp-Serv* has acquired all of the stock of *Minilon Corp.*, doing business as the Skytron Engineering Co. Comp-Serv is a supplier of replacement parts for computers and computer peripherals . . . *Computer Sharing, Inc.*, a Pennsylvania subsidiary of Scientific Resources Corp., and *Data Network Corp.*, based in N.Y., jointly announced an agreement in principle for a merger of the two corporations, each of which is engaged in providing computer time-sharing facilities and services . . . Spokesmen for *Computing and Software, Inc.* and *Mortgage Associates, Inc.*, a company primarily engaged in computerized servicing of mortgages, announced that preliminary discussions relating to the possible acquisition of Mortgage Associates by Computing and Software were being held . . . *Dataram Corp.* has signed an option to purchase the major interest in Boston's *Alphanumeric Data Corp.* for an undisclosed amount of cash and stock . . . *Datatab, Inc.* has sold its Los Angeles computer letter subsidiary, which had operated at a loss in 1969, to privately-owned *American Computer Resources, Inc.* of L.A. . . . *Datatron Inc.* has agreed in principle to acquire *Bouse Manufacturing Co.*, Santa Ana, for an undisclosed amount of common stock. Bouse produces electronic chassis, computer-type consoles, and equipment enclosures . . . *Data Products Corp.* plans to acquire *Tranetics, Inc.* Terms of the acquisition have not been finalized . . .

HARD TIMES

The Mathatronics Division of Barry Wright Corp., a manufacturer of programmable desk-top calculators, has closed down. Mr. Ervin Pietz, Barry Wright's president, said that the company was unable to find a purchaser for the division within the deadline established by management for either sale or discontinuance of operations . . . The Jonker Corp. of Gaithersburg, Md. has filed for bankruptcy. Jonker manufactured and marketed a "peek-a-boo" card retrieval system . . . Scientific Control Corp. has filed a Chapter XI arrangement to issue over 2 million shares of restricted common stock to Great Southwestern Corp. of Ft. Worth for $1.00 per share. SCC has also suggested a plan which would provide common stock to major unsecured creditors in satisfaction of their claims.

The second revolution in computer time sharing continues.

And we're winning it.

■ The AL/COM interactive time sharing network will electrify every sophisticated computer user in the United States.

AL/COM now gives you more interactive computing power with faster response time, than any other time-sharing system . . . 32,000 36-bit words per user. Cycle time one microsecond. Your access to this increased computer power is instantaneous and direct. Through your telephone. Privately. It's a "tough-job" system and it has the best price/performance ratio there is.

■ AL/COM has a policy about insoluble time sharing problems. We solve them.

We're after the tough jobs, the big ones. We're talking about price/performance ...good response time...and freedoms that time-sharing hasn't granted you before. Things like:

Core Capacity – AL/COM gives you 160,000 characters (32,000 words) in active core per user.

On-Line Storage – AL/COM has a billion characters of disc storage.

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Fast Access – AL/COM can search a 2.5 million character bank in seconds.

■ The things you can do with AL/COM time sharing are limited only by your imagination.

AL/COM has the bugs worked out. We've been up for 3 years. We can connect you with teletypes, line printers, CRT's and multiplexers. We speak eight languages . . . BASIC, FORTRAN IV, COBOL, etc. We're adding others. AL/COM solves problems in science, engineering, and banking. It's for operations research, marketing and statistical analysis, and bridge building . . . for management information, investments, and manufacturing. We even do little problems well.

■ When comparing time sharing services, you can't include AL/COM with the others.

AL/COM service stands out because we've interlaced a string of multi-processing AL-10 systems, with one computer backing up another in each system, and a second dual system backing up the first . . . and we'll soon have ten. They're all side by side, but as close as your local phone. Think about that...central files...back-up...speed . . . reliability . . . distributed nationwide by the AL/COM Time-Sharing Network.

■ When you select AL/COM you get a nationwide network of computer software professionals.

We bring AL/COM to you through a nationwide network of professional software organizations. We're more than reps, dealers or branch offices. We're AL/COM Associates; local, independent firms, among the best in the industry. Systems and applications expertise is an integral part of the AL/COM network. This means you have the largest group of independent computer software experts to help you solve problems more efficiently, right at your elbow . . . through AL/COM. Two new "Associates" are selecting AL/COM each month. Why don't you?

■ In just 30 seconds, you can arrange for a demonstration of the world's best price/performance computer time sharing service.

Experiencing AL/COM is believing. We'll benchmark AL/COM against your present system. Compare the response, the speed, the cost. Do you have a problem you can't solve on your present system? Try us. We're after the tough ones.

■ It takes guts to start a revolution.

Revolutions are started by people dissatisfied with the way things are. Success depends on a change for the better. That's what AL/COM is all about . . . and it's revolutionary.

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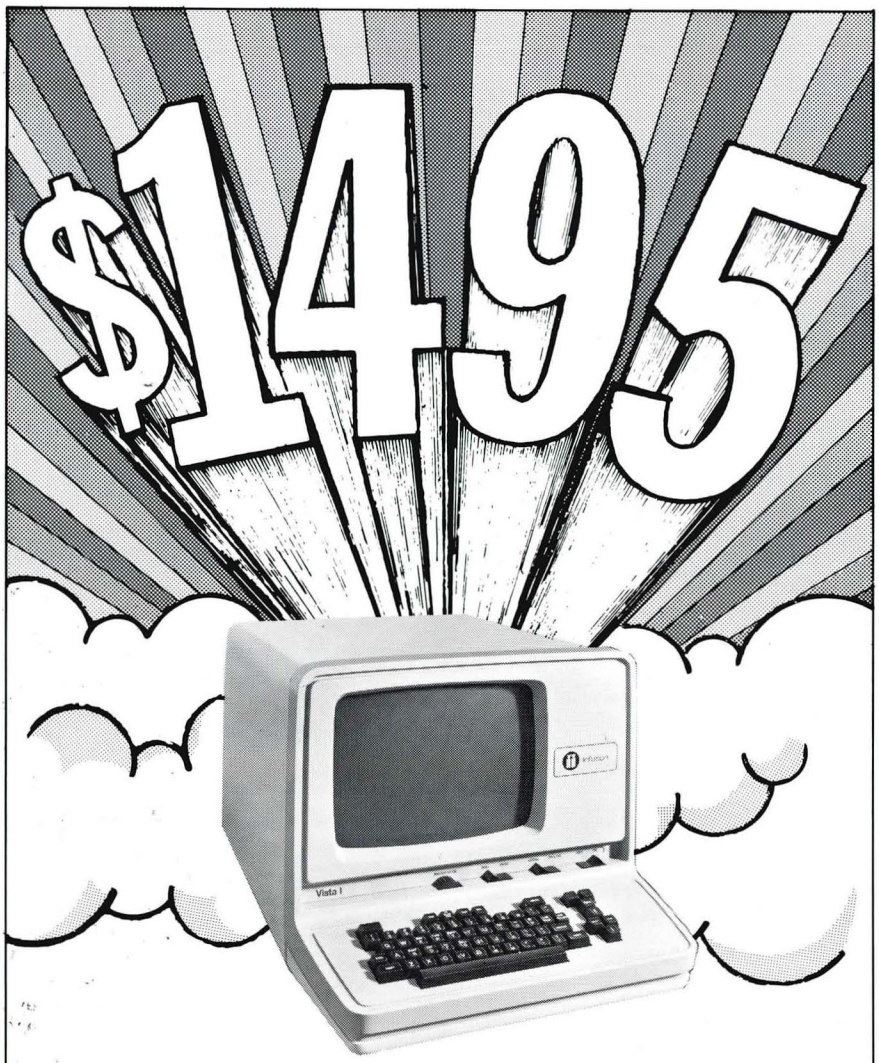
CIRCLE NO. 27 ON INQUIRY CARD

A controlling interest in *Digital Data Systems Corp.,* Pennsauken, N.J., has been purchased by South Jersey businessman, Berdj C. Kalustyan for a reported $450,000 . . . *Financial Technology Inc.,* a Dallas computer firm, has acquired approximately 80% of *Comtec,* a publicly-held New Orleans time-sharing company . . . *Geodatic,* a company providing computerized market research services, has agreed to acquire *National Compu-Graphix, Inc.* of Jenkintown, Pa., a privately-owned designer and distributor of computer forms and supplies . . . *Hospital Corp. of America* has agreed in principle to acquire *Real Time Computer Systems, Inc.* . . . *American Biomedical Corp.* and *Medical Computer Systems, Inc.,* both of Dallas, have announced an agreement in principle by which MCSI will acquire *American Medical Computer Centers, Inc.,* a wholly-owned American Biomedical subsidiary . . . *N.C. Sciences, Inc.,* a public corporation, has agreed to acquire *Datacap International, Inc.,* a privately-held Utah firm, and its subsidiary companies, Graphcomp Sciences Corp. and Datacap Computer Systems, Inc., for an undisclosed amount of common stock . . . *Sylvania Electric Products Inc.* has acquired approximately 72 per cent of the outstanding common stock of *Programming Methods, Inc.* The shares were purchased for $9,225,000 from Riker-Maxson Corp. . . . *Transamerica Computer Co.* has agreed in principle to acquire Toronto-based *Scientific/Commercial Research Services Ltd.* . . . *United Data Centers, Inc.* has agreed in principle to purchase the assets and business of *Sports Data Corp.* of N.Y. City. Sports Data provides golf handicapping and billing services to country clubs. In a separate announcement, UDC reported that it has sold *Computech, Inc.,* its N.Y. data center, to *International Systems Associates Ltd.* for a combination of cash and common stocks . . . The mergers of *Computer Leasing Co.* and *Computer Industries, Inc.* with wholly-owned subsidiaries of *University Computing Co.* became effective in mid-December . . . *Optimum Systems Inc.* of Palo Alto, Cal., and *U.S. Time-Sharing, Inc.* of Reston, Virginia, have entered into merger negotiations . . . *URS Systems Corp.* and *The Matrix Corp.* jointly announced the termination of negotiations for the acquisition of Matrix by URS . . . *Vernitron Corp.* has agreed to acquire *Trygon Electronics, Inc.,* a producer of electronic power supplies and digital voltmeters . . . *World Computer Corp.* has acquired *National Communications Corp.* for an undisclosed amount of stock. Both companies are headquartered in Dallas, Texas.



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FIRE DAMAGE

A fire has seriously damaged the production facilities of Acroscope Engineering, Inc. of Los Angeles. Acroscope, a wholly-owned subsidiary of Electronic Memories and Magnetics, produces disk memory substrates for another E.M.&M. subsidiary, Caelus Memories, Inc., as well as for other disk manufacturers.

Who ever heard of a computer with an EPU*?

Unlike any other computer you've ever seen, the GRI 909 Computer, a Direct Function Processor, has an expandable instruction set. Starting with the basic configuration of nearly one hundred instructions, it can be expanded with firmware modules to literally thousands of instructions.

Typical units in our standard library of plug-in firmware operators are "Multiply/Divide" "Byte Swap/Pack", "Byte Comparator", and "General Purpose Registers". And, if you prefer, you can make up and plug in your own proprietary operators.

This is a true hardware expansion of the processor unit . . . not merely a read-only memory execution of subroutines. (Although the GRI 909 can handle that too, of course.)

Don't box yourself in. Get the GRI 909. It's a family of computers within a single processor unit.

For more information on the Direct Function Processing technique write:

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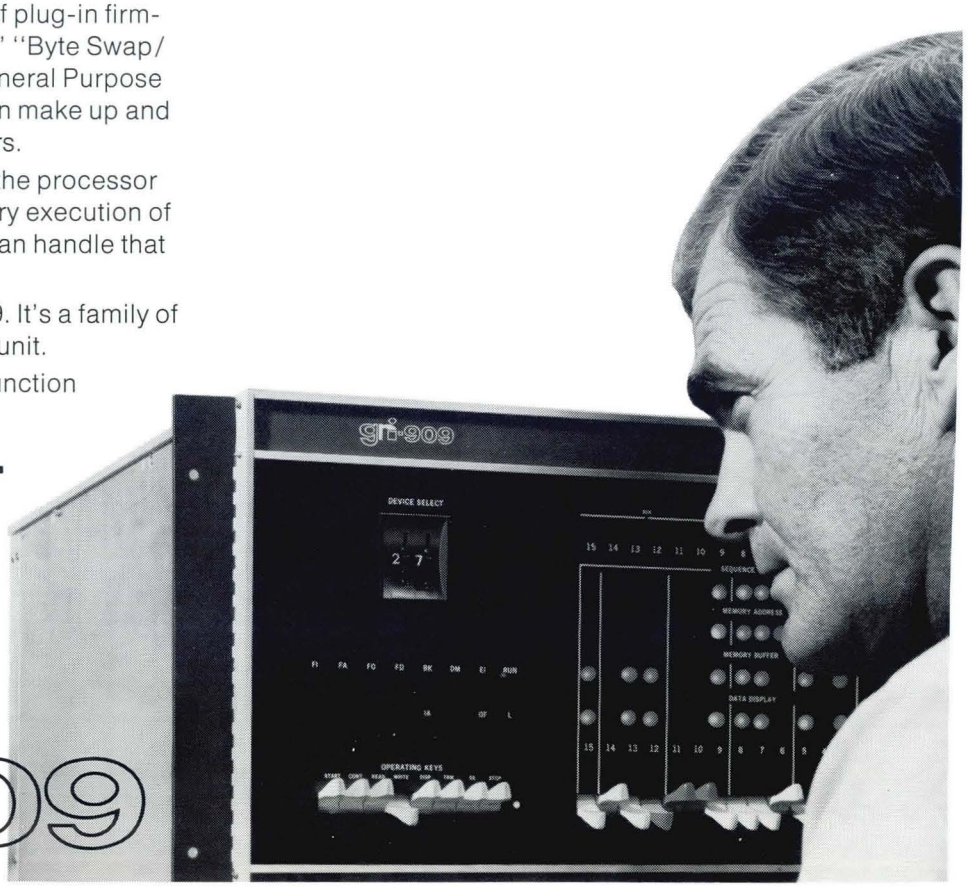

* EXPANDABLE PROCESSOR UNIT

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THE NEW BREED

datalinks

A Newsworthy Compendium of How EAI Hybrid, Digital and Analog systems help make a complex world relatively simpler.

HOW ROUND IS ROUND?

Grammarians assure us that something is either round or it is not, not more nor less. But what is so in the world of grammar may not be necessarily so in the world of dynamics. Take an ordinary automobile tire for example. At rest it may look round, measure round, and, indeed be round. But at 60 MPH, it is subject to enormous stresses of centrifugal force as 87.5 feet of tread-face whip past a given point in a second's time. How now, round tire? How round? How imbalanced? The time to answer these fair and important questions is not after the fact but during the manufacture. And that is just what a solid-state control system engineered by EAI is doing daily for a number of tire manufacturers. Result: a superior product with a much lower reject rate, a faster manufacturing cycle, and added peace of mind for grammarians and others travelling at 60 MPH.

If you're concerned with making things that must maintain their geometry under dynamic as well as static conditions you'd be well advised to see what we have for you. Write and request "Tire", Dept. 206D. Please mention what you want to measure and control, too.

GC PEAKS AND THE SOFTWARE DEMON

As with motherhood and the flag, consensus holds that computerized data reduction is with us to stay. But, in practice, it all gets a bit hairy. Take data from an analytical instrument like a GC. A few giants in the industry continue to stumble over problems in GC like noise, signal processing, or really useful software. EAI is still the pioneer here in its PACE III analytical data system. One seemingly small thing is a software technique for resolving complex GC peaks. It consistently and accurately apportions complex areas, ranging from overlapping components to poorly resolved shoulder peaks. Part of the technique accommodates the usual "skew" in component elution to give consistent improvement in accuracy of quantitative analysis. (Our research people gave a paper on it at the 158th National ACS meeting.) It's all part of the whole PACE III system--a turnkey data system for many analytical instruments--GC, mass spec, and the like.

For a copy of the paper and a detailed booklet on PACE III write to Dept. 206D.

IMITATION POLLUTION CAN BE A SOLUTION

A topic destined to polarize the citizenry these days is pollution--any kind of pollution. Take a simple thing like free oxygen in water. Overload the water with oxygen-hungry chemicals--no oxygen. Or develop too many organisms--plant life prospers (called eutrophication) and no oxygen. Either way, no fish. And with no fish, you've upset the water ecology. Pragmatic scrutiny tells us we can't shut down our industries to bring back pristine, airy waters. Fortunately, we can imitate these conditions by computer simulation, and get a grip on the ameliorative aspects of a solution.

Recently, EAI provided the HEW with a hybrid-computer simulation of the Delaware River Estuary. From this simulation engineers can tell where to best locate stand-by reservoirs, what flow rates to employ, and when to do it. We've written this one up. A request to "Delaware", Dept. 206D, will get you a copy, and get us both cracking on another solution.

KINETIC DATA MEANINGFULLY SHAPED BY COMPUTER

In olden times petrochemical process design involved finding rate and equilibrium constants for several reactions required a trial-and-error method. Much trial. Much error.

Most process designs involve the solution of ordinary differential equations --in a lumped-parameter system where changes are taking place in time but not space. With the use of analog computers, solutions poured forth. However, distributed parameter systems involve changes in time and space simultaneously--expressed by partial differential equations. Many approaches to PDE solution have evolved for digital computers. But such solutions consume more and more hardware, with ever-present error creeping back in as problem complexity increases.

Hybrid computers clear this difficulty up. Kinetic data is programmed into the analog portion, actual results go into digital computer memory. The analog makes a series of process condition runs, the digital stores the data, matches the results from the plant and computes least mean square deviations. The "solution" has been found when results of simulation most closely match actual conditions, and no further reductions can be made in mean square deviation values. Optimization is achieved--in time, money and results.

After much struggle, EAI is pleased to offer a software package in this arcane speciality--write to "Kinetic", Dept. 206D Electronic Associates, Inc., West Long Branch, N.J. 07764.

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Harold V. Semling, Washington Editor

DC DATASCAN

HOUSE STANDARDIZATION HEARING — Standardization in government data processing systems and related matters are expected to be the subject of some hot Congressional hearings in February or March. The hearings will be held by the House Government Operations General Activities Subcommittee, headed by Rep. John Brooks (D. Tex.). In two or three days of hearings, the group will hear from the Bureau of Budget, General Services Administration, and the National Bureau of Standards on, among other things, standardization of OCRs and data management systems.

BY THE NUMBERS — The infantry soldier historically frequents some of the nastiest areas and climates in the world, performing dirty and tough jobs. But at the Army Infantry School at Fort Benning, Ga., young officers and officer candidates practice battlefield techniques on a "Buck Rogers" computer teaching system. Advanced students conduct mock battles using a Honeywell Model 200 computer that simulates battlefield conditions and judges the effectiveness of the students' plans. Officer candidates learn and practice mortar fire direction using a CRT console. Questions and problems flash across the screen, and the students key-in their answers for on-line processing and scoring.

SHIPPING LINES — A unique seminar on computer-aided management for shipping line executives was sponsored recently in Washington by the Maritime Administration. About 30 high-ranking executives of major U.S. shipping lines attended lectures on computer-aided management techniques and discussions of actual cases involving applications of these techniques. The programs were developed by Applied Decision Systems, Cambridge, Mass. "We believe that the application of modern computer and management techniques to the marine industry has not kept pace with improvements in the techniques themselves," Maritime Administrator A. E. Gibson commented.

DATA INDEPENDENCE — Congressman Jack Brooks (D. Tex.) has urged freeing data from dependence on detailed and specialized application software. "Data on any tape must be self-defining" and "able to stand on its own," Rep. Brooks said in a speech at a meeting of the International Business Forms Industries. Unless we take the approach that data in a computer should be as independent as the data in a statistical table or reference book, he fears "we are in for an era of severe confusion and trouble."

NETTING COMPUTER SYSTEMS — The Air Force has told the Electronics Industry Association that it estimates that 90 percent of AF computers will be netted (networked) within a few years. EIA's Government Products Division is working on a report entitled "Computer Netting Standardization and Systems Management" which will be submitted to the Air Force for its consideration early this year.

ARMY POSTAL SERVICE — An Automatic Mail Directory System (AMDS) is now in operation at the U.S. Army Military Mail Terminal in San Francisco. The system was developed by Burroughs under contract with the Post Office Dept., and is operated by the Army Postal Service Agency. All letters and parcels undeliverable at the unit of address, and for which a forwarding address is not on file at the unit or serving APO, are referred directly to AMDS without recourse to directory service at a serving Area Postal Directory. The Area Postal Directory in Vietnam will be eliminated under the AMDS concept. A new factor in processing mail is the use of social security account numbers instead of Army service numbers.

MEDICAL JOBS — An "Occupational Analysis of Computers in Medical Sciences" has been published by the U.S. Dept. of Labor to meet the growing need for information concerning computer applications in medicine. The 90-page publication describes 19 occupations. It points out that "up to now the developments in computer technology, as applied to the medical sciences, have been occurring at separate points, with little opportunity for participants to communicate or to exchange information." The booklet can be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for 45¢.

NOT THE ANSWER — Theodore D. Woolsey, director of HEW's National Center for Health Statistics, recently told the American Public Health Association that data banks which store data as individual elements intended to be retrieved in aggregate forms are often inefficient in serving statistical users. Money spent on such banks, he said, "could much better be spent on improving the basic sources of the data that make up the statistics and on distributing them in published form." Mr. Woolsey made it clear that he did not object to using the computer for processing data and putting statistics in tabular or charted form, but to: the form of the relationship between the user and the data bank, the urge to link many kinds of data inside the computer, and the tendency of data bank proponents to neglect basic problems of data collecting.

FOR MORE INFORMATION ON PRODUCTS ADVERTISED ON THE FOLLOWING PAGES, CIRCLE NO. 30 ON INQUIRY CARD

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First we went overboard on the computer itself and came up with the best you can buy. A high speed, low cost unit with microprogramming, available off-the-shelf for only $3200. You get the basic processor with 16 multipurpose registers, 256 words of read-only store, basic console, enclosure and power supply to function as a microprogrammed controller. When you add up to 32K bytes of core memory, you also get the fastest computer in its class with a 1.1 μs memory cycle time and a 220 ns micro command execution time.

Then we went overboard on options so more of you could buy the 800. Take a good look at our selection. Chances are you'll find the board you need right here. If not, give us a call anyway. We can provide special options within 90 days for volume users. In the meantime, write for details on the Micro 800 and its microprogrammed general purpose partner, the 810.

Central Processor Option Boards

POWER FAIL AND AUTOMATIC RESTART. Provides interrupt when loss of power is imminent and when power is turned on.

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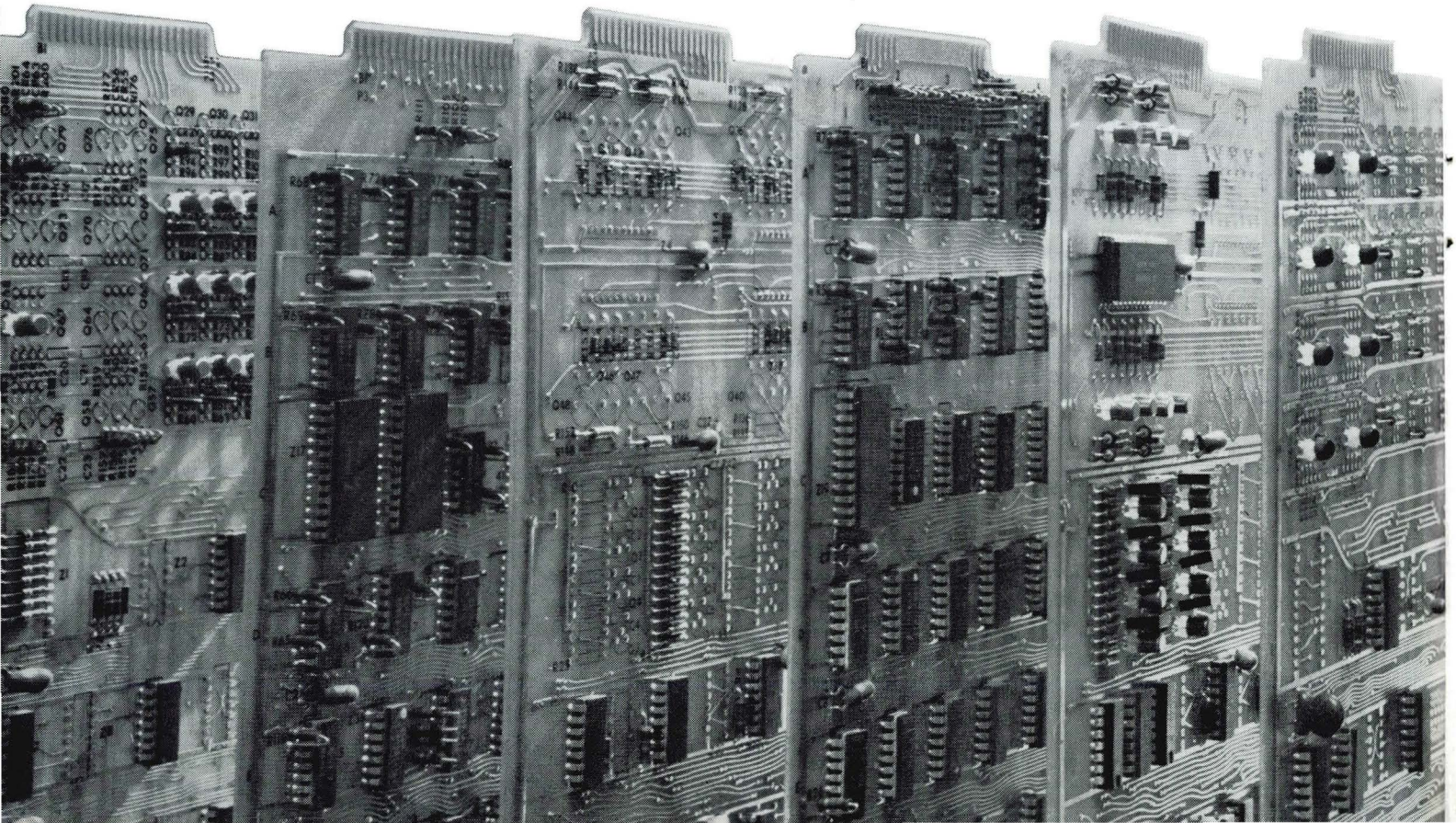
Utility Interfaces

INPUT/OUTPUT LINE DRIVER AND RECEIVER BOARD. Expands the internal I/O bus to an external bus allowing integration of up to 10 peripheral interfaces under program control, or concurrent data transfer with interrupt.

PARALLEL TELETYPE CONTROLLER. Assembles and disassembles serial information to and from the teletype for parallel transfer to and from the computer under program control or concurrent block transfer.

We've gone overboard on options



GENERAL PURPOSE I/O BOARD — WIRE WRAP. Accommodates 14, 16, or 24 pin integrated circuit sockets in the following quantities: 135 units—14 or 16 pin sockets. 24 units —24 pin sockets.

PRIORITY INTERRUPT BOARD. Allows interfacing of 8 external interrupt lines with expansion capability to 64 lines using 8 boards.

DIRECT MEMORY ACCESS SELECTOR CHANNEL. Provides for transfer of 8 bit bytes directly between external devices and core memory.

32 x 32 DISCRETE I/O. Expands the 8 bit I/O bus into multiple (4) byte I/O and operates with standard DTL or TTL logic levels.

Communications Options

SYNCHRONOUS MODEM CONTROLLER. Interfaces a Western Electric 201 or equivalent data set and operates with point to point or switched networks with optional automatic calling-answering for either 2-wire or 4-wire service.

LOW-SPEED ASYNCHRONOUS MODEM INTERFACE. Accommodates up to sixteen 103 type modems and operates with point-to-point or on switched networks.

MULTIPLE TELETYPE INTERFACE. Accommodates up to 24 locally connected teletypes and functions as a 4-wire full duplex with 20 ma currents.

Device Interfaces

CARD READER. Provides control of an 80 column card reader, 12 lines per column in Hollerith or two binary bytes, at reading rates of 225 or 400 cards per minute.

PAPER TAPE READER/PUNCH. Consists of two separate functions which can be mounted on the same board.

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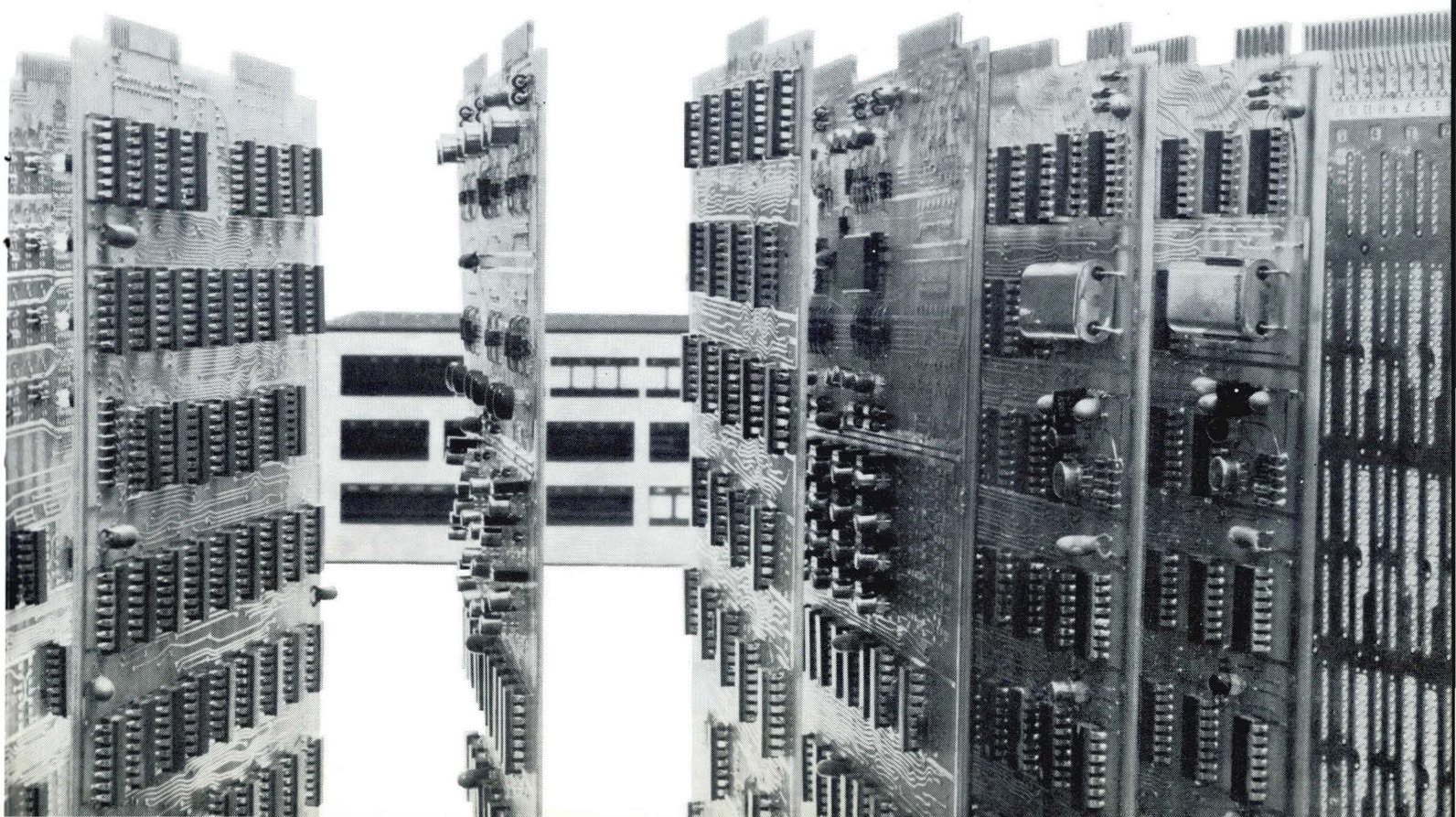
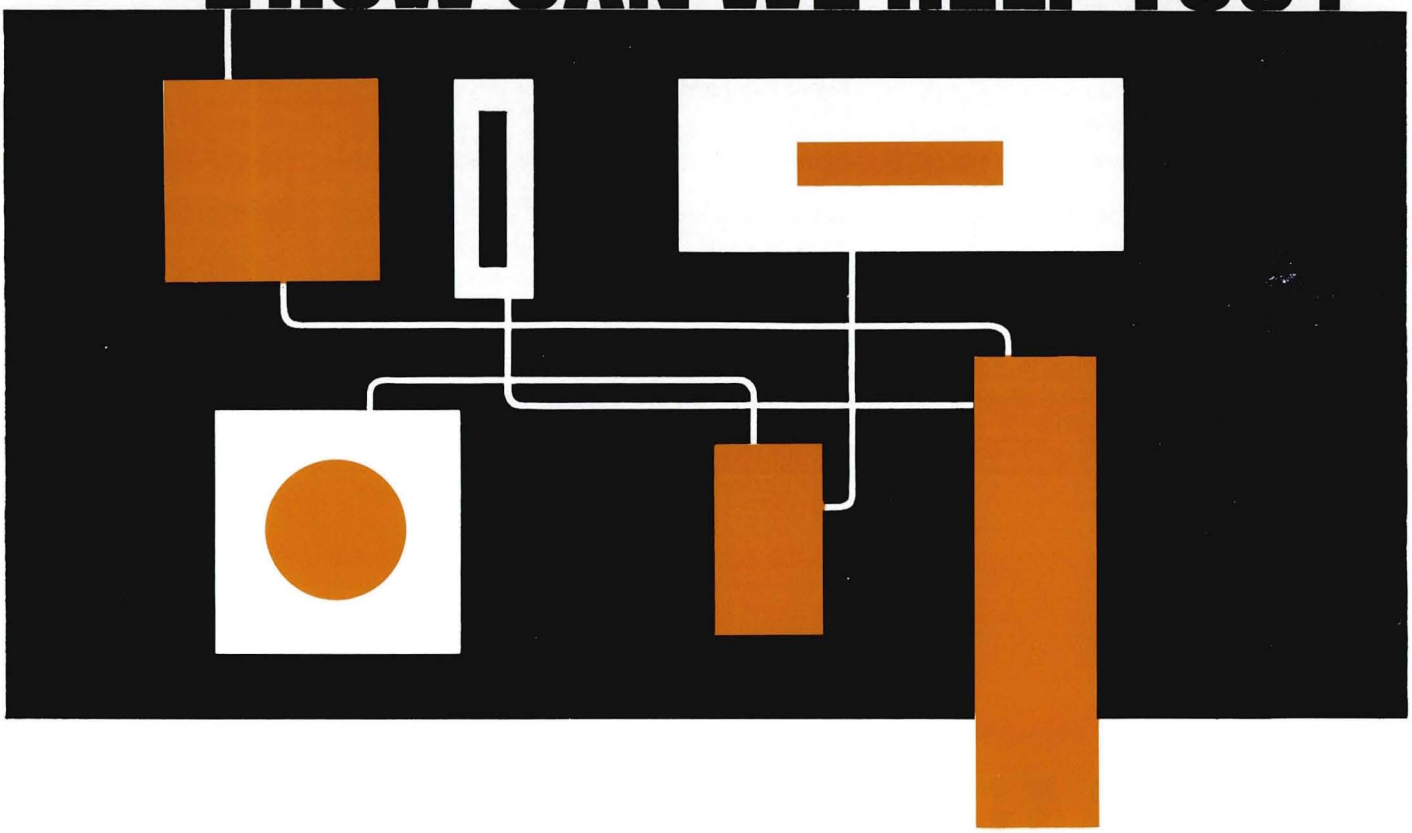


? HOW CAN WE HELP YOU?



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CORPORATE PROFILE

Featured this month:

APPLIED LOGIC CORPORATION

(over-the-counter)

One Palmer Square

Princeton, N. J. 08540

DIRECTORS: **Richard M. Colgate,** Chairman of the Board; **James H. Bennett,** Ph.D., Managing Director of Applied Logic Research Institute; **Thomas F. Droege,** Director of Systems Engineering; **William B. Easton,** Manager of Advanced Systems Development of Applied Logic Corp. and Technical Director of ALRI; **James R. Guard,** Ph.D., President of Applied Logic Corp. and Director of ALRI; **John Kean,** President, National Utilities & Industries Corp.; **Martin T. Mobach,** Executive Vice-President; **Thomas H. Mott. Jr.,** Ph.D., Dean, School of Library Service, Rutgers University; **Harry R. Slack, IV,** Vice-President, Corporate Relations, Purolator, Inc.

BACKGROUND: Applied Logic Corporation, founded in 1962, offers remote access, interactive computer services, through its AL/COM time-sharing system, to business, financial, engineering, scientific, industrial, and educational institutions. The company markets its time-sharing service through a nationwide network of AL/COM service centers and through the AL/COM associate network comprised of independent consulting and software companies that act as distributors. The company and the associates maintain data communications centers in 20 principal cities throughout the country. The AL/COM time-sharing service, based on Digital Equipment Corporation's PDP-6 computer, became operational in January 1966. Since that date, the company has implemented a new multiprocessing time-sharing system called the Dual AL-10, four of which are now in operation, with another scheduled to join them in the first half of 1970.

FACILITIES: ALC's corporate headquarters are in Princeton, N. J., where the first two Dual AL-10 time-sharing computer systems are installed. The company's first computer building, in Mathematics Park, consists of 20,000 sq. ft. including a 7,500 sq. foot computer room, and was completed in May 1969. The Mathematics Park complex is expected to provide facilities for approximately 24 Dual AL-10 time-sharing systems and 300 employees. The major hardware elements for the fifth, sixth, seventh, and eighth AL-10 Systems are already in process and should be brought into commercial service in 1970.

SERVICES: Applied Logic Corp. offers a computer time-sharing service which permits many people at different, remote locations to use simultaneously a centrally-located computer. The Dual AL-10 Systems are programmed to handle the complex problems of scientists, businessmen, managers, and engineers. Each system provides up to 32,000 36-bit words per user, with a cycle time of less than one microsecond. Up to 500 million characters of on-line disk storage and up to 1,250,000 characters per user file are available. The fourth system's configuration offers 700 million characters by virtue of supplementary disk files. This feature will ultimately be implemented in all AL-10s.

Remote terminals include Teletype Models 33, 35, and 37; IBM 2741 Communications Terminal; Dura and Datel Terminals; CalComp 12-inch and 30-inch plotters; line printers; CRTs; and multiplexers. Seven programming languages are available, including BASIC, FORTRAN IV, COBOL, AID, SNOBOL, MACRO-10, and LISP 1.6. Applications programs include ECAP, COGO-10, SIM-8, CPM, HYDNET-IV, and the AL/COM Crystallography Library.

The company is now designing and building an advanced communications computer to link each remote location to the central computer complex in Princeton. Initial output of the communications computer will be used by Applied Logic, but the company may market it to others as well.

CURRENT POSITION: During the year ended September 30, 1969, ALC achieved record gross revenues of $3,090,109, up 263 percent over the previous year's gross revenues of $1,176,080. However, because of the company's rapid expansion, a small loss resulted. Losses for fiscal 1969 were $75,235, or 4 cents per share, compared to earnings of $90,889, or 6 cents per share in 1968.

ALC successfully completed its first public stock offering in March of 1969, when 200,000 shares of Common Stock were sold at $25.00 per share. The proceeds from this offering are being used to stage Dual AL-10 Systems and for other corporate purposes.

OUTLOOK: Within the next three years, according to current industry projections, remote time-sharing sales will increase to about $1 billion annually. Applied Logic Corporation plans to win a substantial share of this market by continued expansion of its service through the installation of new Dual AL-10 Systems. The company feels that the favorable cost/performance ratio of the AL-10 System is the basis for expanded revenues and profits in years ahead. The Dual AL-10s also have the capability to handle emerging services in the time-sharing field such as data bank services and information networks.

ALC's 45 percent ownership of Mathematics Park, Inc., a company which is developing a research complex for technological and computer-related industries, may prove to be of substantial value in the future. For the purposes of further development and construction at Mathematics Park, MPI has arranged equity financing for a total of $1,260,000. Mathematics Park's first computer building will house six Dual AL-10 Systems. An additional computer building and an office building are due for completion in 1970.

Besides the large investments in new facilities and equipment that tripled ALC's time-sharing capabilities in 1969, the company's personnel roles grew from 100 to more than 225 employees.

FINANCIAL SUMMARY: The following statement of revenues and earnings shows the company's operations for the five years ended September 30, 1969.

YEAR ENDED SEPTEMBER 30			
Year	Revenues	Net Income (Loss)	Net Income (Loss) Per Share
1969	$3,090,109	$(75,234)	$(.04)
1968	1,176,080	90,889	.06
1967	533,309	51,217	.07
1966	358,708	15,930	.04
1965	74,091	(13,654)	(.12)

STOCK TALK

DRUG STOCKS

Stock Talk is a regular monthly column prepared by Spear & Staff, Inc. especially for MODERN DATA. Investment questions of general interest will be answered, as space permits, in this column.

Address questions to:
Dept. RAS
Spear & Staff, Inc.
Babson Park, Mass. 02157

Drug companies supply essential products whose use can rarely be deferred. Keeping ourselves in good health is a primary concern in any period and demands solution at all costs. The drug industry has benefitted from this essential demand and has been propelled to an impressive history of growth.

In the stock market, a premium has been and is being paid for this record. Drug issues have far out-performed the market averages and most industry groups in years past. Drug stocks consistently outpaced the market in 1969. In the last three months, while the market (as measured by Standard & Poor's 425 industrial average) dropped about 5%, the Standard & Poor's 12 drug stock average had gained 12%. In large measure, this recent impressive performance stems from the restrictive measures taken by the government to control inflation. Investors, uncertain about the economic future, have been drawn toward industries whose performance is basically unaffected by the ups and downs of the business cycle.

The drug industry has been earmarked by a history of above-average profitability. A First National City Bank study reported that in 1968, 39 leading drug companies had the highest percentage of net income on sales (profit margin) — 9.7% versus the 5.1% average reported for 42 manufacturing groups. This 9.7%, while an impressive figure, is less than the over 10% range that predominated in the early 60s.

This trend toward narrowing profit margins reflects the transitional period of the industry. Both the complexity of as yet unsolved health problems and the rising costs of research have been responsible for skyrocketing development expenditures. Since the passage of the 1962 drug amendment, research costs have climbed dramatically. The industry now estimates that it takes 5 years and costs $7 million to put a new drug on the market. Between 1959 and 1962, research spending increased at an annual rate of 7%. But between 1962 and 1968, the yearly rate jumped to 13%.

Government scrutiny of drug marketing practices, plus major patent expirations, has resulted in a 9% decline in drug prices since 1961. Another drain on profit margins comes from the fact that, with all the pressures on the industry from regulatory agencies, the companies have defensively been diversifying into lower-margined businesses. With inflation a predominant force today, rising labor and material costs have also been cutting into gains. These influences are expected to continue to have a slightly negative effect on profit margins into the 70s.

With all these factors considered, however, the industry should continue to hold its recession-resistant image. While drug industry sales are not likely to match 1968's 20% flu-inflated increase, shipments from drug manufacturers should have climbed about 9% in 1969.

On the international scene, drug exports and foreign manufacturing and research have been expanding consistently for nearly half a century. In 1969, drugs manufactured abroad accounted for most of the drug industry's foreign sales which were 30% of total volume. Ethical drug sales outside the U. S. showed a 12% increase last year as opposed to an increase of around 8% for domestic sales.

The U. S. Federal Government is the world's largest single drug customer and, as such, is an important force to be reckoned with by the industry. Approximately 2/3 of the Government's drug spending in 1968 went for Medicare payments and Medicaid reimbursements, with the remainder channeled through several Federal agencies. Total direct and indirect government drug spending increased 47% in 1968 to account for about 4% of total drug sales and some 12% of prescription sales. The government estimates that by 1975 its drug costs will be about two and a half times present levels — approximately 45% of the industry's domestic ethical drug sales.

Since 1938, no drug company has been allowed to market a new drug in the United States unless the Food & Drug Administration has declared it safe. Concomitantly the 1962 Kefauver-Harris Drug Amendments gave the FDA control over the advertising of prescription drugs, broadened its authority over manufacturer's quality control, and extended government supervision into clinical testing. As one can see, the government has a more-than-casual interest in the affairs of the drug industry.

One of the most important provisions of this legislation requires the industry to submit, for review, extensive evidence to the FDA to prove the efficacy as well as the safety of new drugs. The job of review was given to The National Academy of Sciences — National Research Council and, in late 1966, investiga-

tion of some 2900 drugs began. Completion of the review is scheduled for 1971. From these reviews the Administration will assign each drug to one of the following categories: 1) effective; 2) effective but; 3) probably effective; 4) possibly effective; and 5) ineffective.

The first major controversy has already arisen from the review. In April, 1968, the FDA proposed to halt marketing of 78 different antibiotic combination products. The contention was that antibiotics in fixed combinations, although widely prescribed, are not more effective than the individual ingredients used independently in amounts dictated by the patient's condition. This proposal has, in varying degrees, affected most major antibiotic producers.

The government has stated that it would like to increase price competition in the industry by advocating generic prescriptions. Since generics are marketed primarily by smaller companies, after brand-name patents expire, there is still controversy surrounding the use of these lower-priced compounds.

The recent government ban on cyclamates, which was subsequently revised, should have only a small negative impact on earnings of certain drug firms, however, it manifests the extensive influence which the government will exert if necessary.

There is no question that there are several problem areas which may affect the future of this industry. It faces higher development costs, increased government scrutiny, fewer new products, a rash of patent expirations on older products, and increasing foreign competition. On the positive side, however, the industry's future growth prospects continue to look encouraging. An expanding over-65 population, greater affluence, and increasing foreign interests should produce favorable sales trends in future years. Most industry specialists are looking for an 8%-to-10% annual growth rate in the 1970s.

With drugs one of the few groups showing gains, they are vulnerable to profit taking by institutions looking for performance. Drug issues, selling at relatively high price-to-earnings multiples, should be purchased cautiously on weakness.

INCOMING MAIL

Q) Twenty-five years ago I bought shares of Standard Sanitary at $13. Should I continue to hold these shares? F. O.

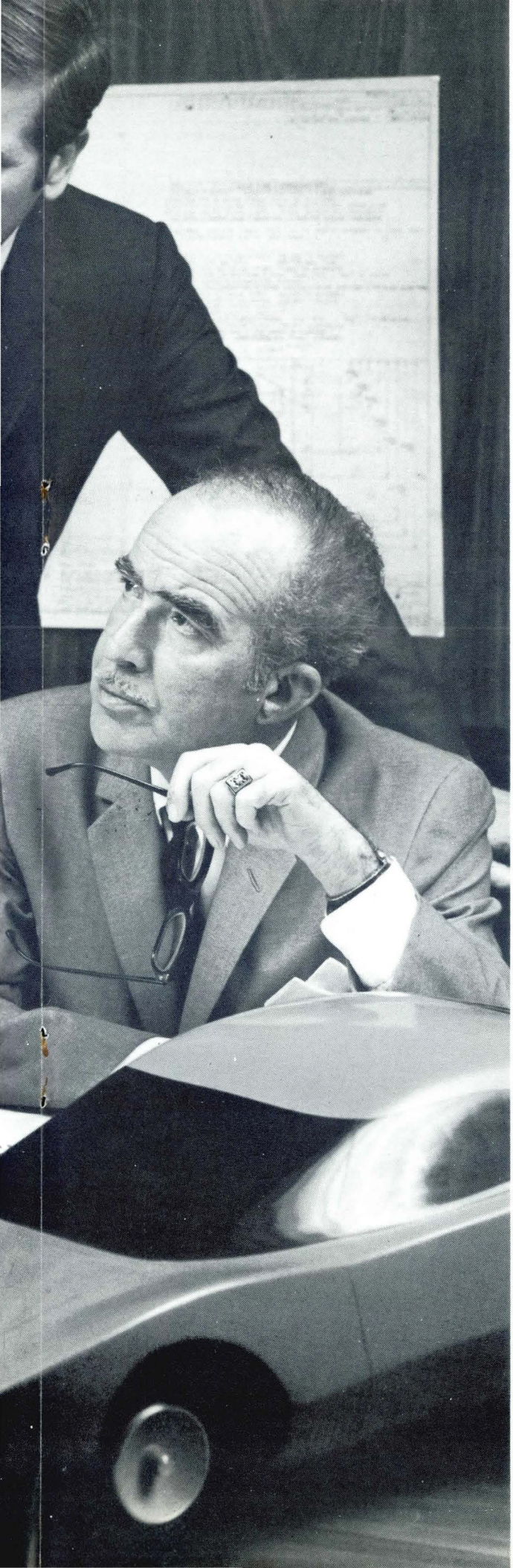
A) Now trading as American Standard, this company has been altered quite a bit since your purchase. In 1966, new management instituted a program of diversification, which resulted in several major acquisitions. In a parallel move, several marginal divisions were disposed of. Investor reappraisal was reflected in the up-graded level of the earnings multiple which still holds. Through the first nine months of 1969, earnings gained 19% on a 13% increase in sales. The intermediate prospect for these shares is clouded by the building slowdown. However, a higher level of construction activity in response to pent-up demand is looked for in the latter part of 1970 if the financial climate eases.

Q) I am a novice in the market and have about $5000 clear of savings. What do you think of investing half this sum in Addressograph-Multigraph? R. P.

A) Addressograph-Multigraph's development of two new machines, the AMCD copier-duplicator and the Telekon facsimile transmitter are giving an extra boost to sales and earnings. Both are to be marketed, primarily on a lease basis. While this will increase Addressograph's financing requirements, it will also, in effect, create a captive customer list for suppliers. Sales for three months, ending October 31, 1969 increased to $96 million versus the $90 million reported for the same period in 1968. With older lines continuing to prosper, earnings should score a gain in 1969-70. This issue is attractive for long-term purchase.

Q) I would like a general guide on price-to-earnings ratios? How do these vary among industries? P. E.

A) Since this broad question could easily be expanded into a book, our brief coverage must be simple and practical. Industry ratios are difficult to calculate because the merger mania has brought under one corporate name many diversified industries. However, identifying the predominating industry will soon be made easy as a result of the Security Exchange Commission's new profit disclosure rules. Readers who want to improve investment techniques should figure price-to-earnings ratios on each of their stocks; estimated earnings for 1969 could be checked at a broker's office. Compare these ratios with each stock's 10-year record of its yearly price-to-earnings range published in Standard & Poor's individual stock reports. These comparisons should enable readers to evaluate their holdings more critically and lead to switching for faster growth elsewhere. Whenever new purchases are being considered, earnings multiples should be checked before orders are placed. The stocks may be good ones to own but the timing could be poor if shares are trading near their historically high multiple. Investors must understand, however, that the price-to-earnings concept does not produce numerical absolutes. The market is always discounting future conditions either known or surmised. Psychology, therefore, influences the price-to-earnings calculation. A buoyant mood may easily push up earnings multiples to unrealistic levels; deep pessimism may depress them unduly. Stocks with a "story" often skyrocket to high multiples that remain high for a long time, but they can drop like lead when the story loses its lustre. Prosaic and cyclical stocks — also those reflecting corporate problems — will produce modest multiples unless earnings are boosted dramatically or a story breaks unexpectedly. The influence of such factors on price-to-earnings ratios often lead to puzzling discrepancies between stocks which, in many respects, resemble one another. The price-to-earnings ratio is an indispensable aid in stock selection, yet it should not be used to the exclusion of disciplined judgment.



Computer downtime could cost this user his share of a multi-billion dollar market.

That's why he depends on Gerber Scientific and Hewlett-Packard.

In the automotive market, being second with a hot new body design just doesn't make it. That's why car manufacturers are turning to computerized drafting systems, like those made by The Gerber Scientific Instrument Company, South Windsor, Connecticut.

The auto industry knows that computers can mean the margin of difference—when they're working. But when they're not, you just might be "last under the checkered flag." That's why trouble-free performance was a key factor in Gerber Scientific's computer selection for its Series 1200 and 700 controls. These drafting systems make it possible to bring fresh new auto design concepts to market in record time. Gerber's systems are also slashing design time and costs in electronics, aircraft, garments, maps and other detailed work that used to take weeks of manual effort.

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There are other reassuring facts about our small computers. Like Direct Memory Access, a feature now available with the new HP 2114B. The DMA option gives you the flexibility to use high-speed peripherals. And it makes possible the acquisition of very high-speed data. Yet this computer's base price is only $8500. If you're looking for something a bit more powerful, try the HP 2116B. It's the heart of our popular time-share, real-time executive and disc operating systems. Cost: $24,000.

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SUPPLIES & ACCESSORIES	ACME VISIBLE RECORDS	OTC	--------	47.0	31.0	42.4	5.6	1.82	23
	ADAMS MILLIS	NY	621	22.3	11.5	14.1	1.0	0.86	16
	BALTIMORE BUS. FORMS	OTC	--------	27.4	21.0	21.0	– 4.0	0.92	22
	BARRY WRIGHT	AM	608	29.2	17.6	23.6	1.6	0.99	23
	CAPITOL INDUSTRIES	AM	385	56.2	29.0	53.4	4.4	1.59	33
	DATA DOCUMENTS	OTC	--------	44.4	26.0	32.4	1.0	1.77	18
	DATA PACKAGING	OTC	--------	30.2	17.6	28.6	2.0	-------	----
	DENNISON MFG.	NY	1687	54.7	20.2	24.6	4.2	1.96	12
	DUPONT	NY	3586	165.4	101.2	107.1	4.4	7.48	14
	ENNIS BUS. FORMS	NY	274	19.0	18.1	18.4	0.1	0.92	19
	GENERAL BINDING	OTC	--------	43.0	30.0	30.4	– 1.4	0.76	40
	GRAPHIC CONTROLS	OTC	--------	28.6	15.6	16.0	– 3.0	1.10	14
	LEWIS BUS. FORMS	OTC	--------	23.0	16.0	19.0	1.6	0.86	22
	MEMOREX	NY	4597	173.7	65.0	148.0	– 4.6	1.83	80
	3M	NY	2437	118.4	94.0	109.5	– 1.2	3.18	34
	MOORE CORP. LTD.	TSE	665	39.7	29.5	36.6	1.3	-------	----
	REYNOLDS & REYNOLDS	OTC	--------	48.4	30.0	44.4	1.4	1.27	35
	SAFEGUARD INDUSTRIES	AM	649	25.4	10.0	14.6	0.7	0.52	26
	STANDARD REGISTER	OTC	--------	31.0	23.0	29.6	4.2	1.93	15
	UARCO	NY	230	36.2	25.3	34.7	0.7	1.80	18
	WALLACE BUS. FORMS	OTC	--------	40.0	27.4	40.0	2.6	1.40	28
SOFTWARE & SERVICES	APPLIED DATA RESEARCH	AM	543	40.0	19.0	23.4	1.4	0.65	35
	APPLIED LOGIC	OTC	--------	24.4	12.4	17.6	– 3.4	0.07	----
	ARIES	OTC	--------	19.0	6.0	8.0	1.4	0.17	47
	AUTOMATIC DATA PROC.	AM	2993	43.4	21.7	42.7	5.2	0.50	84
	BOLT, BERANEK & NEWMAN	OTC	--------	19.0	7.4	10.2	– 3.4	0.32	31
	BOOTHE COMPUTER	OTC	--------	45.4	23.0	25.4	– 0.2	1.62	15
	BRANDON APPLIED SYS.	OTC	--------	17.0	7.0	8.6	0.0	-------	----
	COMPUTER APPLICATIONS	AM	658	21.7	9.4	11.3	0.3	0.22	50
	COMPUTER ENVIRONMENTS	OTC	--------	16.0	6.4	12.0	– 0.4	-------	----
	COMPUTER EXCHANGE	OTC	--------	18.0	4.0	6.2	– 1.2	0.08	77
	COMPUTER INVESTORS	AM	562	25.0	7.6	12.3	3.2	0.38	31
	COMPUTER METHODS	OTC	--------	12.4	1.2	1.4	– 0.2	-------	----
	COMPUTER PROPERTY	OTC	--------	13.0	9.0	12.0	1.0	-------	----
	COMPUTER SCIENCES	NY	6383	34.6	19.4	34.0	4.4	0.60	56
	COMPUTER TECHNOLOGY	OTC	--------	36.0	12.3	12.3	– 6.5	0.12	102
	CTC COMPUTER	OTC	--------	24.0	14.0	19.0	16.4	-------	----
	COMPUTER USAGE	OTC	--------	40.0	7.0	7.6	– 3.0	(d)1.58	----
	COMPUTEROLOGY	OTC	--------	6.4	1.4	2.0	0.0	-------	----
	COMPUTING & SOFTWARE	AM	1285	72.6	37.0	65.4	6.0	0.99	65
	COM-SHARE	OTC	--------	23.0	11.4	14.6	– 3.6	-------	----
	CYBER-TRONICS	OTC	--------	13.4	7.0	13.1	2.5	0.11	119
	CYBERMATICS	OTC	--------	15.0	6.4	10.4	– 0.4	-------	----
	DATA AUTOMATION	OTC	--------	30.2	13.0	24.0	1.6	-------	----
	DATA DYNAMICS	OTC	--------	16.0	3.4	3.7	0.0	-------	----
	DATA NETWORK	OTC	--------	10.4	4.0	4.0	– 1.6	-------	----
	DATA PROC. FIN. & GEN.	AM	2078	60.2	23.5	31.1	0.0	2.56	12
	DATA SYSTEMS ANALYSTS	OTC	--------	11.0	2.6	2.6	– 0.6	-------	----
	DATRONIC RENTAL	OTC	--------	16.0	4.4	5.2	– 1.4	0.44	11
	DEARBORN COMPUTER	AM	1399	52.6	20.2	23.6	– 0.1	2.10	10
	DECISION SYSTEMS	OTC	--------	8.6	3.0	3.1	– 0.1	-------	----
	DIGITAL APPLICATIONS	OTC	--------	15.0	3.0	4.0	0.0	-------	----
	DIGITEK	OTC	--------	15.0	3.6	3.6	– 1.0	-------	----
	DPA	AM	1169	13.5	8.1	9.7	0.3	0.69	13
	EFFICIENT LEASING	OTC	--------	15.4	2.4	3.0	– 0.5	-------	----
	ELEC. COMP. PROG. INST.	AM	463	38.2	7.6	10.6	1.5	0.14	71
	ELEC. DATA SYSTEMS	OTC	--------	150.0	34.0	150.0	6.0	0.39	----
	GRAPHIC SCIENCES	OTC	--------	70.0	35.4	39.2	– 0.2	(d)1.37	----
	GREYHOUND COMPUTER	AM	1125	28.5	12.0	13.4	0.0	1.25	10
	INFORMATICS	OTC	--------	30.6	11.0	20.6	4.2	0.09	----
	INTL. COMPUTER	OTC	--------	17.0	6.0	6.2	– 1.6	0.07	88
	LEASCO	AM	7585	54.0	22.4	29.4	5.3	2.71	10
	LEVIN-TOWNSEND	AM	2634	57.4	16.4	18.6	0.6	4.03	4
	LMC DATA	OTC	--------	8.2	1.6	1.7	– 0.7	(d)0.01	----
	MGMT. ASSISTANCE	OTC	--------	14.7	2.0	2.7	0.0	(d)0.26	----
	NATIONAL COMP. ANAL.	OTC	--------	22.0	4.4	6.6	0.2	-------	----
	PLANNING RESEARCH	NY	1473	50.3	23.7	47.4	2.4	0.68	69
	PROGRAMMING METHODS	OTC	--------	21.4	13.0	21.0	1.4	-------	----
	PROGRAMMING SCIENCES	OTC	--------	37.0	11.0	25.0	– 4.0	-------	----
	PROGRAMMING SYSTEMS	OTC	--------	11.4	3.2	3.2	– 0.6	0.16	20
	SCIENTIFIC COMPUTER	OTC	--------	8.4	2.4	2.6	– 0.3	0.12	22
	SCIENTIFIC RESOURCES	NY	2820	26.4	10.3	12.6	0.1	(d)1.26	----
	STRATEGIC SYSTEMS	OTC	--------	37.0	2.3	2.4	– 1.1	-------	----
	SYSTEMS CAPITAL	OTC	--------	34.0	5.0	5.4	0.0	-------	----
	TIME SHARE	OTC	--------	13.4	5.3	5.3	– 1.6	-------	----
	URS SYSTEMS	OTC	--------	31.2	17.1	28.0	2.0	0.56	50
	UNITED DATA CENTERS	OTC	--------	7.0	3.2	5.0	0.0	-------	----
	UNIVERSITY COMPUTING	NY	5633	155.0	55.0	96.7	1.3	2.51	38
	US TIME SHARING	OTC	--------	16.0	5.2	7.4	0.2	-------	----

(d) Deficit

* New listing in this issue

eighths of dollars (e.g. 62.2 is 62¼). Trading volume is not given for over-the-counter stocks. ALL DATA COMPUTED BY SCANTLIN ELECTRONICS, EXCLUSIVELY FOR MODERN DATA.

	COMPANY	EXCH.	VOL. (SHARES IN 100's)	1969 HIGH	1969 LOW	PRICE 1-2-70	NET CHG. FROM MONTH AGO	EARN./SHR. (LATEST 12 MONTHS)	P/E RATIO
PERIPHERALS & COMPONENTS	AMP	NY	1521	59.0	32.5	55.4	– 0.4	1.89	29
	AMPEX	NY	1647	49.7	32.4	47.5	4.5	1.42	33
	APPLIED MAGNETICS	OTC	--------	41.4	22.4	41.4	6.0	0.78	53
	ASTRODATA	AM	5607	36.3	15.1	33.5	6.0	0.28	117
	ASTROSYSTEMS	OTC	--------	13.4	5.6	8.6	2.0	0.34	25
	BUNKER RAMO	NY	4175	17.5	9.4	14.2	1.4	0.43	32
	CALCOMP	AM	1123	37.4	18.2	27.6	2.0	0.56	48
	CHALCO ENGRG.	OTC	--------	8.4	3.2	5.0	1.0	-------	----
	CODEX	OTC	--------	47.4	15.0	29.0	0.0	0.26	111
	COGAR	OTC	--------	73.0	57.0	68.0	0.0	-------	----
	COGNITRONICS	OTC	--------	38.4	11.4	13.6	1.0	(d)0.22	----
	COLLINS RADIO	NY	1340	69.6	33.0	36.3	– 0.2	2.50	14
	COMCET	OTC	--------	48.4	27.0	47.0	5.4	-------	----
	COMPUTER COMM.	OTC	--------	48.0	30.0	36.0	– 2.0	-------	----
	COMPUTER CONSOLES	OTC	--------	26.0	8.0	22.0	5.0	-------	----
	COMPUTER INDUSTRIES	OTC	--------	52.0	12.0	23.0	2.0	-------	----
	COMPUTEST	AM	634	33.5	14.2	27.0	0.1	0.60	45
	CONRAC	NY	701	59.3	27.0	31.0	0.2	1.54	20
	DATA 100	OTC	--------	19.0	15.6	16.6	0.0	-------	----
	DATA PRODUCTS	AM	7795	27.7	12.3	24.0	3.2	0.34	70
	DATARAM	OTC	--------	16.4	8.4	14.0	1.2	(d)0.46	----
	DATASCAN	OTC	--------	32.0	15.0	22.0	– 0.4	-------	----
	DIGITRONICS	OTC	--------	22.4	13.0	13.4	– 1.4	(d)0.02	----
	ELEC ENGRG. OF CAL.	AM	212	28.3	10.0	12.5	– 1.7	0.25	48
	ELEC MEMORIES & MAG.	NY	2746	42.3	21.4	38.5	– 0.5	1.01	37
	EPSCO	OTC	--------	20.4	6.4	6.6	– 0.2	0.17	38
	EXCELLO	NY	893	37.3	22.4	24.5	2.1	2.63	9
	FABRI-TEK	OTC	--------	12.7	5.5	6.0	– 0.1	0.16	----
	FARRINGTON MFG.	OTC	--------	37.4	13.0	16.7	2.1	(d)0.06	----
	GENERAL INSTRUMENT	NY	2436	43.2	26.0	30.7	2.3	0.54	55
	GERBER SCIENTIFIC	AM	387	39.3	20.2	38.1	4.3	0.68	55
	HI-G	AM	--------	33.4	9.6	12.0	– 1.5	0.43	28
	INFORMATION DISPLAYS	OTC	--------	21.4	9.4	15.0	0.0	-------	----
	ITEL	AM	--------	37.5	14.2	23.1	–11.1	-------	----
	LOGIC	OTC	--------	23.0	7.0	14.2	2.4	-------	----
	MILGO	AM	5935	75.2	17.7	67.3	5.6	(d)0.48	----
	MOHAWK DATA SCIENCES	AM	2660	89.1	59.6	73.2	2.6	1.15	63
	NORTH ATLANTIC IND.	OTC	--------	22.0	5.4	6.6	– 1.6	0.18	33
	OPTICAL SCANNING	OTC	--------	118.0	41.0	53.0	1.0	(d)0.45	----
	POTTER INSTRUMENT	AM	1902	46.0	23.6	37.5	4.1	0.80	46
	RECOGNITION EQUIP.	OTC	--------	76.0	52.0	74.4	3.0	(d)0.51	----
	SANDERS ASSOCIATES	NY	2084	61.7	22.0	26.7	2.5	0.59	44
	SANGAMO	NY	1448	43.4	19.2	26.1	2.4	0.60	43
	SCAN-DATA	OTC	--------	85.0	27.0	42.0	8.0	-------	----
	SEALECTRO	AM	577	15.6	6.6	11.7	4.2	0.20	55
	TALLY	OTC	--------	36.0	15.0	17.4	0.0	(d)2.73	----
	TELEX	AM	7448	111.6	20.6	92.4	– 4.0	1.26	73
	TEXAS INSTRUMENTS	NY	1798	140.2	94.6	128.0	8.0	2.66	48
	TRACOR COMPUTING	OTC	--------	7.0	5.2	7.0	1.6	(d)0.46	----
	VARIFAB	OTC	--------	13.0	4.4	4.6	– 0.6	-------	----
COMPUTERS	APPLIED DYNAMICS	OTC	--------	18.2	14.2	16.2	– 1.0	(d)0.36	----
	BECKMAN	NY	1712	63.4	43.7	47.4	0.7	1.39	33
	BURROUGHS	NY	2944	167.4	120.6	158.6	3.6	3.04	51
	CONTROL DATA	NY	4761	159.2	110.0	119.2	4.0	3.61	32
	DIGITAL EQUIPMENT	AM	1675	104.7	54.4	104.7	14.1	1.14	91
	ELECTRONIC ASSOCIATES	NY	2130	25.2	9.6	10.5	– 0.1	0.07	142
	GENERAL ELECTRIC	NY	6297	98.2	74.1	76.5	– 1.3	4.10	18
	HEWLETT-PACKARD	NY	1066	114.5	75.2	102.3	0.3	1.67	61
	HONEYWELL	NY	1596	157.2	107.6	143.4	– 1.4	4.00	35
	IBM	NY	4138	368.6	291.6	364.6	8.6	8.25	44
	LITTON INDUSTRIES	NY	12124	74.4	35.0	36.4	– 2.2	2.39	15
	NCR	NY	3472	162.6	108.0	160.4	14.4	3.91	40
	RCA	NY	6614	48.1	33.6	34.4	– 0.7	2.44	13
	RAYTHEON	NY	2415	50.2	30.5	33.2	– 1.2	2.30	14
	REDCOR	OTC	--------	49.0	25.0	31.4	1.0	0.14	225
	SCIENTIFIC CONTROL	OTC	--------	43.4	1.5	2.6	– 0.6	(d)2.43	----
	SPERRY RAND	NY	9860	55.4	36.1	37.2	– 4.6	2.27	16
	SYSTEMS ENGRG. LABS	AM	3954	53.7	26.1	47.5	– 2.7	0.73	64
	SYSTRON DONNER	AM	569	32.3	13.5	28.5	2.6	1.07	26
	VARIAN ASSOCIATES	NY	3380	37.2	24.4	28.2	1.2	0.91	30
	VIATRON	OTC	--------	58.0	14.2	31.4	0.4	(d)0.83	----
	WANG LABS	AM	1825	61.4	44.1	50.4	– 3.4	0.78	64
	WYLE LABS	AM	1625	20.2	7.7	9.1	0.7	0.53	16
	XEROX	NY	8029	115.0	85.0	104.4	– 0.6	2.03	51
AVERAGES	**COMPUTER STOCKS**			**47.0**	**24.2**	**34.4**	**–2.8%**	**1.03**	**33.5**
	DOW JONES INDUSTRIALS			**968.85**	**769.93**	**800.36**	**+0.9%**	**3.71**	**13.6**

SOFTWARE FORUM

WE OURSELVES MUST JUDGE OURSELVES

Editor's Note: SOFTWARE FORUM's Guest Editor this month is **Douglas T. Ross,** formerly head of the computer applications group of MIT's Electronic Systems Laboratory and now President of SofTech, Inc. of Waltham, Mass. At MIT, Mr. Ross was a principal developer of APT (still the most widely-used system for automatically programming numerically-controlled machine tools) and AED (for Automated Engineering Design — a system which provides a building-block approach to software design). In addition to offering software consulting and educational services, SofTech markets proprietary software systems based on the AED approach. Ken Falor, SOFTWARE FORUM's regular editor, will be back next month with a survey article on programming aids.

Never before in history has such awesome responsibility been forced by circumstances on so young a field as software. Its life spans but two decades and most of its practitioners are only a few years older. Thus, it is difficult for many to realize what a serious business they are in, and more so for many to comprehend the far-reaching implications — social, economic, civic, professional — of their work.

That everybody's life is affected in many ways by software is evident in the pervasive influence of the computer on credit cards, banking, insurance, weather forecasting, city planning, and countless other aspects of our society. And that most people admire and, at the same time, fear these developments is reflected by the nervous titters that accompany the mounting rash of ever-sharper "giant-brain" jokes. Such admiration, fear, and blasphemy have always characterized the primitive reaction to the sacrosanct unknown.

The popular press shapes all these mysteries into one bogeyman — the computer. The general public thinks of flashing lights and whirring tape reels as the sacred source. But we all know that it is not the hardware but the software which determines whether things go smoothly or poorly in any application. Even today's primary hardware problems — system architecture — are really just hardened software problems. Hence those in the software field must bear the brunt of virtually all computer responsibility.

Indeed, practitioners of software must accept a higher measure of responsibility because no one else understands enough to share the responsibility. The reason is clear because the nature of software is so unclear; whatever we do, software is still, for the most part, a black and enigmatic art. Even in organizations that depend heavily on computers and software, how things are done and how well they are done is very much directly in the hands of the software practitioners — even their managers are not in control. Designers, analysts, and programmers all share the robes of high priests — a distinction many covet too highly — of an ill-understood craft.

The priesthood aspect is common to all professional specialties, however, and cannot be excused as the sole source of this lack of understanding by others. Whenever a discipline matures, an esoteric jargon grows naturally as technical vocabulary, and even entire modes of expression evolve to ever-greater precision. Except for the prescription ciphers of the medical profession, this exclusion of "outsiders", through obtuse and foreign language, is not openly exploited. Software shares this phenomenon with other modern specialties; but there is one notable and lamentable difference — the abyss between "insiders" and "outsiders" is even more pronounced because the "inside" itself is so ill-defined. Far from finding it easy to converse with the populace, the high priests have difficulty talking among themselves.

A similar chaotic state prevailed centuries ago when astrology and alchemy preceded the evolution of modern chemistry. In those days, however, the health and well-being of the world did not hinge on attempts to change lead into gold or on other equally worthy aspirations. There was time for scientific understanding to evolve and for suitable goals to be set before society depended upon results. Today's reincarnation of those times in the software field is a tragic anachronism which must be reversed. And this time, the rush of events calls for speedy resolution — not centuries of evolution.

The first step in this resolution is for software as a discipline to become better understood by the "insiders" themselves. There are, fortunately, new movements in the software world that will accelerate this understanding. New developments now taking place already are resulting in greater uniformity and a firmer software engineering base. As the chaos within the field lessens, insiders will be better able to communicate with outsiders. Managers finally will be able to manage. Software technologists will replace the priesthood.

But until these developments become dominant (it may take a while because even high priests are human and thus resistant to change) all of us in the software field must, individually and collectively, make a conscious effort to become fully aware of our responsibilities. Above all, we must remember that the corollary to responsibility is accountability. The day is not far off when software, deprived of its mystique, will have to answer to society for its deeds and misdeeds.

Because we have, whether by circumstance or design, created an elite society in an occult world of our own, no one outside of that world understands us well enough to judge our efforts. But in that thought we should seek no solace nor from it derive any satisfaction. It only adds to our responsibility. **We ourselves must judge ourselves.**

Great Moments in Software...
From Edward Lloyd's Coffee House

It all began because Edward Lloyd's coffee house in the London financial district was a popular meeting place for merchants, bankers, seafarers and underwriters. The seekers of insurance found it a convenient place to transact business and get their ships and cargoes covered.

As a service to his customers, Lloyd began sending couriers to the waterfront to collect and post the most recent shipping news. Soon he was publishing Lloyds List, which came to be trusted as a dependable basis for financial transactions. Out of this basic information system grew the world's leading insurance exchange.

The need for efficient management information systems is even more important today. One of the major efforts at TRW in recent years has been the development of information systems for the filing and retrieval of management data in a wide variety of business, research, government, and education applications. TRW's analysts and programmers tailor each information system to the specific needs of the user so that the necessary data elements are provided in a clear, concise format ready for evaluation.

For more details on TRW's information systems capabilities, contact Marketing Services, Software and Information Systems Division, TRW Systems Group, One Space Park, Redondo Beach, CA 90278.

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THE SYSTEMS SCENE

VIRTUAL PROFITS

The Systems Scene is a regular monthly column written by Jerome Wiener and Thomas DeMarco of Mandate Systems, Inc. Readers are invited to submit comments and questions on new developments in systems to: **The Systems Scene, MODERN DATA, 3 Lockland Avenue, Framingham, Mass. 01701**

It is always amusing to read in business reviews and stock market analyses about the enormous profitability of just about anything that has to do with time-sharing. Some people just can't read red ink. Some people can, of course, and that's why we've just seen a rash of personnel freezes, cut-backs, and price hikes from the time-sharing community. As we indicated in our August and September columns, problem solving time-sharing has all the earmarks of a profit-losing operation. Recent retrenchment in one form or another by ITT, Allen-Babcock, Tymshare, Honeywell, and GE would seem to bear this out.

There are some exceptions to this gloomy picture. CP/CMS is one of them. This 360/67 system comes out of the Cambridge Scientific Center at IBM. It takes the old ATLAS principle of virtual memory one step further and comes up with a complete virtual machine.

The system is not new, and the idea of a virtual machine dates back eight years or more. What **is** new is profitability. At least one vendor of CP appears to be in the black.

The Control Program (CP) simulates a number of virtual machines, each with its own virtual peripherals. The console typewriter for each of these simulated machines is considered to be the associated user's terminal. Instead of being connected to an artificial environment, as is the case with most time-sharing systems, the user seems to be connected to a complete 360 batch machine with a remote console. This machine can have tapes, printers, disks, etc. associated with it at the user's request. CP simulates this individually-tailored environment simultaneously for thirty or more users.

Each user can run his own system: CMS, OS, DOS, HASP, etc. He has as much as a million characters of virtual core at his disposal. He runs his machine in a single-thread batch mode, but pays only for the CPU time really used. He can take a running production program, divert I/O to the console, and bring it up, system and all, under CP. The effect is that the program is on-line. No scheduler, no telecommunications, no executive processor or accounting package need be written. And there is no need to multiprogram in order to cover waste time. The system takes care of all these things.

Most subscribers end up using CMS rather than OS since it is particularly well-adapted to run under CP. It is console-oriented, has a beautiful context editor, and offers easy-to-use library facilities and simplified JCL. It is largely OS compatible; all compilers are taken from OS. *How about OS COBOL-F on-line?*

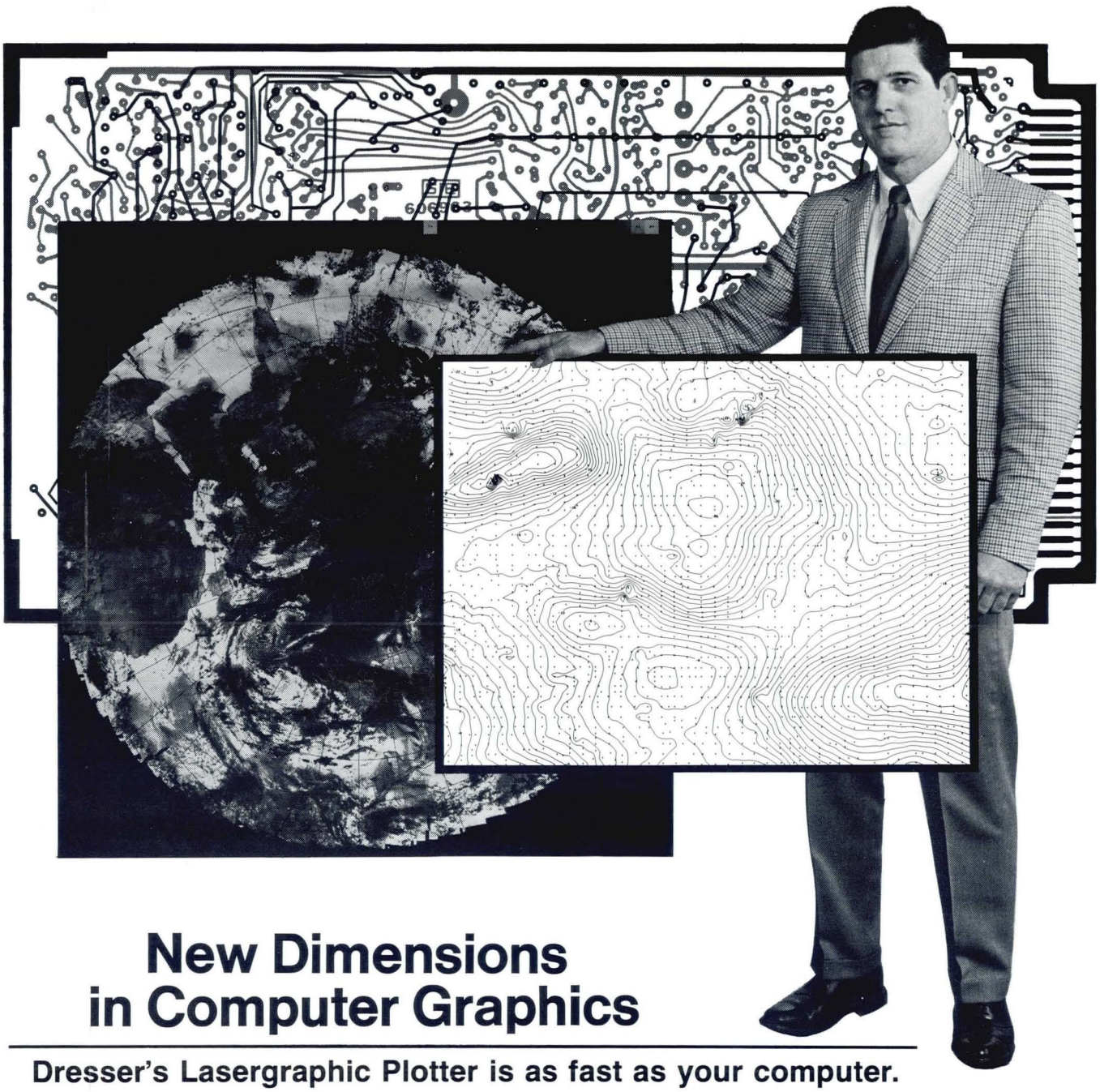
CP/CMS appeals to market segments that previously had never been very easily approached by time-sharing vendors. These segments include: commercial production users (COBOL, tape oriented); commercial development users (who want to develop on-line, but run production in batch); and large core users, system builders, and overflow users who need extra capacity on a machine virtually identical to their own.

CP services are commercially available from Computer Software Systems, Interactive Data Systems, Virtual Computer Services, Computers Unlimited, and Data Network. CSS (of Stamford, Connecticut) is at present the most advanced, and offers such facilities as COBOL symbolic debugging and a low-priced deferred task handler for production jobs.

A typical CP/CMS operation costs better than $200,000 per month to run, so prospective entrepreneurs must be prepared to think big and sell fast. Also, a more than modest development effort is required to run the system commercially. IBM-Cambridge has put a lot of genius into the system, but also left some enormous holes that each of the vendors has had to pave over.

CP/CMS has enough profit potential to attract new vendors at the rate of nearly one a month. It also presents substantial risks due to the size of the 360/67 operation. One of the established vendors recently called a special stockholders' meeting to announce that it had gone through all its capital (over $1,000,000) and still hadn't been able to build up revenues to cover even 25% of monthly operating costs. The best offer to pick up the bones of the company was a stock acquisition for about half of what most investors had paid.

Should that deter you from starting up such an operation? Not at all! While the outside investors stand to lose more than half their invested capital on the prospective acquisition, the insiders (who bought in at a much lower price) would show a 1400% profit. A virtual miracle.



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ON-LINE

THE DAY OF THE TERMINAL

THURBER J. MOFFETT, Mgr., Interactive Graphic Systems ■ TRW Systems Group, Redondo Beach, Cal.

The residents and business people of Las Vegas had a misfortune on their hands for three days last November during the Fall Joint Computer Conference. It befell the 35,000 odd conferees, too, but they, at least, had an inkling of what was up. Those uninvolved with FJCC thought their telephone system had suddenly caught some terrible malady. Finding a way to make a long-distance call successfully developed into a major secondary preoccupation. Even when you were lucky and got through, you crossed your fingers lest you be mysteriously disconnected.

New Yorkers have been increasingly irate over the slow collapse of their phone service ever since the New York Stock Exchange went on-line all over the country. The Las Vegan's three-day travail was for the same reason. Almost a third of the some 1,000 Las Vegas conference exhibitors had a terminal or two operating remotely to somewhere else. The somewhere elses included almost everywhere, tying up the Strip's and Downtown's normal voice channels for a fare-thee-well.

Teleprocessing first put on-line terminals into the Joint Computer Conferences years ago. But now their sheer numbers startle even the pros. Somebody's got a terminal for almost anything your heart desires. The price may not be as right as you'd like and the interface you want may not yet be there, but there the terminal is, running on something. Interfacing hardware and software is, at least an acceptable subject for conversation now. A year ago, the world wasn't at all like that. It's almost as if the kid who has been dreaming of candy stores found himself standing in the middle of one.

It's clear that of all the things the 1970s are going to be the years of, on-line terminals are sure to be one of the biggest. Data Products went on Los Angeles TV right after the FJCC and announced a new terminal envisioned for home use priced well below your automobile or your swimming pool. It's not for doing your "work" work at home, although it will, but for your "home" work — household accounting, budgets, taxes, filing — whatever; even, perhaps, for fun and game playing.

All this is going to change things a lot. It's starting to already. No longer, for instance, are you necessarily stuck with a still relatively expensive refresher CRT light pen terminal if you want a reasonably responsive graphics system. Even though the established companies have improved their prices markedly, several new companies have introduced snazzy storage-type CRT terminals for the same or for less money.

Finally, if your graphic response time requirements are in terms of a very few minutes rather than milliseconds (On-line will have much to say on these matters later.), a whole new vista of small, fast, accurate plotters has opened. The new Hewlett-Packard 11" x 17" Model 7200A is a case in point. Designed to interface with Teletype Corp.'s Models 33, 35 or Bell System teleprinters, the 7200A accepts ASCII digits and plots points or vectors up to 3 inches. Static accuracy is ± 0.030", resolution is 0.005", resettability is 0.007", and plotting speed is 1.1 sec./point or line. The basic price is $3300.

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On-Line is a regular monthly column concerned with various developments in computer technology particularly in the areas of computer graphics and computer-aided design. The author, Thurber J. Moffett, is a nationally-recognized expert in interactive graphic systems. Readers are invited to submit comments and questions regarding subjects covered in this column to: On-Line, MODERN DATA, 3 Lockland Avenue, Framingham, Mass. 01701

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ESCHEW OBFUSCATION

The following correspondence ensued between a systems user and a major computer manufacturer. Names have been omitted to protect the guilty.

.....

Sirs:

Please publish Programming Systems Report No. 1976 that should be in Summary No. 95 as you stated in Programming Systems Report No. 2772, Summary No. 99. See also Programming Systems Report No. 2856, Summary No. 102.

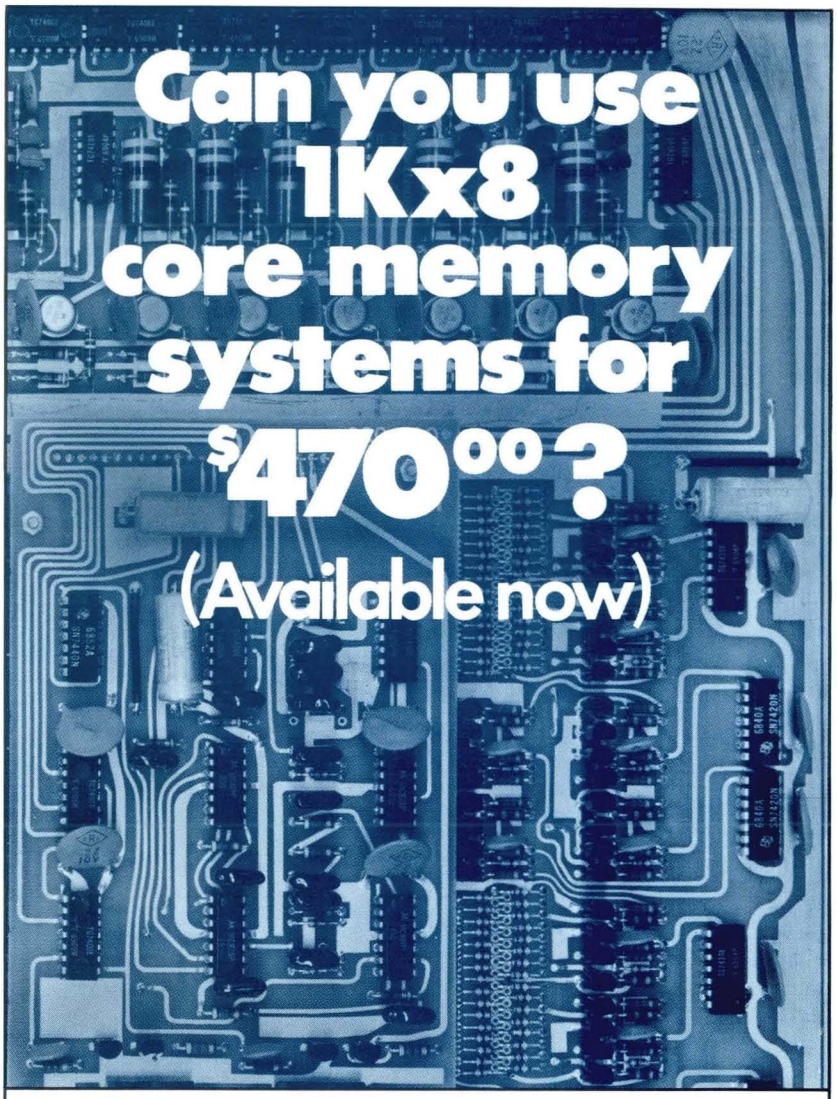
.....

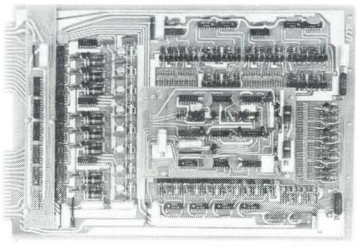
Dear Sir:

The reference to Programming Systems Report No. 1976, Summary No. 95, in the response to Programming Systems Report No. 2772 was incorrect. Programming Systems Report No. 1976 was in Summary No. 79.

.....

Submitted by:
Edward Hart Rice,
The Johns Hopkins
Medical Computing Ctr.,
Baltimore, Md.

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COMMUNICATIONS CLINIC

"RANDOM LINE HITS"

COMMUNICATIONS CLINIC is a regular monthly column written by the staff of **Berglund Associates, Inc.** Questions from readers on any aspect of communications and its integration with computers will be answered, as space permits. Address questions to: **Ralph Berglund, Data Communications Editor, 1060 North Kings Highway, Cherry Hill, N. J. 03034.**

NEW COMMON CARRIERS

Would-be, private microwave common carriers are hanging out their shingles at a rate we usually associate with software companies. The hole in the dike was, of course, Microwave Communications, Inc., whose application for a Chicago-to-St. Louis service was approved in August of 1969, the result of six years of hearings and evaluations before the FCC. The first "me-too" application was filed prior to the MCI decision (December 1968) by Interdata Communications, Inc., who filed for a New York-Philadelphia-Washington route. Since the MCI decision, however, six other entities have filed for specific routes. The biggest and most ambitious filing is that of the UCC subsidiary, Datran. Of the other five, four are MCI affiliates. Also, Interdata is understood to be planning to be a part of the MCI system. Additionally, the MCI group has indicated that ten more regional affiliates will file within the first half of 1970.

All of these companies will be competing with established common carriers for the heavy demand anticipated for communication channels. We understand that the Bell System will require and will have some 800,000 intercity circuits by 1975, but the MCI studies indicate a shortage of 150,000 to 200,000 circuits by then. In addition to seeking to fill an expected deficiency, the applicants are all quoting rates substantially below present tariffed rates. Their logic is that by vectoring in on specific applications and routes, the plant investment and resultant charges to end users will be lower than for present carriers, whose plant must support national, general-purpose use.

This will be a profound and vital issue for the FCC. In general terms, if the carriers, who are pricing on national plant needs, lose revenue on high density areas to the new competitors, the lost revenue must be obtained elsewhere, from rate increases on other services, or by stimulating use of other services. Therefore, lower costs to users in certain regions may result in higher costs to all users for other types of service. Either higher rates, or demand shut-out by higher rates, may impact our economy. A versatile communications network is a primary factor in developing and sustaining our economy and social system. Tampering with the economics thereof could have a dangerous effect. Although we emotionally side with the small company and the innovative offering, and although we favor a sharply skeptical attitude towards established common carriers, we believe and hope that the FCC will move very cautiously in granting licenses. We hope that potential effect on future national systems will be predictable with a very high degree of probability before any additional experimentation is allowed. We believe that the burden is on the applicants to show, and the FCC to confirm, that a multiplicity of cream-route carriers is in the national interest.

The essence of the FCC decision was that MCI should be given an opportunity to show that it can compete productively. The majority decision, however, emphasized that:

"*The findings and conclusions reached herein apply only to the frequencies specified, and for the areas described, in the applications now pending before us. Should MCI seek to obtain additional frequencies or to extend its microwave service to new areas, our action on its application will be based on a close scrutiny of its operations, the rules then governing the grant of applications for common carrier microwave frequencies, and all other applicable policy considerations. Likewise, in connection with an application for renewal of license, we may deny the application if circumstances so warrant or grant renewal on such conditions as we deem essential to insure that MCI's subscribers receive a reliable transmission service of acceptable quality.*"

Presumably this "show-me" approach will apply to other applicants, and this is the essence of interest to end users. If the FCC does take an exceedingly fine approach to new applications, there should be one to two years of operating experience of MCI Chicago-to-St. Louis before any new applications are granted. Construction of new systems will require an additional one to two years. Hence, the era of reduced rate data circuits on a widespread basis is still two to four years away in general terms.

4800 BPS OVER DDD

On two occasions this past year we have indicated negative attitudes about 4800 bps on dialed circuits. As happens so frequently in this industry, those attitudes may be obsolete. Datamax Corporation, Ann Arbor, Michigan, is offering a 4800 bps modem for use on switched network circuits. In fact, it operates at 7200 bps, and that is the basis for its claimed success. While there is a throughput of 4800 bps, the difference between 4800 and 7200 transmitted is due to bits introduced by the modem for forward acting error detection and correction. These non-data bits are added in a defined relationship to the data bits. At the receiver, all bits are examined and, by a reverse of the encoding process, a high degree of errors can be detected and corrected. Datamax claims operation with less than one error in 1,000,000 bits. This, of course, is a theoretical error rate based, presumably, on statistical distributions and values of white noise and impulse noise. If it holds

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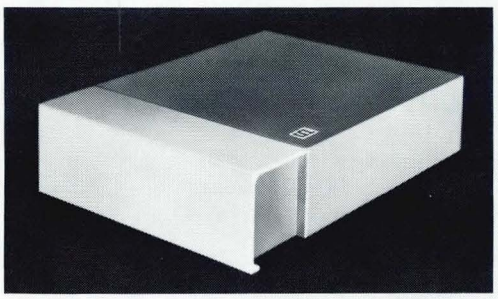

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Communications Clinic.....Cont'd

up in the real world, the unit could prove useful for remote batch inputs, or to enable a private line system to use the DDD network for backup.

NEW TARIFFS

There have been several new tariffs filed for interstate rates in recent months. Mostly as a result of FCC direction to have rates compensatory to rate base, the changes have been upward in Telpak and TWX, and downward in WATS and long-distance toll. At this writing (early January), the Telpak rates may be court contested. If so, AT&T requested permission to cancel the reductions if the increases scheduled for February 1 did not go into effect. As soon as the smoke clears we will cover the net result in this column. The rate changes imply a need for system operators to sharpen their pencils and re-analyze their system cost-effectiveness. Also, the new rates should be plugged into the planning for new systems.

INTEGRAL MODEMS

Shortly after we said (in the Nov. 1969 issue) that Novar was the first company to build a modem into their terminals, we heard from Daedalus Computer Products, who announced an integral modem in their terminal about two weeks after Novar. Although technically number two, it's close enough that they deserve mention also. The idea of integral modems creates a new OEM marketplace for modem manufacturers. If they can show the terminal manufacturer a lower buy-vs.-build cost, and a lower cost-in-use to the end user, it should represent an attractive market. If costs are right, it's also to the benefit of the end user, since one more component (the modem) is taken out of the multiple vendor per system category.

Vadic Corp. in Palo Alto, Cal. is supplying the Novar unit. Tel Tech in Silver Spring, Md. and Penril in Rockville, Md., are also soliciting OEM work. A newcomer contending for this market is Intertel of Burlington, Massachusetts, a new venture created by some of the modem engineers from Codex.

TELETYPE'S MAG TAPE TERMINAL

We mentioned Teletype's magnetic tape terminal last month in our FJCC coverage. A new thought, however, is that the expected tariff is out-of-line with price. Quoted at $2800 from Teletype, we understand that AT&T will tariff it at $120 to $150. If the unit is as reliable and durable as Teletype equipment has been historically, a long useful unit life should be the case. However, even if one assumes only three years depreciation, present market interest rates, and $30 per month service, the monthly rate would be about $117. On a five-year writedown, it would be about $86 per month. Conclusion: AT&T may be another "umbrella" company like IBM, setting and getting rates which permit other smaller companies to market comfortably with price competition. Standby for this magnetic tape terminal to be offered by leasing companies.

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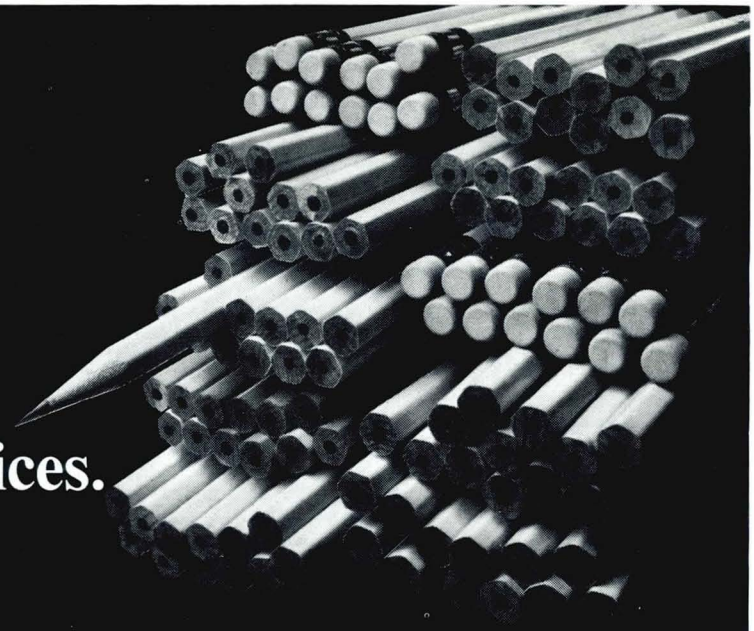
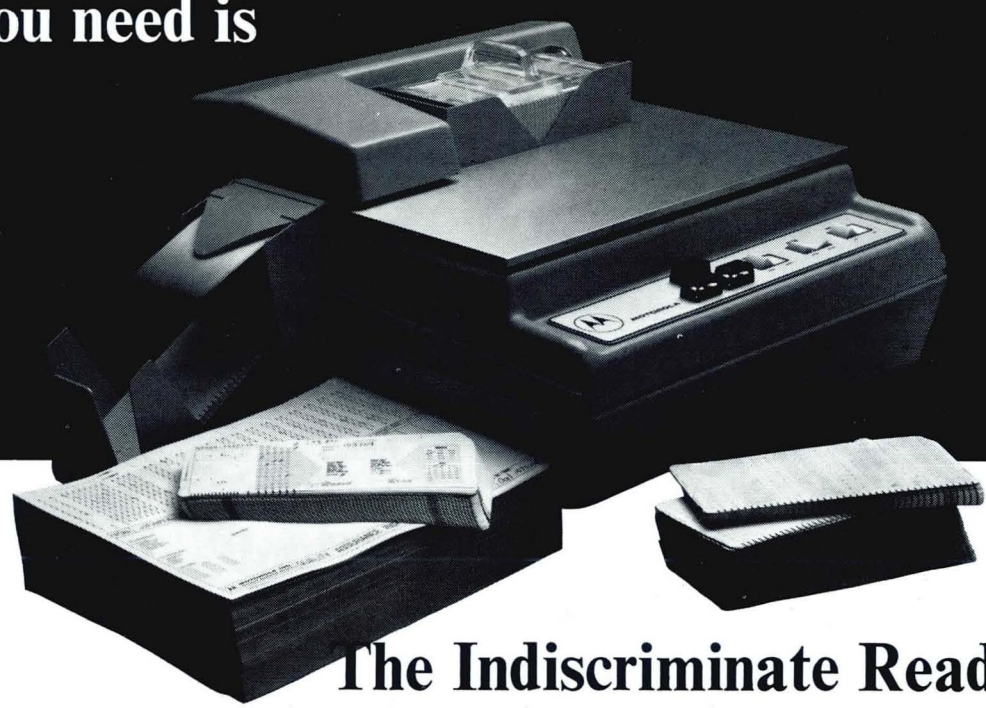


To make them computer-compatible, all you need is



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CIRCLE NO. 38 ON INQUIRY CARD

DR. BORIS BEIZER, Dir. of R&D • Data Systems Analysts, Inc.

THE VIABILITY OF COMPUTER COMPLEXES

Part 4—Achieving Viability

Editor's Note: In the final article of this series, Dr. Beizer discusses the principles that are applied to achieve a high viability system. Primary among these are over-design, redundancy, and automatic self-repair.

Viability is enhanced through increased performance, increased reliability, and reduced maintenance time. Performance can be increased through over-design, reliability can be increased through redundancy, and repair time can be reduced by marshaling the capabilities of the complex towards self-repair. The last method is by far the most effective and the most complex.

OVER-DESIGN

Over-design is a valid means of increasing viability **if** full credit is allowed for excessive performance. That is, **if** the user consciously chooses to credit the accumulated extra capacity of the system when it is good to its poorer performance when it has partially failed.

Over-design is usually unintentional. The computer manufacturer offers a discrete product line. Since he cannot offer a processor that is too small, and is aware that one that is larger than absolutely necessary may be thought of as over-priced, he offers the smallest system that will do the job. Thus the required capacity will typically fall somewhere in between two of his products and the final system will have extra capacity.

We cannot blame the manufacturer if he tries to convert this mis-match into a sales feature — he has given us the best he has. The situation is something like that of a man buying a suit at "Cheap John's." He wants a size 42, but the store has only a size 34 and 55 in stock. Fitting the 55 (the 34 is obviously too small), the tailor extols the "fullness" of the garment, and hints that the customer will put on weight in the future. Try all you want, Sam, you still made the pants too long.

REDUNDANCY

It should come as no surprise that the classical approach to achieving high reliability, increases viability as well. Almost all of the early high-viability computer complexes achieved their requirements through brute-force redundancy. The complete system was duplicated or even triplicated. In a typical duplex system, only one of the systems is on-line, performing the actual work required of the complex. The other accepts and partially processes the same inputs, but does not provide outputs to the real world. The standby system is said to "ghost" the on-line system, and is constantly in a position to take over its functions. The detection of failures can be manual or automatic, as can the actual switchover.

Ghosting schemes, while tried and true, are very expensive, particularly for multi-computer complexes. The actual redundancy of a ghosting scheme is not 100% but is closer to 130%. The reason is that extra equipment is needed to perform error detection and switchover, and extra-processing time and memory are required to coordinate the activities of the two computers. *Virtual* ghosting schemes (i.e., both computers are lock-stepped on an instruction by instruction basis) have been attempted, but with little success. The timing variations in peripheral devices such as drums, disks, and tapes makes it almost impossible to maintain such a lock-step without severely penalizing the on-line computer.

Self-repair methods use redundancy as well, but the level is closer to 30% than to 130%.

SELF-REPAIR

The most dramatic improvement in viability, the reduction of effective Mean-Time-To-Repair (MTTR), is gained by having the system repair itself. To do this, the system must detect malfunctions, isolate the malfunctioning elements, verify their inoperability, remove them, obtain replacements, verify the repair, and finally, re-initialize the programs. If there are no available spares, the system should go to an alternate mode of processing in which the required element is not used. Typically, when the system goes into such a state, some performance will have been sacrificed.

The implementation of the self-repair scenario mentioned above is accomplished by a **configuration switching network.** The configuration switching network allows any subsystem to replace any other subsystem of the same type. Thus, in the overseas AUTODIN system described in Part I of this series, any core memory can serve any computer, and any computer can be moved to any of several different functional positions. It is the configuration switching network that establishes the relation between the physical structure of the complex and its functional structure.

The system is subjugated to a hardware or software processor called the **viability executive,** which is charged with the detection of malfunctions and the reconfiguration of the system in response to those malfunctions to achieve an equivalent or degraded configuration state. The viability executive may or may not be the same as the system's functional executive. In either case, the viability executive operates at a higher priority than the functional executive.

Given a failure in a tape unit, for example, the viability executive causes the configuration switching network to disconnect the tape so that it can be repaired off-line. It then acquires a working tape unit and assigns it to the functional role of the one that failed. The automatic replacement of failed units thus reduces the effective MTTR of a tape unit from a half-hour to a few hundred milliseconds. If enough redundancy is supplied (20-30% is usually sufficient for a large complex), the system can achieve arbitrarily high viabilities.

Unfortunately, the above example grossly over-simplifies the realities of the situation since the configuration switching network is itself an element of the system and is also prone to failure. This is similarly true for the malfunction detection hardware and software, the viability executive processor, and in fact **all** the elements of the system concerned with self-repair. Despite these shortcomings, however, it is possible to build systems with arbitrarily high viabilities, albeit at arbitrarily high costs.

EXECUTIVE MALFUNCTIONS

The most complex, interesting, and crucial aspects of self-repair are those that deal with the repair of *a failed viability executive.* Because almost every other self-repair action in the computer complex is a simplification of this case, we shall consider the action of the system and the methods used to deal with and detect executive malfunctions.

EXECUTIVE REPLACEMENT proceeds in four distinct steps which can be mechanized by hardware or software: (1) Executive malfunction detection. (2) Executive assignment. (3) Reconfiguration. (4) Recovery. The processors that perform these roles are shown symbolically in Fig. 1.

The **configuration control** consists of the configuration switching network and related hardware, and the control programs that are charged with changing the configuration. The configuration control may also be used for purposes other than self-repair, such as routinely re-assigning tape transports or disk drives.

The **viability executive** directs the configuration control and detects actual or impending malfunctions in the system. In most cases, the configuration change will be initiated and completed at the viability executive level. There is an **alternate viability executive** available in case of failure.

The **monitor** is a hardware or software processor whose sole purpose is the detection of failures in the viability executive. Given that the viability executive has failed, the monitor alerts the **executive assignment processor,** which will cause the switch-over from the original viability executive processor to its alternate. The executive assignment processor can be looked upon as another, smaller configuration switching network used only to switch the alternate viability executive.

If the above discussion appears vague as to whether we are talking about hardware or software, or whether computers or special-purpose devices are being considered, this is intentional. All of these approaches are possible and have been used in one or another system.

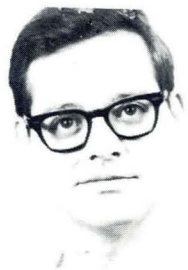
EXECUTIVE MALFUNCTION DETECTION is accomplished either by itself, through check-routines and hardware malfunction indicators, or by external processors, e.g., the monitor. (Both methods of malfunction detection are employed in most systems.) Only in those cases where self-detection fails is it necessary to fall back on the external means.

There are three possible failure modes for the viability executive itself:

The viability executive processor goes down **sane.**
The viability executive processor goes down **dead.**
The viability executive processor goes down **crazy.**

A **sane** processor is one which successfully communicates its plight to the monitor. This, of course, is the classical instance of self-detection. The monitor can then initiate the alternate executive processor for an orderly take-over of viability executive duties.

A **dead** processor is one which, to the external monitor, appears to be incapable of rational communication about its plight; either because it does not communicate,



Dr. Beizer is Director of R&D at Data Systems Analysts, Inc., Pennsauken, N.J., where he is responsible for the development of proprietary software packages and programming techniques. In addition, he is a well-known consultant on hardware and software systems architecture. Prior to his present position, Dr. Beizer directed and participated in numerous government and commercial R&D projects over the past 15 years. He received his B.S. degree from the City College of New York and his Ph.D. from the University of Pennsylvania.

or because what it does transmit is garbage. For the monitor to detect a dead processor, it must interpret the lack of communication with the viability executive processor as failure. One way or another, the viability executive must communicate to the monitor something like "12 o'clock and all is well." This is usually done by a periodic check signal. Should the viability executive fail to send this check signal at the proper time, the monitor will interpret its absence and direct the executive assignment processor to perform a switchover to the alternate viability executive.

It is entirely possible that the viability executive will fail in such a way that it continues to transmit the proper periodic check signal. It could, because of a failure, be caught in a program loop that included the check signal generator. A processor behaving in this way is said to be **crazy.** To guard against this possibility, the viability executive periodically transmits two totally-independent signals to the monitor. The two independent signals are generated in different parts of the viability executive program so that the probability of both being transmitted correctly by a malfunctioning computer is very small. The first check signal, because it is primarily intended to guard against dead processors, is called the "dead man" signal. The other signal is expectedly called the "crazy-man" signal. Typically, ten dead-man signals will be transmitted for each crazy-man signal. A numerical relation such as (crazy-man) = (dead-man)^2 − 17 is used to establish a further level of protection.

THE MONITOR

The monitor insures that a "viable" viability executive will always exist, that it has graceful degradation capabilities, and that the assignment of viability control is unambiguous and autocratic.

Autocratic control assures that as long as the viability executive is in control, it is in **complete** control over questions relating to viability (except for its own failures). If this were not the case, an alternate viability executive could attempt to usurp control with disastrous results to the system. Autocratic control, however, does not mean that the viability executive cannot abdicate or be deposed. It must be replaced or repaired if it is found wanting.

Several forms of monitors used and proposed in the past are:

HUMAN MONITOR — This is the earliest and simplest, but least effective, monitor system used. The human "monitor" periodically runs tests to validate the viability of the system. If he detects a failure, he "throws the switch" replacing the on-line viability executive with its standby. He then initiates what he must to allow the system to recover. The human monitor is generally too slow to be effective, and cannot remember the complete algorithm required for the reconfiguration of a large multi-computer complex.

CHECK-BOX MONITOR — A check-box monitor is a simple logic network consisting of a signal receiver from the present viability executive and circuits to time the "dead-man" and "crazy-man" signals. If either signal fails or arrives out-of-sequence, the monitor assumes that the viability executive has failed, causes it to be disconnected, and initiates a signal which will start the new viability executive.

THE UNSTRATIFIED MONITOR — The unstratified monitor is a distributed processor. Its functions are distributed among several computers so that the failure of the monitor can occur only if the entire system has failed. The operability of the viability executive will be determined by a concensus of the working computers in the system. The viability executive sends its periodic check signals to all known functioning computers in the complex. These computers in turn either verify or deny the validity of the check signals. If the check signal is judged to be good, the working computers each send a confidence message to the viability executive. If a working computer is not satisfied with the check signal, it sends its confidence message to the computer which has been designated as the successor to the viability executive. If the present viability executive wins the confidence vote, it continues to operate. If it does not win the confidence vote, it will abdicate (if it can). If the alternate executive receives a majority vote, it will assume the executive functions.

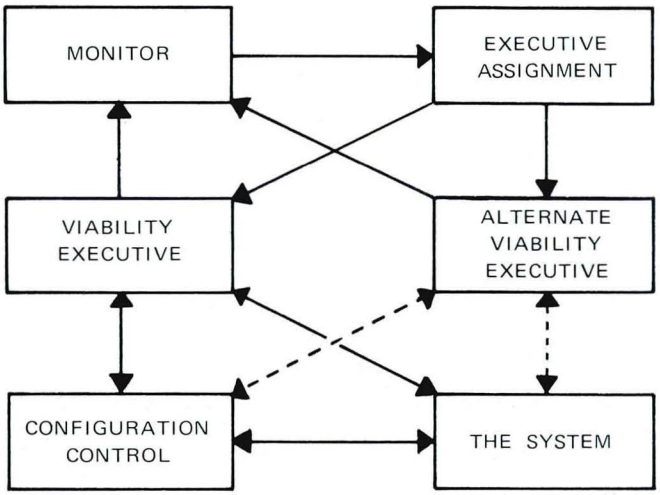


Fig. 1. Self-repair

EXECUTIVE ASSIGNMENT

Once the monitor determines that the viability executive has malfunctioned, it performs the necessary actions to activate the new viability executive by using or signalling the executive assignment processor. The new executive assumes control and the system is again safeguarded from failures, except possibly from another failure in the executive. At that point a new alternate executive must be assigned.

The ideal alternate executive processor is one which is physically identical to the present executive and is performing the most dispensible functions — that is, the executive is chosen after studying the functions that are

next to be discarded. This is sort of like combing skid row for a new vice president who happens to wear the same size clothing as the president.

RECONFIGURATION

The process of reconfiguration for viability executive malfunction is logically lengthy, but may actually take only a few seconds of elapsed time. Reconfiguration begins with the assignment of a new executive and ends with the physical restructuring of the system. Reconfiguration is followed by recovery. Actually, these functions are almost always overlapped. Reconfiguration is primarily physical and structural activity; recovery is primarily functional and logical.

Reconfiguration begins with the new executive processor's assignment to that role. The alternate executive processor contains a small bootstrap program which is sufficient to get the reconfiguration process started. The first thing the new executive must obtain is control over the configuration switching network. This is usually given to it by the executive assignment processor. Having control over the configuration switching network, the new executive acquires the memory (drum or disk) in which the full executive program is stored. Once this connection has been made, the actual reconfiguration process can begin.

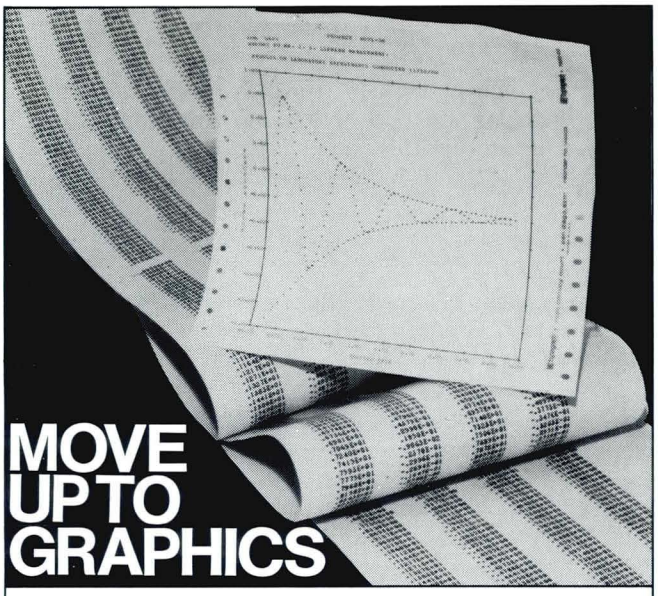
Along with the executive programs there is a set of tables which describes the complete state of the system prior to the failure. This set of tables is known collectively as the **ledger.** It is periodically written onto several memories. An analysis of the ledger will tell the new executive just what must be done to complete the reconfiguration and to perform the recovery which must follow.

The first major item of business for the new executive is to get rid of the old executive, or rather the hardware elements of old executive that had failed. The old executive now represents some hunks of dormant hardware which will be used by the new executive to structure as complete a complex as it can. The new executive successively brings more elements into the system until the best configuration is achieved.

While all this is going on, the new executive may find that some connections cannot be established because of previous failures, or that new elements fail while reconfiguration is in progress. These too must be taken care of or the system will fail catastrophically.

The actual reconfiguration may require much testing of paths; many attempts at alternate configurations; testing and discarding faulty ledgers; recovery from failures in the configuration switching network; controls, etc. However, this is all not only possible, but such systems have been in operation for several years. Among these are the Overseas AUTODIN system whose 11 sites have been in operation since 1967 and which first performed automatic reconfiguration in early 1966, and the Weather Message Switching Center being contracted for the FAA by North American Philips and which is due to go on-line in late 1971.

Automatic reconfiguration is used to advantage in the Overseas AUTODIN system as a simple means of getting the system into operation from a cold start. The reconfiguration bootstrap is loaded in the executive pro-



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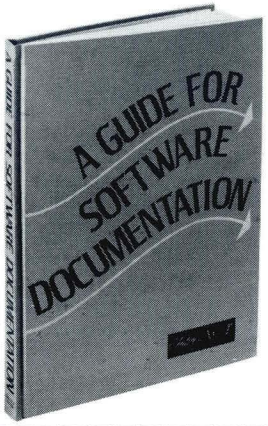

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cessor which then proceeds to "recover" from what appears to have been a very serious malfunction. Since all subsystems are up, the system rapidly and automatically achieves the full operational state.

RECOVERY

Recovery is that process by which the system resumes operation after failure. There is no single, universal approach to recovery. Nor are there many generalized techniques. Recovery should be looked upon as the result of a philosophy which pervades the design of every program in the system, rather than as the action of a specialized recovery program. Every program must be considered from the point of view of what information would be required to resume its operation after a failure. The recovery problems associated with a program should be considered at the time of design, not after the fact.

Some programs resume proper operation by simply restarting them, with the proper information on the processing queue for that program. In general, recovery of a particular program will begin at some logical starting point of that program — a point whose parameters have been stored in the ledger.

The necessities of recovery impose a great deal of formality in the design of the various programs. Many otherwise "clever" tricks cannot be used lest the recovery of such programs be made very difficult.

Recovery itself is not a single event: the complete recovery of the system after a failure may stretch over many cycles. It may proceed at different rates for different processors and for different programs within a processor. High-priority functions will be recovered first. Some functions may not be recovered until after a second failure has occurred.

Just as many elegant information retrieval or file searching algorithms fail because of the updating requirements, many otherwise elegant methods for improving viability fail because of the recovery problems. The following observations should be included in any evaluation of a viability enhancement technique.

1. Recovery need not occur all at once — it can and should be stretched out over several cycles.

2. Processing by unfailed elements can continue while recovery of failed elements occurs.

3. Another failure may occur before recovery is completed.

4. Recovery may be to a higher-capability or lower-capability state — or (in the overwhelming majority of cases) to an equivalent state.

5. It is generally neither possible nor desirable to recover the system for everything, in all possible cases.

6. The recovery "program" may have to co-exist with the operational program for significantly long time intervals.

7. The recovery "program" is rarely a single identifiable program. It is usually an initialization routine or a special entry to all subroutines and programs in the system. It is a prime example of a distributed processor.

8. The analysis effort required for the recovery of a particular function may equal or exceed the analytical effort required for the operational design of the program.

9. Recovery will most often occur as the result of a transient malfunction rather than as the result of a hard failure.

The problems associated with recovery can be best exemplified by recounting the tribulations of a large-scale communications system. A program modification had been made which resulted in the vulnerability of some (not all) sites to a peculiar syntax error in a message. The bug occurred only when the message was transmitted. The message entered the system and was analyzed, stored, and readied for relay to another site. As soon as the particular character combination that was causing the problem occurred, the bug manifested itself and the program blew up. This system, employing a straight-forward ghosting scheme, turned control over to the standby (ghost). The ghost (the new prime) retrieved the ledger and proceeded to continue where the old prime left off. All was well until the bogey message was reached, at which point it also blew up. In the meantime, the original prime system had gone through the test programs successfully, reloaded all programs, and assumed the ghost position. The result was that the two systems oscillated at about 30 cycles per minute — an awesome and disturbing sight to its operators.

SUMMARY

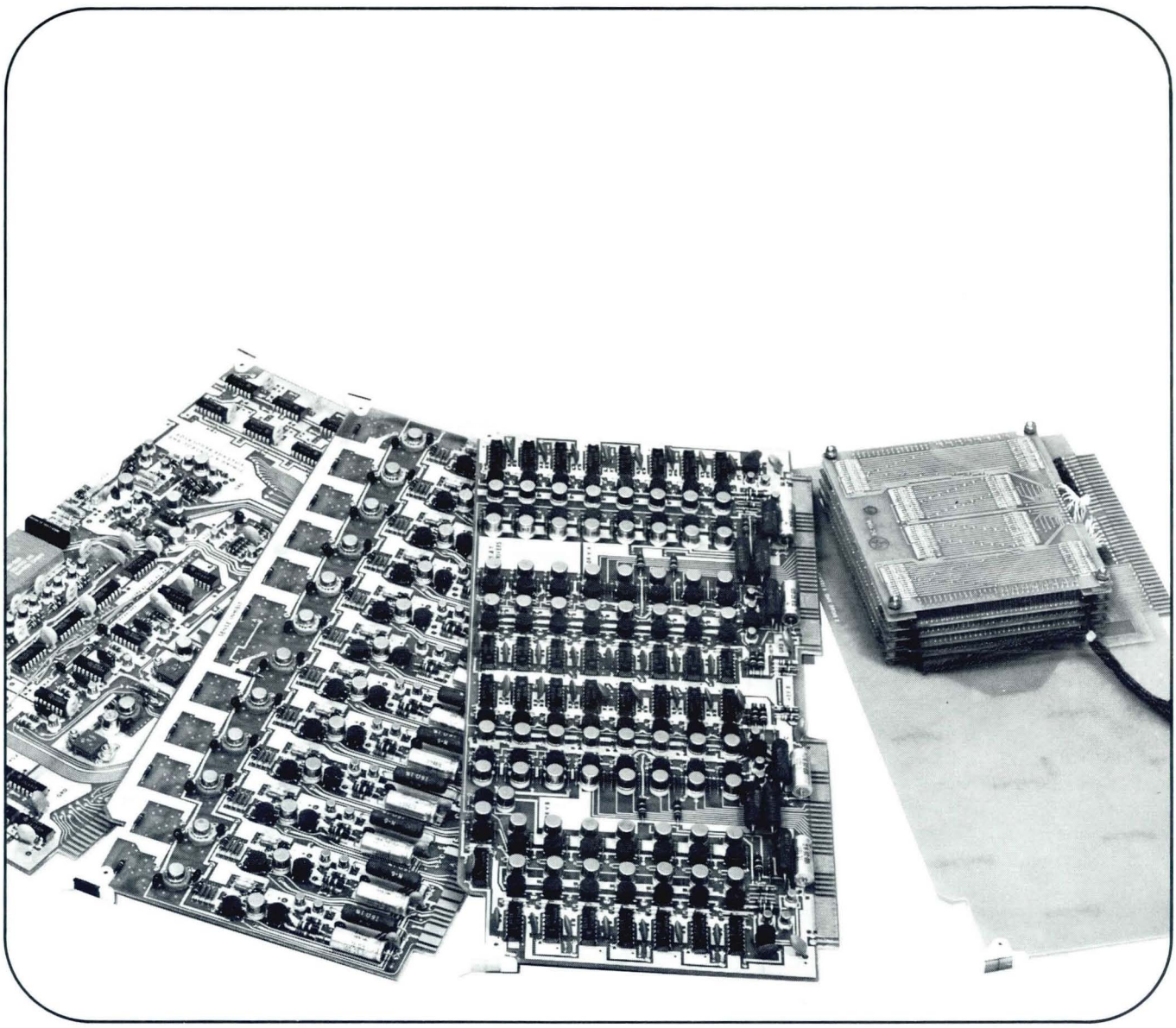
We have in these articles learned what viability is, how it is achieved, and how it is implemented. Viability is not a wish or a vague desire on the part of a user for something that could be granted to him at some distant time in the future. It is an aspect of the computer complex that he should specify numerically, be granted by the manufacturer, and be willing to pay for. All too often, manufacturers are unwilling to provide the data on which viability could be calculated, or to verify that the numbers given are valid. Conversely, users frequently specify unrealistic requirements and are not willing to pay the inevitable increased costs. A defensive attitude on the part of the manufacturer and an uncompromising one on the part of the user will not yield the desired viability — it will only increase the cost. There is no point in kidding ourselves into believing that the system will not fail, or that high viability can be obtained at no cost. We can obtain our desire only by considering the following maxims:

1. *Every system can and will fail.*

2. *Arbitrarily high viability can be bought at arbitrarily high costs.*

3. *Buy no more than you need — as measured by the cost of failure.*

4. *Negotiate.*



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THE WANG 3300 **BASIC** SYSTEM

Will 1970 be "The Year of the In-House Time-Sharing System?"

Having initiated 1970 by extolling the virtues of shared in-house BASIC systems, we were fully prepared to wager that another half-dozen or so of these systems (presently ranging from $40K to $60K for a 4-terminal configuration; providing for up to 12 additional terminals at $1500 — $3000 per) were already "on the pike" and scheduled for announcement by the fall (FJCC) of this year. Our expectations were based on our beliefs that **1.** the market is "clear and present"; **2.** the field is wide-open competitively (at the time we knew of only two systems which were being actively marketed); **3.** the state-of-the-art is well within realization; and **4.** $40K-$60K is not unreasonable for a flexible BASIC system geared to handle up to 16 user terminals.

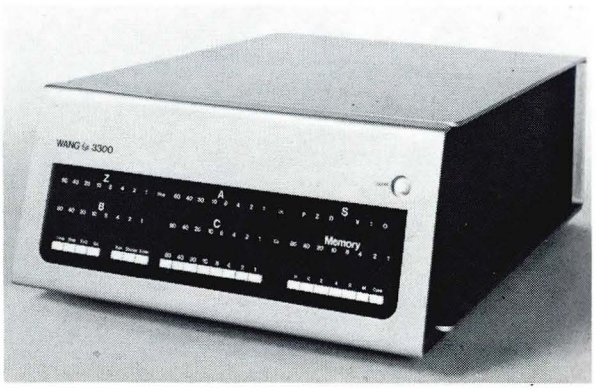
So much for our expectations. As of this month, Wang Laboratories, Inc. will offer an up-to-16-terminal BASIC system that will sell in the $25K range for a typical 4-user configuration, including Selectric terminals and cassette drives. As a result, while we are even more convinced that 1970 will be "The Year of the In-House Time-Sharing System," we have revised downwards our expectations as to the number of companies that will be offering competing systems in the near (12 month) future.

HARDWARE

The heart of Wang's Time-Sharing System is a spanking-new 4K-64K (bytes), 1.6 usec. processor designated the Wang 3300. In its minimum 4K configuration, the TTL/MSI 3300 sells for $4,950, making it the first g-p mini priced under $5K. Add-on memory modules are available in 4K increments for $2,500.

These low prices in large part reflect Wang's choice of an 8-bit word, but the decision to use a smaller word size has had proportionately little effect on performance. An extensive repetoire of 72 instructions includes 20 for memory reference alone and five single and double arithmetic instructions which operate in either binary or decimal mode. Instruction logic is therefore equivalent to many 16-bit machines. Additional hardware instruction features include a complete and compatible set of bus and channel I/O, interrupt, and skip instructions; the ability to permit I/O direct memory access cycle-stealing between instruction execution sub-cycles; and a unique, push-pop auto-incrementing and decrementing indirect addressing feature throughout memory for both single and double instructions.

A standard 3300 time-sharing configuration consists of one 4K processor ($4,950); two additional 4K core units ($5,000); two Selectric I/O terminals ($4,200); a terminal control unit ($500 — controls up to four Selectrics); a pair of magnetic tape cassette drives ($1,400); and the BASIC software package which includes a one-time set-up and initialization fee ($1,500). Total: $17,550. Assuming individual terminal users are content with 1400-byte partitions (partition size is determined at set-up time), a 4-user Selectric/cassette system would cost $25,650. Two- and four-user TTY systems are priced at $15,250 and $21,250. Goodies include an acoustic coupler ($795) for use with the TTYs, and still-to-be-priced 65K and ½-megabyte disks.



The WANG 3300 — The CP of Wang Labs' new T-S system.

SOFTWARE

Since the BASIC compiler was simulated on an S/360-65 while the hardware was still in development, the resulting system has all the advantages of a happy hardware/software marriage. Significant features of Wang BASIC are:

- **An "Immediate Mode"** — unnumbered BASIC statements are immediately executed in calculator fashion.
- **A "Diagnostic Pointer" and "Trace Mode"** — for debugging and error checking.
- **Common Data Allocation** — variables can be retained between chained programs to allow more efficient use of allocated core.
- **BASIC PRIME and TAB Extensions** — for plotting functions.
- **Terminal Convenience Features** — such as the ability to save and load programs via high-speed cassette tapes, and to modify and copy statements on a character basis.

These features, along with Boolean logic functions, unlimited subroutines, and a full 8 digits of decimal ac-

curacy (data may have exponents between 10^{-63} and 10^{63}) should be more than enough to handle the needs of most present time-sharing users.

SUPPORT

Wang is certainly geared to produce, sell, and support these turnkey systems. The company is a most efficient manufacturer (last year Wang generated over $23 million in revenue with only 55,000 sq. ft. of plant space; an additional 85,000 sq. ft. facility is under construction), and has an excellent sales and marketing track record in the desk-top calculator field. In addition to what the company already provides in its extensive BASIC program library, Wang can draw upon the resources of Philip Hankins Inc., acquired in 1968, for systems and programming support.

Dr. An Wang, the company's president and treasurer, summed-up Wang Laboratories' capabilities and support philosophy very neatly: "As the leader in sophisticated calculators, it was logical to enter the small computer market. We have our traditional strength in hardware, an excellent software group, and an extensive field sales and service organization. Not only can we develop a total system, we can also support the user." We don't doubt it.

For more information on the Wang 3300 BASIC System, Circle No. 109 on the Inquiry Card.

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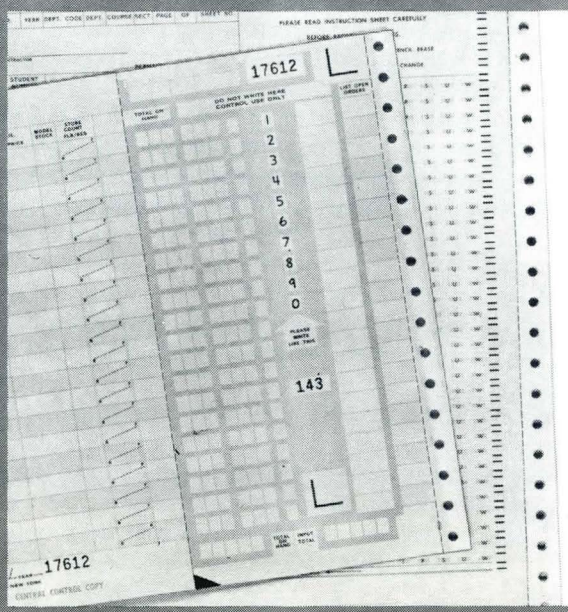

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CHARLES H. WHITE, JR., Dir. of Prof. Education • Computer Environments Corp., Hanover, N. H.

TECHNOLOGY PROFILE UPDATE

TIME-SHARING SERVICES

MODERN DATA's fourth Technology Profile of commercial time-sharing services.

Since February 1968, this series of Technology Profiles has chronicled the dynamic growth of the time-sharing industry. *But does growth in itself signify health?* Glowing generalities have characterized the growth of time-sharing. The time has come for a harder look.

Statistics are always hazardous. Even the highly abbreviated data contained in the accompanying table opens itself to scrutiny. For instance, the concept of "simultaneous users" creates a number of questions. *What does it mean to have 30 simultaneous users?* If all the users do calculate-heavy computing, the experienced response time will be significantly different than in a situation wherein some users manipulate large data banks. *Does the "simultaneous user" statistic indicate the point where "graceful degradation" becomes intolerable, or does it, on the other hand, indicate the user load at which system degradation begins? What happens to system response time when one of the users happens to use a graphical display unit? And what is the likelihood of encountering a busy signal?* Obviously, potential customers of time-sharing firms must get answers to questions raised under the simultaneous user rubric.

Language and library capabilities also must be analyzed by the potential user. *One firm may boast of an extensive array of user languages, but what relevance do rarely-used languages have for new or single-language users?* Some system libraries likewise have been fertile areas of obfuscation. Scientific sounding mnemonics have disguised frivolous programs. And customized *ad hoc* programs have found their way into some program catalogs only for the purpose of filling up the library. The potential customer should explore both the system library **and** its documentation.

In a stable situation the admonition *caveat emptor* might apply. But the climate is not stable. It's a **buyer's** market.

IS THE GLAMOR GOING?

"Shakeout" is an increasingly-heard term and connotations of impending disaster are inherent in it. It is clear that, at this point in time, the time-sharing industry is "overstocked" *vis-a-vis* its community of users. This overstocking has made user education an integral element in the time-sharing firms' mix of offerings. A competitive advantage can be expected to accrue to those organizations with strong educational arms. Client development is also an important endeavor.

Salesmen are scrambling, and the heavy overhead burdens have pushed some of the big-machine firms back to Wall Street for additional placements. The central question has become one of assessing the projected duration of the overstocking. Wall Street, however, has measurably cooled its enthusiasm for new time-sharing firms. Implicitly at least, it is predicting that the overstocked period will have sufficient duration to make new-firm investment less attractive. The combination of lessening receptivity among the financial community, along with the inescapable cost of supporting the overstocking, might create a climate of quiet attrition, especially among the large-machine (and therefore large-overhead) independents. The insufficiently capitalized firms might become increasingly likely merger candidates in the near term.

Charles H. White, Jr., Director of Professional Education at Computer Environments Corp., graduated from Boston College and holds advanced degrees from Dartmouth College and Yale University. A member of the Massachusetts Bar, Mr. White has written extensively on the legal and managerial impact of shared computing.

The time-sharing independents have always been managed by optimistic men. As a group, they are betting that the industry's overstocked posture will simply be transitory. Rather than a wrenching shakeout they anticipate a substantial growth in awareness, interest, and use of time-sharing among the technical and managerial communities. They have ample reason to be optimistic.

In our first Technology Profile (**MODERN DATA,** Feb. 1968), we outlined the advent of new management techniques in our top graduate business schools. A recent **Business Week** article (*"The 'New Management' Finally Takes Over,"* Aug. 23, 1969) indicated that a "new management" grounded both in quantitative and computer techniques has "finally taken over." If the time-sharing industry has been growing dramatically, so has its community of users. The time-sharing entrepreneurs are betting that user growth will soon catch the industry's collective capability growth. But in the meantime the waiting period has become uncomfortable for the heavy-overhead independent firms and some structural readjustment can be expected.

Table 1 on the following pages provides information on 95 time-sharing companies listed alphabetically and showing region(s) served. The regional areas given in Col. 2 are illustrated in Fig. 1 — Regional Breakdown of States — shown on page 70.

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TABLE 1 • COMMERCIAL TIME-SHARING SERVICES

CORPORATE NAME AND ADDRESS	STATES PRESENTLY SERVED	CPU	CONVERSATIONAL USER LANGUAGES	TERMINALS	NO. OF SIMULTANEOUS USERS	CHARGES MIN	CHARGES TCT	CHARGES CPU	CHARGES STORAGE	SPECIAL NOTES
Academy Computing Corp. Oklahoma City, Oklahoma	**West S. Central** Ariz., Cal., Colo., Kans.	GE 430, 255 (3)	ACCESS*, BASIC, EDIT, FORTRAN	CRTs, card-readers, plotters, TTYs, etc.	30/sys.	$100/mo.	$10/hr.	$0.05/min. (430); none (255)	$1.00/1K chars./mo. (430); $0.50/1K chars./mo. (255)	
Allen-Babcock Computing Inc. Los Angeles, California	**Mid-Atl.,** Cal., Ill., Oreg.	IBM S/ 360-50	PL/1	CRTs; Datel; Dura; IBM 1050, 2741, 2780; TTYs, etc.	65	----	On request	$5.00-$15.50/ min.	$4.00 or $12.00/ 100K chars./mo. (datacell or disk)	
APL Computing Services Van Nuys, Cal.	Cal.	IBM S/ 360-50	APL	Datel; Dura; IBM 2740, 41	100	----	$11.00/hr.	None	$5.00/32K chars./mo.	Formerly Marquardt Corp.
APL Manhattan New York City	N.Y.	IBM S/ 360-44	APL	ADS-715, Datel, Dura, IBM 2741, Tycom	----	$100.00/ mo.	$12.00/hr.	----	$1.00/7K chars./mo. >64K	Division of Industrial Computer Systems, Inc.
Appl. Computer Time Share Inc. Southfield, Michigan	Ind., Ky., Mich., N.Y. Ohio	GE 265 (2) 430 (2); IBM 360/67	ALGOL; BASIC, XBASIC; FORTRAN II, IV	Dura, IBM 2741, TTYs	200	On request	----	----	----	Specializes in education, finance, engrng., retailing, and mfg.
Applied Logic Corp. Princeton, New Jersey	**Mid. Atl.,** Cal., Conn., D.C., Ill., Ind., Mass., Md., Tex.	AL/COM Dual AL-10s (4 pairs of DEC) PDP-10s	BASIC, COBOL, FORTRAN IV, LISP, SNOBOL	CRTs, Datel, Dura, IBM 2741, plotters, TTYs, etc.	200	$100.00/mo. (after 3 mos.)	$10.00/hr.	On request	$0.10-$0.75/1K chars./mo.	Additional terminals and languages available.
Axicom Systems, Inc. Paramus, New Jersey	**Atl.,** Conn., Mass., Cal.	Univac 1108	CFOR, BASIC	CRTs, card-readers, IBM, TTYs, Univac, etc.	64	None	$10.00/hr. (prime); $5.00/hr. (non-prime)	$0.28/sec (prime); $0.19/sec. (non-prime)	$0.04/ 10,752 chars./day	Formerly Access Systems, Inc. Additional terminal processors
Bolt Beranek and Newman Inc. Cambridge, Massachusetts	**Mid. Atl., N. Engl.** D.C., Del., Md.	DEC PDP 7/8, 10; XDS 940	BASIC, BBN-LISP, FORTRAN IV, TELCOMP	CRTs, plotters (XDS only), TTYs, etc.	32/sys.	$100/mo. (XDS only)	$15-12-18/ min.	$0.20/sec. (PDP-10); $3.50/min. (XDS)	$1.00/1K chars./mo. (PDP-10); $6.00/6K chars./mo. (XDS)	BBN plans to merge with Graphic Controls Corp. to form BBN-Graphic Inc.
Burlington Management Services Greensboro, North Carolina	**"Conti nental U.S."**	RCA Spectra 70/46 (2)	XBASIC, COBOL, FORTRAN	CRTs, IBM 2741, RCA, TTYs, Univac, etc.	48	$100/mo.	On request	$0.10/sec.	$6.00/25K chars./mo. >25K chars.	Extensive library incl. remote batch and interactive progs.
Call-A-Computer, Inc. Minneapolis, Minn.	**Atlantic, E. Central, N. Engl.,** Ariz., Cal., Minn.	GE 255, 265 (5)	BASIC, XBASIC, FORTRAN II	CRTs, TTYs	40/sys.	$2.00/mo. (validation)	$6.50/hr.	$0.03/sec.	$1.50/1500 chars./mo.	New system to be announced shortly.
C-E-I-R Washington, D.C.	D.C., N.Y., Pa.	GE 265, 420	ALGOL, BASIC, X BASIC, FORTRAN IV, BASIC	TTYs	40/sys.	$100.00/mo.	$8.00/hr.	$1.00/min. (GE 265); $2.00/min. (GE 420)	$0.40/1K chars./mo.	Subsidiary of Control Data Corp.
Central Computing, Inc. Wichita, Kansas	Kans., Tex.	GE 420	BASIC	TTYs	30	----	$10.00/hr.	$0.05/sec.	$2.50/1536 chars./mo.	
Codon Computer Utilities Waltham, Massachusetts	**N. Engl.,** N.J., N.Y.	DEC PDP-10	BASIC, COBOL, FORTRAN IV	CRTs, Datel, Dura, IBM 2741, TTYs, etc.	64	None	$9.00/hr. (300 baud); $15.00/hr. (1200 baud)	$0.01/1K words/sec.	On request	Assembler and special packages available incl. high-speed interactive graphics.
Community Computer Corp. Philadelphia, Pennsylvania	Pa.	HP 2116B (mult. sys.)	BASIC, XBASIC	Any std. 10 cps ASCII	16/sys.	$50.00/mo.	$5.00/hr.	None	$0.10/128 chars./mo.	Various charge plans available.
Computer Center Corp. Seattle, Washington	Oreg., Wash.	DEC PDP-10	ALGOL, BASIC, FORTRAN IV, LISP	CRTs, TTYs	20	----	$8.00/hr.	$0.08/sec.	$1.00/1K chars./mo.	Additional special languages available.
Computer Complex Inc. Houston, Texas	**West. Central,** Ariz., Cal., Colo., Kans.	XDS 940	BASIC; CAL; FORTRAN II, IV; SNOBOL; XTRAN	Any std. 10 cps ASCII**	40	None	$15.00/hr. >200 hrs./ mo.; sliding scale < 200 hrs./mo.	None	$0.02/1K chars./day >60 K	
Computer Dynamics Inc. Boston, Massachusetts	Mass., N.H., R.I.	AL/COM Dual AL-10 (pair of DEC PDP-10s)	BASIC, COBOL, COGO-10; FORTRAN IV, LISP, SNOBOL	Datel, Dura, IBM 2741, plotters, TTYs, etc.	30 (Local)	None	$10.00/hr.	On request	$0.10 to $0.75/1K chars./mo.	Applied Logic Corp. associate. Additional terminals and special languages available.

Note to Table 1: The information contained in this table has been obtained by questionnaire. Companies not included in this table either failed to reply to our questionnaire or were not known to us at press time.

TCT (Terminal Connect Time) and other rate data may vary with time and user requirements.

*Proprietary O.S. and language processor for GE 255.

**15 and 30 cps terminals going on-line. Additional special languages available.

TABLE 1 • COMMERCIAL TIME-SHARING SERVICES cont'd

CORPORATE NAME AND ADDRESS	STATES PRESENTLY SERVED	CPU	CONVERSATIONAL USER LANGUAGES	TERMINALS	NO. OF SIMULTANEOUS USERS	CHARGES				SPECIAL NOTES
						MIN	TCT	CPU	STORAGE	
Computer Innovations Chicago, Illinois	**Central,** Pa.	IBM S/ 360-50	APL	Datel; IBM 1050, 2741	35	None	$15.00/hr.	None	$5.00 32K chars./mo. >64K chars.	
Computer Network Corp. Washington, D.C.	**Mid. Atl.,** D.C., Ill., Md.	Burroughs B-5500, IBM S/360-50	ALGOL, BASIC, COBOL, FORTRAN IV	CRTs, CDC 200, TTYs	40	----	$10.00/hr.	On request	On request	Special non-prime-time rates available.
Computer Response Corp. Washington, D.C.	8 eastern states plus Tenn.	Univac 1108	ALGOL, XBASIC, COBOL, FORTRAN IV	IBM 1050, TTYs, Univac, etc.	----	On request	----	----	----	Additional terminal processors.
Computer Sharing, Inc. Bala-Cynwyd, Pennsylvania	**Atlantic, N. Engl.,** Cal.	XDS 940 (3)	ADAPT PLUS, BASIC/70, CAL, FORTRAN	Friden, TTYs	40/sys.	----	$10.00/hr.	$2.50/min.	$1.00/1K chars./mo. >60 K chars.	Additional special languages available.
Computer Sharing Services Denver, Colorado	Colo.	GE 400	BASIC, XBASIC; FORTRAN IV	Datel, Dura, Friden, IBM, TTYs	60	None	$4.00/hr. (prime); $10.00/hr. (non-prime)	On request	$2.00/1800 chars./mo.	
Computer Software Systems Stamford, Connecticut	Cal., Conn., Mass., N.J., N.Y., **Canada**	IBM S/ 360-67 (3)	BASIC COBOL, FORTRAN IV, PL/1, SNOBOL	IBM 2741, TTYs, Univac DCT 2000, etc.	----	None	$6.00-8.00/hr.	$0.38/sec.	$15.00/120K chars./mo.	Additional special languages available.
Computer Solutions, Inc. East Orange, New Jersey	N.J.	Hewlett-Packard HP-2000A	ALGOL, XBASIC	Card and mark-sensing readers, CRTs, TTYs	16	On request	----	----	----	
Computer Technologies, Inc. New Orleans, Louisiana	La.	GE 420	BASIC, FORTRAN	TTYs	30	----	$10.00/hr.	$0.05/sec.	On request	
Comp/Utility, Inc. Boston, Massachusetts	**Mid. Atl., N. Engl., Southwest**	DEC PDP-8,10	XBASIC, COBOL, COGO, FORTRAN IV	Dura, IBM 2741, plotters, TTYs, etc.	40/sys.	On request	----	----	----	Additional special languages available; extensive program library.
Compu-Time, Inc. Ft. Lauderdale, Fla.	Fla.	GE 430	BASIC, XBASIC; FORTRAN IV	Datel, Friden, TTYs	30	$10.00/mo.	$10.00/hr.	On request	$1.50/1620 chars./mo.	
Comserv Philadelphia, Pennsylvania	**Mid. Atl.,** D.C., Del., Canada	XDS Sigma 7	BASIC, COBOL, FORTRAN IV, SYMBOL	IBM 2741, TTYs, Univac	60	None	$9.00/hr.	$0.12/sec.	$0.50/1024 chars./mo. (quantity)	Complete utility services, incl. T-S and remote batch.
Com-Share, Inc. Ann Arbor, Michigan	**Mid. Atl., N. Central,** Cal., Mass., Tenn., Va.	XDS 940(8), XDS Sigma 7	BASIC, CAL, SNOBOL, XTRAN	CRTs, card-readers, plotters, TTYs, etc.	44	On request	----	----	----	Additional special languages available.
Comsonic Corp. New York City	Conn., N.J., N.Y.	DEC TSS-8	BASIC, FOCAL, FORTRAN, PAL	CTS Executport 300, TTYs	16-30	$10.00/mo.	$6.50/hr.	$0.03/sec.	$1.75/2048 chars./mo.	Extensive systems consulting and support services. Formerly Strategic Time-Sharing, Inc.
Consolidated Computer Services Toronto, Ontario, Canada	All Canadian Provinces	CCS 2100 Series TSS	BASIC	CTC CRTs, HP cardreader, TTYs	16	$50/mo.	$4.00-$7.50/hr.	None	$0.12/128 chars./mo.	Volume discounts available.
Control Data Corp. Minneapolis, Minnesota	**"Continental U.S."**	CDC 3300 (5); CDC 6600 (7)	BASIC, SHADE	CDC MARC II, III, IV; TTYs	256	None	$10.00/hr.	$0.10/sec. (3300); $0.40/sec. (6600)	$0.01/1K chars./day (avg.)	
Cyphernetics Corp. Ann Arbor, Michigan	**East N. Central,** Md., Pa., W. Va.	DEC PDP-10 (mult. sys.)	XBASIC, FORTRAN IV	CRTs, Datel, Dura, IBM 2741, TTYs	64	None	$10.00/hr. (prime time); $6.00/hr. (non-prime time)	$0.02/page-second	$1.00/1K chars./mo.	Extensive applications library incl. substantial graphics capability.
Datalogics, Inc. Cleveland, Ohio	Ohio	GE 425	BASIC, FORTRAN IV	TTYs	30	----	$9.00/hr.	$0.08/sec.	On request	Volume discounts available.
Data Network Corp. New York City	Ill., N.Y., Okla., Tenn., Tex.	GE 420, XDS 940	XBASIC, CAL, FORTRAN IV, QED	Cardreaders, CRTs, Friden, plotters, TTYs	30/GE; 40/XDS	$100.00/mo.	$9.00-$18.00/hr.	$0.04/sec (GE); None (XDS)	On request	
Davis Computer Systems, Inc. New York City	Conn., N.J., N.Y.	DEC PDP-10*; XDS Sigma 7	XBASIC, COBOL, FORTRAN IV	CRTs, Datel, Dura, IBM 2741, TTYs, etc.	40	None	$10.00/hr.	On request	$1.00/3200 chars./mo.	Prices refer to PDP-10 services only. Assembler and diagnostic packages available.
Dial-Data, Inc. W. Newton, Massachusetts	**Atlantic, N. Engl.**	XDS 940 (4)	XBASIC; CAL; FORTRAN II, IV; QED, SNOBOL	Various 10, 15, 30 cps ASCII	32	None	On request	On request	$4.00/6K chars./mo. >60K chars.	Variety of financial and engineering packages available.

*Company represents On-Line Systems, Inc.

Fig. 1 REGIONAL BREAKDOWN OF STATES

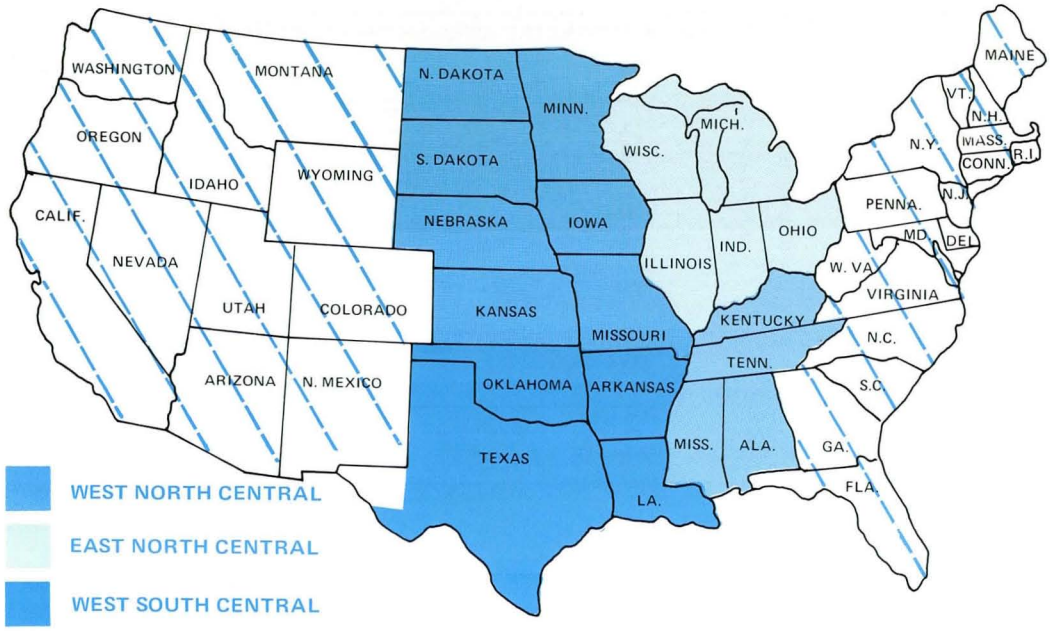

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TABLE 1 • COMMERCIAL TIME-SHARING SERVICES cont'd

CORPORATE NAME AND ADDRESS	STATES PRESENTLY SERVED	CPU	CONVERSATIONAL USER LANGUAGES	TERMINALS	NO. OF SIMULTANEOUS USERS	CHARGES: MIN	CHARGES: TCT	CHARGES: CPU	CHARGES: STORAGE	SPECIAL NOTES
Dialog Computing, Inc. Fairfield, Connecticut	**N. Engl., S. Atl., W. Central,** Ala., Ky.	IBM S/360-50, 65 (mult. sys.)	BASIC, COGO, FORTRAN IV, TEXT EDITOR	Dialog 15, 40; Dura; IBM 2741; TTYs	----	On request	----	----	----	Extensive program and language library incl. engrg. and sci. routines, etc. Special application terminals available.
Direct Access Computing Corp. Southfield, Michigan	Ill., Mich., Ohio, Tenn., Mexico	Burroughs B5500 (mult. sys.), Honeywell H-120	ALGOL, XBASIC, COBOL, FORTRAN IV	TTYs, etc.	48	None	On request	On request	$1.00/1K chars./mo. >75K	Affiliate in S. Africa (Comsource Ltd.). Bulk discounts. High-speed terminals becoming available.
Directed Research Inc. New York City	N.J., N.Y.	PDP-10 (4)	BASIC, COBOL, FORTRAN, MACRO, SNOBOL	CRTs, IBM 2741; TTYs	100/sys.	None	$10.00/hr.	On request	$0.75/1K chars./mo.	Assoc. of Applied Logic Corp. Considerable proprietary software available.
DynaCom, Inc. Hubbard, Ohio	Ohio, Pa.	IBM S/360-30, 40	MIS	IBM 1050, 1062, 2740, 2780	8	$200/mo.	None	On request	On request	
EDP Central, Inc. Portland, Oregon	**Pacific,** Colo., Idaho	IBM S/360-65	BASIC, REACT (subset of PL/1)	IBM 2741, TTYs, etc.	120	On request	$2.00/hr.	$6.00/min.	$0.90/7.3K chars. (track)/mo.	Additional terminal processors.
EDP Com Share New Orleans, La.	La., Miss.	SDS 940	BASIC, CAL, FORTRAN, SNOBOL	TTYs	6	$300.00/mo.	$28.00/hr.	On request	On request	
General Electric Co. (Information Services Dept.) Bethesda, Maryland	32 states	GE 265, 605, 635	ALGOL, BASIC, FORTRAN IV	Dura, Friden, GE Terminet 300, plotters, TTYs, etc.	----	On request	----	----	----	Wide range of languages, programs, services.
Graphic Controls Corp. Buffalo, N.Y.	**"Continental U.S."**	DEC PDP-10/50; GE 265 (2)	ALGOL, BASIC, XBASIC, EDIT, FORTRAN IV, LISP	CTS, GE Friden, TTYs	64 (PDP-10); 40 (each GE-265)	$10/mo.	On request	$0.10/8K (core)/sec. (PDP-10); $0.04/sec. (GE 265)	$1.00/640 chars./mo. (PDP-10); $0.20/200 chars./mo. (GE 265)	Special educational rates. Additional special languages available.
Hobbs Associates, Inc. Corona Del Mar, Cal.	Cal.	----	BASIC	----	16	----	$5.00-6.00/hr.	On request	$0.20/128 chars. (disk)/mo.	Special monthly rates for full-time private line service.
Honeywell, Inc. Minneapolis, Minn.	At least 8	H-1648	BASIC, FORTRAN IV	Plotters, TTYs, etc.	48	On request	----	----	----	Additional special languages available.
Information Management Corp. Pennsauken, New Jersey	Del., N.J., Pa.	DEC PDP-10 (2)	BASIC, COBOL, COGO, FORTRAN IV, LISP, SNOBOL	Datel, Dura, IBM 2741, TTYs	----	None	$10.00/hr.	On request	$0.025/1K chars./day	Applied Logic associate – additional terminals and languages available.
Information Network Corp. Phoenix, Arizona	Ariz.	IBM S/360-44	SHARP	CRTs, Datel, Dura, Friden, GE, IBM 2741, TTYs, etc.	80+	$100.00/mo.	$5.00/hr.	$0.03/sec.	On request	Business-oriented applications.
InterAccess Corp. Palo Alto, California	Cal.	CDC 1700, 3800	ALGOL, XBASIC, COBOL, FORTRAN, SIMSCRIPT	CDC 200, IBM 2741, TTYs	200	None	$10.00/hr.	On request	$0.10/1K chars./mo.	Conversational and remote batch access to a common data base, concurrently.
Interactive Computing Corp. Orange, California	Cal.	DEC PDP-10/50	BASIC, COBOL, FORTRAN IV	Univac DCT 2000, TTYs	64	$100.00/mo.	$10.00/hr.	On request	$0.60/1K chars./mo. >100K	Additional special languages available incl. assemblers, editors, diagnostics, etc.
Interactive Data Corp. Waltham, Massachusetts	**"Continental U.S."**	IBM S/360-67	BASIC, COBOL, FORTRAN, SNOBOL	Datel, Dura, GE Terminet 300, IBM 2741, TTYs	----	None	$13.00/hr. ($8.00/hr. after 6:00 p.m.)	$1,000/hr.	$25.00/120K chars./mo.	Additional special languages as well as ALGOL and PL/1 under remote batch. Company has extensive on-line financial data base.
Interactive Sciences Corp. Braintree, Massachusetts	Mass., Pa.	DEC PDP-10/8	XBASIC, FORTRAN IV	TTYs	----	On request	----	----	----	Additional special languages available.
Interface Computer Inc. Salt Lake City, Utah	Idaho, Utah, Wash.	XDS Sigma 7	BASIC, COBOL, FORTRAN	TTYs	60	None	$7.50/hr.	None	On request	Special languages include assembler and file manipulator.
Intn'l. Telecomputer Network Corp. Washington, D.C.	**Mid. Atl.,** Ala., Conn., Ohio, Va., W. Va.	GE 635 (2 back-to-back)	BASIC, XBASIC; FORTRAN	Datel, IBM 2741, plotters, TTYs, etc.	120+	None	$10.00/hr. (T-S); $25.00/hr. (R.B.)	$0.01/1K words/sec (T-S); $.0075/1K/sec (R.B.)	$1.00/1280 chars./mo.	Provides extensive remote batch facilities. Bulk storage rates available.
International Timesharing Corp. Chaska, Minnesota	Cal., Ill., Minn., N.Y.	CDC 3300	BASIC, FORTRAN IV, FORTRAN/FTN	CRTs, IBM 2741, plotters, TTYs, etc.	48 (lines)	On request	$10.00/hr.	$0.09-0.012/sec	On request	

*Plans to merge with Bolt Beranek and Newman Inc. to form BBN-Graphic Inc.

TABLE 1 • COMMERCIAL TIME-SHARING SERVICES cont'd

CORPORATE NAME AND ADDRESS	STATES PRESENTLY SERVED	CPU	CONVERSATIONAL USER LANGUAGES	TERMINALS	NO. OF SIMULTANEOUS USERS	CHARGES MIN	CHARGES TCT	CHARGES CPU	CHARGES STORAGE	SPECIAL NOTES
Intranet Industries, Inc. Los Angeles, California	Cal.	Univac 1108-II	I-BASIC, FORTRAN	TTYs	----	$100.00/mo.	$10.00-16.00/hr.	$10.00/min.	On request	
ITS/Information Network Inc. North Hollywood, California	**Mountain,** Cal.	DEC PDP-10	AID, XBASIC, FORTRAN IV, MACRO-10	TTYs, etc.	63	None	$6.00/hr. (prime)	On request	On request	Company offers range of utility programs, batch services, and special discounts.
I.T.T. Data Services Paramus, N.J.	**Mid. Atl.,** Cal., Colo., D.C., Ill., Mass., Mo., Tex.	IBM S/360-50, 65	BASIC, COBOL, FORTRAN	IBM 1050, 2741; TTYs, etc.	31/sys.	$150.00/mo.	$12.00/hr.	$7.00/min. (Mod 50); $20.00/min. (Mod 65)	$9.00/30K chars./mo.	Division of Int. Tel. and Tel. Corp.
Keydata Corp. Watertown, Massachusetts	**Mid. Atl., N. Engl.,** Del., Ill., Mich.	Univac 494 (2)	None. All programming is performed by Keydata.	TTYs	200+	On request	----	----	----	Company provides on-line transaction and off-line summary reporting services.
Leasco Systems and Research Bethesda, Maryland	**Atl., N. Central,** Mass.	Hewlett-Packard HP-2000A (mult. sys.)	XBASIC	TTYs	16/sys.	On request	----	----	----	
McDonnell Automation Co. St. Louis, Missouri	Cal., Colo., Mo., N.J., Tex., Va.	CDC 6400; GE 420; IBM S/360-65, 67; XDS Sigma 7	BASIC, COBOL, FORTRAN IV	CRTs, plotters, TTYs, etc.	----	----	$10.00/hr.	On request	On request	Wide range of terminals, languages, programs, services.
Marketing Operations Inc. Boston, Massachusetts	**Mid. Atl., N. Engl.**	GE 265	ALGOL, BASIC, FORTRAN II	CTS Execuport 300, Friden, TTYs	76	None	$4.50-9.00/hr.	$0.02-0.03/sec.	$1.00/1K chars./mo.	Exclusive marketing reps. for Call-A-Computer, Inc. Company also supplies special terminals, systems support, and consulting services.
Matrix Corp. El Segundo, Cal.	Cal., Mass.	GE 635; IBM S/360-65	ALGOL, BASIC, COBOL, FORTRAN IV, JOVIAL, SNOBOL	TTYs	10	----	$10.00/hr.	$18.00/min.	$0.25/1K chars./mo.	
MetriData Computing, Inc. Louisville, Kentucky	Ind., Ohio, Ky.	GE 420	BASIC, FORTRAN	Friden 7100, 7102; TTYs	30	$100.00/mo.	$10.00/hr.	$0.05/sec.	$1.75/1K chars./mo.	
Multicomp Inc. Wellesley Hills, Massachusetts	Cal., Mass., N.Y.	CDC 3600 (2); DEC PDP-8 (2)	BASIC, COGO, FORTRAN IV	IBM 2741, TTYs	100	None	$8.00/hr.	$0.20/sec.	$2.00/2K chars./mo.	
On-Line Systems, Inc. Pittsburgh, Pennsylvania	D.C., Ill., N.Y., Pa.	DEC PDP 10/8	BASIC, FORTRAN IV, LISP	CRTs, Datel, Dura, GE, IBM 2741, plotters, TTYs, etc.	64	$100.00/mo.	$10.00/hr.	On request	$1.00/3200 chars./mo.	
Philco-Ford Philadelphia, Pa.	**Mid. Atl.,** Mich.	Burroughs B5500	ALGOL, BASIC, COBOL, FORTRAN IV	TTYs	40	$25.00/mo.	$9.00/hr. (prime); $7.00/hr. (non-prime)	$0.12/sec. (prime); $0.08/sec. (non-prime)	$1.00/1K chars./mo. >75K	Special remote batch rates.
Prime Information Inc. Princeton, New Jersey	**Mid. Atl.**	AL/COM Dual AL-10 (pairs of DEC PDP-10s)	Special application languages							
Princeton Time Sharing Services, Princeton, N.J.	**Atl.,** Conn.	IBM S/360-65	BASIC, CPL/1, FORTRAN	CRTs, Datel, Dura, Friden, IBM 2741, TTYs, etc.	----	None	$7.00/hr.	$0.25/sec.	$10.00/100K chars./mo. >1M chars.	Company offers high- and low-speed remote job entry into OS/360 with variety of prog. languages.
Programs and Analysis, Inc. Waltham, Massachusetts	Mass.	GE 430	BASIC, FORTRAN	TTYs	30	$100.00/mo.	$10.00/hr. (prime); $5.00/hr. (non-prime)	$0.06/sec. (prime); $0.03/sec. (non-prime)	$0.85/1K chars./mo.	Company is 80% oriented to business applications.
Pryor Computer Time-Sharing Chicago, Illinois	Ill.	GE 430	BASIC, FORTRAN IV	Friden 7100, TTYs	----	----	$8.00/hr.	$0.05/sec.	$0.10/180 char./mo. >9K chars.	Affil. of Pryor Computer Industries of Northbrook, Ill.
Rapidata New York City	**Mid. Atl.,** Mass.	GE 435	X BASIC, FORTRAN IV	Datel, Dura, Friden, IBM 2741, plotters, TTYs	40	$100.00/mo.	Based on volume	$3.00/min.	On request	
Realtime Systems Inc. New York City	**Mid. Atl.,** Conn., Mass.	Burroughs B5500 (2)	ALGOL, BASIC, COBOL, FORTRAN	CRTs, card-readers, IBM, TTYs, etc.	60	On request	$7.50/hr. (avg.)	$0.14/sec.	On request	Company has special financial language; remote batch capabilities; terminal processors.
Remote Computing Corp. Los Angeles, California	Cal.	Burroughs B5280	ALGOL, BASIC, COBOL, FORTRAN IV	CRTs, Datel, Dura, IBM 2741, plotters, TTYs, etc.	36	None	$5.00/hr. (low-speed)	$0.10/sec.	On request	
Scientific Time Sharing Corp. Washington, D.C.	**Atl.** N. Engl.	IBM S/360-50 (2)	APL PLUS	Datel; Dura; IBM 1050, 2740, 2741; TST 707	60	None	$12.00/hr.	$0.10/sec.	$10.00/32K chars./mo.	

*Applied Logic Corp. associate; q.v. for additional information re rates, terminals, etc.

TABLE 1 • COMMERCIAL TIME-SHARING SERVICES cont'd

CORPORATE NAME AND ADDRESS	STATES PRESENTLY SERVED	CPU	CONVERSATIONAL USER LANGUAGES	TERMINALS	NO. OF SIMULTANEOUS USERS	CHARGES MIN	CHARGES TCT	CHARGES CPU	CHARGES STORAGE	SPECIAL NOTES
Service Bureau Corp. (IBM) New York City	**Atl., E. No. Central, Pacific,** Colo., Conn., Mass., Minn., Mo., R.I., Tex.	IBM S/360-50	BASIC, FORTRAN, PL/1	IBM 2741, TTYs, etc.		$100.00/mo.	$11.00/hr.	$9.00/min.	$1.50/3400 chars./mo.	
Shared Computer Systems Corp. Chicago, Illinois	Idaho, Ill., Ind., Mich.	Burroughs B5500	ALGOL, BASIC, CANDE, COBOL, FORTRAN IV	CRTs, TTYs, etc.	32	None	$11.00/hr. (prime); $5.50/hr. (non-prime)	$0.18/sec. (prime); $0.12/sec. (non-prime)	$0.70/1K chars./mo.	Wide range of portable and R-D terminals. CPU and storage charges vary with usage.
System Development Corp. Santa Monica, California	Cal., D.C., Tex., Va.	IBM S/360-65, 67	COBOL, FORTRAN IV, WATFOR	CRTs, IBM 2741, TTYs	40/sys.	$100.00/mo.	$9.00/hr.	$12.00/min.	On request	Interactive MIS. Additional special and T-S languages.
Technical Advisors, Inc. Wayne, Michigan	**"Continental U.S."**	Varian 620A, 620I	TECH-MAC	TTYs	9	None	On request	None	$0.50/page/day	TECH-MAC is a proprietary, problem-oriented language for surveying and mensuration.
Tel-A-Data, Inc. N. Miami Beach, Florida	Fla.	Burroughs 300	Burroughs Basic Assembler	Burroughs TC 500, TTYs	8	*$1,000.00	None	None	None	
Telecomputations, Inc. Silver Spring, Maryland	**Atlantic,**	Honeywell H-416, H-516 (2)	BASIC, COBOL, EDIT, FORTRAN IV	All std. 10 cps ASCII	48	$25.00/mo.	$4.50/hr.	None	On request	Basic service is inventory control. Additional special languages available.
TIM, Inc. (Technology for Information Mgmt.), Albany, New York	Ill., N.Y., Ohio, Wisc.	GE 420	BASIC, XBASIC, FORTRAN IV	Friden 7100, TTYs	40	----	$11.00/hr.	None	$0.10/180 chars./mo.	
Time Share Corp. Hanover, New Hampshire	**N. Engl.,** N.J., N.Y.	Hewlett-Packard HP-2000A	XBASIC	TTYs	16	----	$6.00/hr.	None	$1.00/1K chars./mo.	Company charges $600/mo. for unlimited, dedicated-line service.
Time-Sharing Systems, Inc. Milwaukee, Wisconsin	Ill., Wisc.	Burroughs B5500	ALGOL, BASIC, COBOL, FORTRAN IV	TTYs	32	On request	----	----	----	
Transdata Phoenix, Arizona	Ariz., Nev.	XDS Sigma 5	----	Cardreaders, TTYs	24	None	$8.50/hr.	$0.20/sec.	$1.60/2K chars./mo.	
Transnet Corp. Red Bank, N.J.	N.J.	DEC PDP-8	BASIC, FORTRAN	Cardreaders, CRTs, Datel, Dura, GE, TTYs	16	On request	----	----	----	Additional special languages available.
Tymshare, Inc. Palo Alto California	**"Continental U.S."**	XDS 940	XBASIC, CAL, EDITOR, FORTRAN IV, SNOBOL IV	CRTs, card-readers, IBM 2741, plotters, TTYs, etc.	42	$80.00/mo.	$16.00/hr.	$0.04/sec.	On request	Additional special languages and packages for T-S and remote batch. Service now includes TYMNET international teleprocessing network.
United Computing Systems, Inc. Kansas City, Missouri	**6 Central** states, Cal., Colo., Ga., Pa.	CDC 6400; GE 265, 420	ALGOL, BASIC, COBOL, COGO, FORTRAN IV	CRTs, CDC, IBM, TTYs, etc.	At least 70	On request	----	----	----	Additional special languages available; variety of R-B and T-S services.
University Computing Co. Dallas, Texas.	**11 Central** states, **Mid. Atl.,** Cal., Fla., Mass.	UNIVAC 1108; DEC PDP-8, 9	ALGOL, APT, BASIC, CASH, COBOL, FASBAC, FORTRAN V	CRTs, Datel, IBM 2741, TTYs, etc.	----	None	$7.50/hr. (basic)	$0.33/sec. (U-1108 execution)	$0.25/1K chars./mo. (scheduled); $0.50/1K chars./mo. (demand)	Additional special languages and packages for T-S and remote batch. Advanced communications facilities under development. Flexible rate schedule.
U.S. Time-Sharing, Inc. Reston, Virginia	**Atl., N. Engl., Pacific,** Colo., Ill., Mo., Ohio, Okla., Tex.	IBM S/360-50, 65	ALGOL, BASIC, FORTRAN IV, PL/1	CRTs, IBM 2741, plotters, TTYs, etc.	60	None	$10.00/hr.	$10.00/min. (Mod. 65)	On request	Additional special languages and packages for T-S and remote batch. R-B terminal processors. "SHARE OS/360" provides conversational R-B access.
VIP Systems Washington, D.C.	"Continental U.S."	IBM S/360-50	COBOL, FORTRAN, PL/1, VIPcom	----	200+	$100/mo.	$3.50/hr.	None	On request	VIPcom provides on-line text editing, formatting, etc. Extensive remote batch capabilities.
Virtual Time Sharing, Inc. Union, New Jersey	**Mid. Atl.,** Ind.	IBM S/360-67	FORTRAN, PL/1, SNOBOL	Datel, IBM 2741, TTYs	----	On request	----	----	----	Additional special languages available.
Westinghouse Information Systems Laboratory Pittsburgh, Pennsylvania	"Eastern U.S."	RCA 70/46 (2)	BASIC, CAMPOINT, CAMPTURN, COBOL, FORTRAN IV, WITS	CRTs, Friden, IBM 2741, TTYs, etc.	48/sys.	On request	----	----	----	
World Wide Time Sharing Inc. Chicago, Illinois	Ill., Ind. Minn., Wisc.	Burroughs B300, CDC 3150	COBOL, FORTRAN	Friden 7100, Burroughs TC 500, TTYs	256	On request	----	----	----	

*Company has a fixed monthly charge based on customer requirements.

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INFORMATICS' ICS-500 "TOTAL" SYSTEM

New communications switching system is a model "turnkey" operation — in which Informatics assumes total responsibility for overall design, hardware, software, and maintenance.

Informatics Inc. of Sherman Oaks, Cal., one of the largest independent software suppliers, now offers through its Communications System Division headquartered in River Edge, N. J., complete communications switching systems on a turnkey basis: furnishing equipment, software, and support services, while taking full responsibility for total system performance on a fixed-price basis. Since most customers intend to operate and maintain their own system, Informatics' fixed-price responsibilities usually end at cutover. If the customer requires, however, Informatics will accept responsibility for continued system operation and maintenance.

THE ICS-500

The ICS-500 Communications Switching System (which uses SDS Sigma-5 equipment), currently being installed at the Federal Reserve Bank of N. Y. and at Dun & Bradstreet Inc., is the first of many such total systems packages Informatics expects to offer. Its scope, of course, depends on specific customer requirements, but generally includes the following products and services: computer equipment for the switching center; all software necessary for switching center operation and maintenance; all engineering, programming, and management services necessary to plan, specify, and implement the system; and complete documentation and training services.

As an integrated communications switching system, the ICS-500 operates as a store-and-forward message processing system and can be used both in a free-standing mode and as the front-end for a data processing system. It interfaces all types of terminal equipment and computers, translates codes and formats when necessary, and permits free exchange of data and control information between all connected elements. It also monitors the operation of circuits, terminals, and connected computers — as well as its own internal elements — and institutes corrective action either automatically or under operator control when necessary.

SYSTEM ORGANIZATION

Although single processor systems can be provided where the user can accept occasional outages, the basic ICS-500 is a dual processor system which uses a configuration of peripheral equipment determined by individual customer requirements. Since a single processor normally can handle the traffic load, the backup system is required only to monitor the on-line system and invoke switchover procedures when necessary. In this posture, the backup machine secures all in-bound data, checkpoints the on-line machine, and accomplishes switchovers without loss of in-bound data or discontinuity of service.

As the monitoring responsibility takes only a small portion of the time and memory of the backup system, the ICS-500 system provides facilities which allow the user to perform data processing in the backup system concurrently with the monitoring function. The user has the option of performing either batch processing, time-sharing, or a combination of both in the backup machine using SDS standard monitors (BPM or BTM), language processors, and utility programs. Use of the backup machine as described above is in addition to its normal role as a monitor and does not interfere with the checkpointing and recovery processes.

For applications with very large traffic loads or special requirements, the dual system may use both processors on-line, sharing the load, with graceful degradation in the event one processor fails.

EQUIPMENT FURNISHED

The ICS-500 system uses equipment from the SDS Sigma-5 computer product line. This includes the modular, multi-CPU and I/O processors (up to 131K 32-bit words; cycle speed of 850 nanoseconds) with up to 192 2.4 megabyte bandwidth I/O channels; and a determined number of fixed- and moving-head disks. (In normal operation, critical files are written on at least two physically separate storage devices.) Peripherals, such as displays, tape drives, and unit record equipment, are similarly determined by system requirements. The communications interface (see Fig. 1) incorporates a separate stored-logic processor and can accommodate up to 128 9600 bps mixed lines.

SOFTWARE

Each installation is furnished with a complete set of programs to support its operation. Two types of programs are furnished:

Type 1 programs are standard product-oriented programs normally used in all installations. They are developed and maintained by Informatics on a product-line basis, and consist of the Executive program, recov-

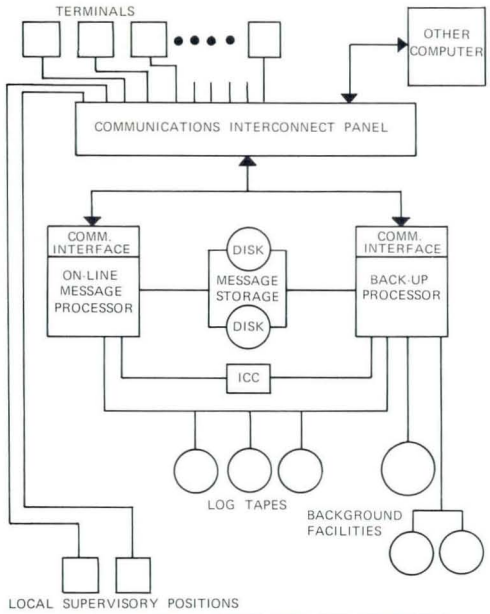

FIG. 1. THE BASIC ICS-500 SYSTEM

ery and switchover system, data management facilities, terminal handlers, communications service programs, and system maintenance facilities.

Type 2 programs are developed and maintained individually under contract, and provide the additional facilities which, together with the facilities furnished in the Type 1 programs, complete the requirements for each installation.

To appreciate the significance of Informatics' position with regard to software, it is necessary to contrast Informatics' packaged approach with the approach most commonly used today, where the customer purchases the computer equipment directly from the manufacturer and either develops the necessary software as a custom project or attempts to use manufacturer-furnished software. In either of these cases, there is a fundamental division of responsibility between customer, equipment manufacturer, and outside consultants which inevitably leads to delays, cost escalation, and a system that, in the final analysis, may not live up to expectations.

SUMMARY

This "total responsibility" approach to both software and overall design may well be the answer to the hiatus many prospective systems users now envision as the result of being weaned from IBM maternalism. But without speculating on the coincidence in timing between the development of Informatics' new ICS-500 design philosophy and the "unbundling" announcement, the system is impressive and the philosophy welcome.

The Shepard 880C, telecommunications printer is an 80 column, high speed, impact printer that can be tied directly to a telephone line for time sharing or remote data communications applications. ☐ The 880C has already been interfaced with the WE 201A, 201B, 202C and equivalent modems in both dial-up and lease-line applications (BAUD rates up to 2400 bits per sec.) ☐ This printer is also available with a standard computer type interface. ☐ We can't promise you the moon, but will 30 day delivery do?☐131st Street & Jamaica Avenue,Richmond Hill, New York 11418 Phone 212-641-8800

VOGUE Shepard Division

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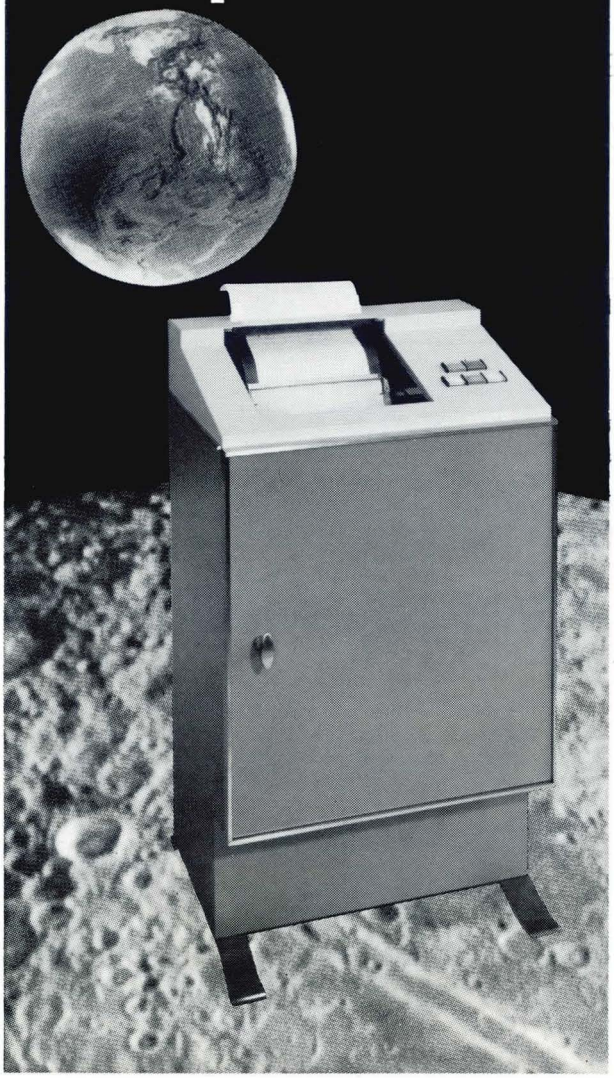


CIRCLE NO. 46 ON INQUIRY CARD

NEW PRODUCTS

DURA REVERSE INDEX FEATURE

Dura has developed an optional reverse index feature for their computer terminals and 1041 automatic electronic typewriters. With it, the typist is able to obtain precise page alignment for subscripts and superscripts by indexing, up or down, a page in one half-line increments. Pressing the reverse index key causes the platen to move a half-space in the direction opposite to normal platen movement for typing superscripts. To type subscripts, the reverse index is then followed by normal single-space indexing. Each index function has a code which, when read in the reader, adjusts the platen for automatic typing of equations or formulas. Similarly, the Dura terminals (Models 1021 and 1051) can transmit or receive and print-out technical information from other terminals or the computer itself. *Dura Div. of Intercontinental Systems Inc., Palo Alto, Cal.*

Circle No. 196 on Inquiry Card.

INTERACTIVE MULTI-MEDIA TERMINAL

The INTERACTgraphic I is a comprehensive and flexible graphics terminal for the interactive manipulation of three primary graphics capabilities: hard-copy plotting, digitizing, and rapid CRT alphanumeric/vector communication. The telephone-coupled INTERACTgraphic I provides a 34" x 44" interactive area for a wide range of research, design, engineering, and production applications. Software permits users to create specific graphic drawings, name them, store them in the data base, and later build with them or modify them to construct improved or higher-level graphic drawings. The system sells for $39,900 and is said to operate at a cost under $25 per terminal hour including the cost of a time-shared computer, or under $11 per terminal hour including the cost of a small satellite computer. *Computervision Corp., Burlington, Mass.*

Circle No. 201 on Inquiry Card.

TRAINING PROGRAM

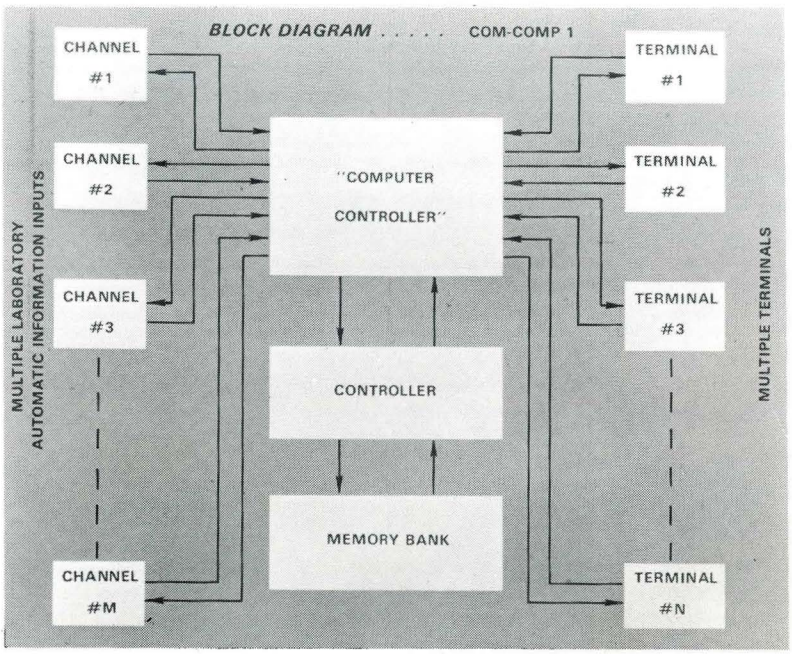
The "Eduputer", a portable training device designed to teach the basic functions of computers in vocational courses and industrial computer installations, simulates the operations of a computer control panel. While in no way a computing device, the Eduputer resembles the IBM System/360 Model 30's control panel, with similar markings, dials, switches, and other features. The simulator is accompanied by a set of self-instructing material that includes a cassette recorder, 16 taped lectures, a course outline, and student and instructor guides. *Programming Sciences Corp., New York, N. Y.*

Circle No. 213 on Inquiry Card.

COPYHOLDER

Completely electric, the Electroline copyholder holds the reading material directly in front of an operator's eyes. The unit is fully-adjustable, and provides its own indirect lighting source. A hand and/or foot control advances the reading material through the platen with positive spacing. The spacing mechanism affords instant indexing to any space desired. *Pres-To-Line Corp. of America, New York, N. Y.*

Circle No. 233 on Inquiry Card.



MEDICAL T-S SYSTEM

The Com-Comp I, a special-purpose conversational time-sharing system for hospitals and clinical pathology laboratories, utilizes a pre-programmed minicomputer with customized ROM and expandable high-speed main memory. The system is designed to accept data from both on-line laboratory analyzers and up to 8 operator terminals. Files include accounting as well as clinical data, and patient records may be accessed or updated by non-specialized personnel. By periodically extracting inactive records for archival storage, the Com-Comp system can maintain a unified data-base for several hundred patients. *Com-Comp, Inc., Hauppage, N. Y.*

Circle No. 204 on Inquiry Card.

ACOUSTIC COUPLER

A compact acoustic coupler features broad compatibility with data-terminal equipment and easy portability. The coupler weighs four pounds, is less than 13″ long, and has an integral hand-hold for convenient carrying. It has no protruding handles, levers, or knobs. A molded elastomeric seal grips telephone handsets firmly to confine transmission whine within the coupler. The acrylic/PVC case is engineered to eliminate mechanical and acoustic resonances, and the solid-state circuitry has high immunity to both acoustic and electrical noise. The coupler's maximum data rate is 300 baud. Transmit/receive modes are half- or full-duplex, switch selectable. Interface cables are available for Teletype 20ma equipment and all RS-232-B equipment. Price of the coupler is $395, with quantity discounts available. *Info-Max, Palo Alto, Cal.*

Circle No. 189 on Inquiry Card.

DATA ACQUISITION SYSTEM

CO7100 Series Data Acquisition Systems are intended for use by industrial and scientific users in the automated collection, recording, and analysis of analog signals. The CO7100 basic system includes a stored program controller with 4096 words of memory, an eight-channel analog multiplexer, a 12-bit analog-to-digital converter, a seven-track magnetic tape recorder, and an ASR33 TTY. The CO7100 is priced at $17,500 including software. *Computer Operations, Incorporated, Beltsville, Md.*

Circle No. 175 on Inquiry Card.

KEY-TO-TAPE

Described as the first multiple-station data entry system to provide complete validation of data at the keyboard entry source, the KeyLogic system detects, identifies, and allows errors to be corrected at the keyboard as data flows through the CPU to disk storage. From the disk, validated data is read back onto a master tape which can be processed on the main frame. The KeyLogic system will handle up to 64 complete 029 keyboard operator terminals. Hardware components include the terminals; a CPU with 860 nanosecond cycle time (16-bit word); a 2 million character fixed-head read/write disk; a synchronous drive tape unit; and a supervisor's console which uses an IBM Selectric. *Penta Computer Assoc., Inc., N.Y., N.Y.*

Circle No. 195 on Inquiry Card.

LOW-COST PRINTER TERMINAL

The DCT-500 free-standing, ASCII-compatible data communication terminal consists of a new 132-column printer mechanism, a control unit, and an optional keyboard. It operates in half-duplex or echo-back (two- or four-wire) modes at optional speeds of 10, 15, or 30 cps, and may be converted to an automatic send/receive device with an optional 30 CPS paper-tape reader/punch subsystem. The DCT-500 will be available with keyboard at less than $100 per month including maintenance, or about $3,400 for outright purchase. A built-in 300-baud modem can be provided for an additional $10 per month. Initial deliveries are planned for the spring of 1970. *Sperry Rand, Univac Div., Phila., Pa.*

Circle No. 185 on Inquiry Card

NEW H-P MINI

Hewlett-Packard's new Model 2114B minicomputer, is priced at $8500, $1450 less than any previous H-P computer. The 2114B features a direct memory access option, which costs $1500 and provides a high-speed data channel that is assignable under program control to any of the computer's seven I/O channels. Multilevel priority interrupt is standard. An optional 56-channel multiplexed I/O system is available with or without the high-speed data channel. According to H-P, the new computer is designed for OEM, data-communication, instrumentation, and educational systems and has "one of the best price/performance ratios in the industry." The 2114B has a memory capacity of 4K 16-bit words expandable to 8K and a memory cycle of 2.0 msec. *Hewlett-Packard, Palo Alto, Cal.*

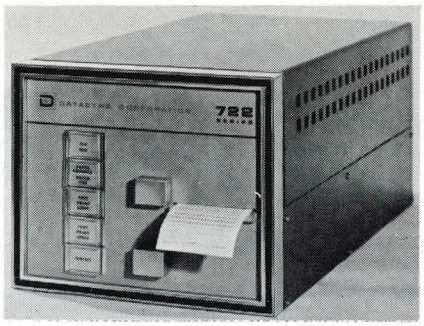
Circle No. 200 on Inquiry Card.

BUSINESS SYSTEM

The DPI-500 consists of a DEC mainframe with up to 8,000 words of core memory. It is designed for small business applications and is available with magnetic tape cartridges and IBM Selectric as an I/O device. The system offers up to 32,000 words of core memory, utilizes magnetic tape or disks, and configurations can include an optical mark punched card or document reader, CRT, and a high-speed printer. All software is provided, and the system requires only a clerk-typist to operate. It may be leased for about $800.00/mo. and up, depending on peripherals. *Data Processing International, Clifton, N.J.*

Circle No. 178 on Inquiry Card.

NEW PRODUCTS



ALPHANUMERIC COLUMN PRINTER

Datadyne Series 722 digital printers can be used either as straight decimal printers or as alphanumeric printers with a full complement of 64 ASCII characters. Printing rates are 60, 40, 30, 20, and 10 lines per second; column widths are up to 32 in increments of four columns. Both table and rack mounting models are available. *Datadyne Corp., King of Prussia, Pa.*

Circle No. 232 on Inquiry Card.

TIME-SHARING PLOTTER

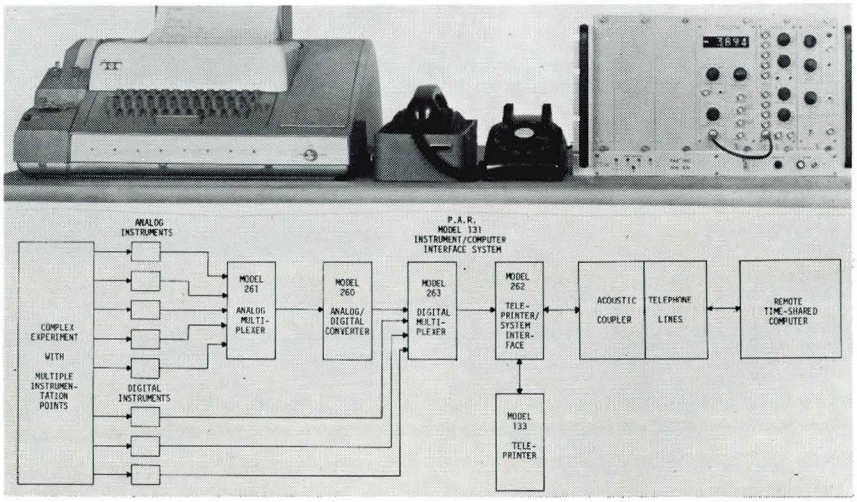
The TSP-212 plotting system combines, in one console, a plotter controller and a Honeywell X-Y recorder. The TSP-212 System directly connects to the IBM 2741, IBM 1050, Teletypes, and most other terminals. Interface through the data set or coupler is accomplished with a single-cable connector. All controls are conveniently positioned on an easy-to-read front panel, and plot size is continuously variable up to a maximum of 11″ x 17″. BASIC and FORTRAN sub-routines accepted by most time-share systems and major-make computers are supplied cost-free with the TSP-212. The routines are usable with many computers not having full ASCII code-set output capability. Software is written so that scaling and dimension factors are easy to use and operator-oriented; alphanumerics and symbols routines offer equal facility. *Time Share Peripherals Corp., Wilton, Conn.*

Circle No. 183 on Inquiry Card.

MULTIPLEXERS

Two new multiplexers, designated types TTC-2000 and TTC-3000, are designed for use with a wide variety of remote terminal units. The TTC-2000 "Mobilizer" multiplexes 2 to 38 channels and has individual channel indicators that show system traffic — a flip of the switch verifies the availability of channels. The TTC-3000 "Optimizer" is intended for computer time-sharing networks in which the load shifts from city to city at different times, such as with time zone changes. It permits full concentration from multiple cities for up to 38 channels on a single phone circuit. Both multiplexers transmit over a single 3 KHz Type 3002 voice-grade circuit. They can be easily expanded at any time by plugging in additional channel cards. Operation is fully automatic; all interfaces are standard EIA RS-232B, and a built-in error control eliminates terminal disconnects. *Tel-Tech Corp., Silver Spring, Md.*

Circle No. 187 on Inquiry Card.



INSTRUMENT/COMPUTER INTERFACE SYSTEM

A new system from Princeton Applied Research Corp., reduces real-time experimental data, then transfers the data to a remote time-shared computer. The researcher can then conduct immediate in-depth analyses of the data he collects by interacting with the computer via telephone. The data storage capacity of the large, general-purpose computer also allows the researcher to collect huge quantities of data for complex programs. Special-character detection circuits permit the experiment to be controlled by the remote computer. The P.A.R. Model 131 Instrument/Computer Interface System can accept experimental data from up to 90 analog and digital instruments such as signal averagers, lock-in amplifiers, signal correlators, polarographic instruments and other precision measuring instruments. These data are then processed by the appropriate instrument modules making up the Model 131. Output from analog experimental instruments is multiplexed by the Model 261 Analog Multiplexer, then converted to digital form by the Model 260 Analog/Digital Converter. Output from this module — as well as output data from digital experimental instruments — is fed to the Model 263 Digital Multiplexer, which converts the input to serial form for output to a teletypewriter, acoustic coupler, or data set for interconnection with the remote computer. The modular construction of the system permits the user to select only those modules which are necessary for his data reduction application. The modules are of RIM (Research Instrument Module) design and are compatible with the widely accepted NIM (Nuclear Instrument Module) series developed by the AEC. Price of the Model 131 is approximately $5200, depending on modules selected. *Princeton Applied Research Corp., Princeton, N.J.*

Circle No. 209 on Inquiry Card.

MAG TAPE DATA ENTRY SYSTEM

The Singer 4300 Magnetic Data Recording System enables any user of conventional magnetic tape drives to record data directly from a keyboard which is nearly identical to the traditional keypunch device. The system's basic unit, the 4301 Magnetic Data Recorder, is a self-contained, free-standing operator work station consisting of a keyboard, a display console, and a magnetic tape deck which produces, and also verifies, high-density computer-compatible magnetic tape for immediate computer entry. Several operators can enter records to the 4301 tape deck from other 4301s or the second unit in the 4300 family of modular machines — the 4302 Magnetic Data Keyboard, which is simply a 4301 without a tape deck. This system can accommodate up to eight work stations and the 4301s or 4302s can be intermixed in any combination. A third unit in the 4300 family is the 4303 Magnetic Data Central Pooler, which can be the basis of a larger pooling system. Up to 16 operators can key information from 4301s and/or 4302s to the 4303 central pooler. If an even larger configuration is needed, the 4304 Magnetic Data Central Pooler can accommodate up to 64 operators from 4301 or 4302 keyboards. Purchase price of the 4300 system units begins at $4,500. Shown in the photo are (l-r): the 4302 Magnetic Data Keyboard, the 4303 Magnetic Data Central Pooler (which includes a 4302 keyboard for programming and other entry and monitoring operations), and the 4301 Magnetic Data Recorder. *Friden Div. of the Singer Co., San Leandro, Cal.*

Circle No. 194 on Inquiry Card.

DISK TAPE MEMORY SYSTEM

The 1640 Disk Tape is a newly-patented mag tape system whose performance falls between that of tape and disk systems. A multi-tape device (2, 4, 6, or 8 reels), it is capable of storing up to 30 million 8-bit bytes with an access time of 30 seconds or less and a data transfer rate of over 16 thousand bytes per second. The bi-phase (frequency doubling) method of recording is used so that data densities of 1600 bits per inch are realized. Tape speed is 90 inches per second. Data is recorded in bit serial on four pairs of tracks, two pairs in each direction per tape. Up to 32 pairs of tracks are available for an 8-tape unit. Each track of the 1640 will store a theoretical maximum of 8,640,000 bits. Record search can be performed in both the forward and reverse direction. Simultaneous read and write operations are possible. Each tape operates independently and is completely interchangeable. *Electronic Engineering Co. of California, Santa Ana, Cal.*

Circle No. 181 on Inquiry Card.

VOICE RESPONSE UNIT

The Datatrol CI-114 Voice Response Unit provides Touch-Tone telephone input with voice response controlled by an IBM 1130 computing system. It is connected to the Storage Access Channel (SAC or SAC II) of the computer and controls Bell 403 Datasets and a built-in speech device. Options include control of a Bell 801 Automatic Calling Unit, a multiplexer, a real-time clock, and a local loud-speaker. The CI-114 allows the user to send data to, or request data from, the computer from the keyboard of his Touch-Tone telephone, and receive, in return, spoken messages assembled by the computer. Using the Automatic Calling Unit, the computer may dial the user and deliver messages or request data. 31, 63, 93, or 189 words, or combinations of words and phrases, are available for the speech device. The basic CI-114 with single-line capability sells for $8,200 including software. *Datatrol Inc., Hudson, Mass.*

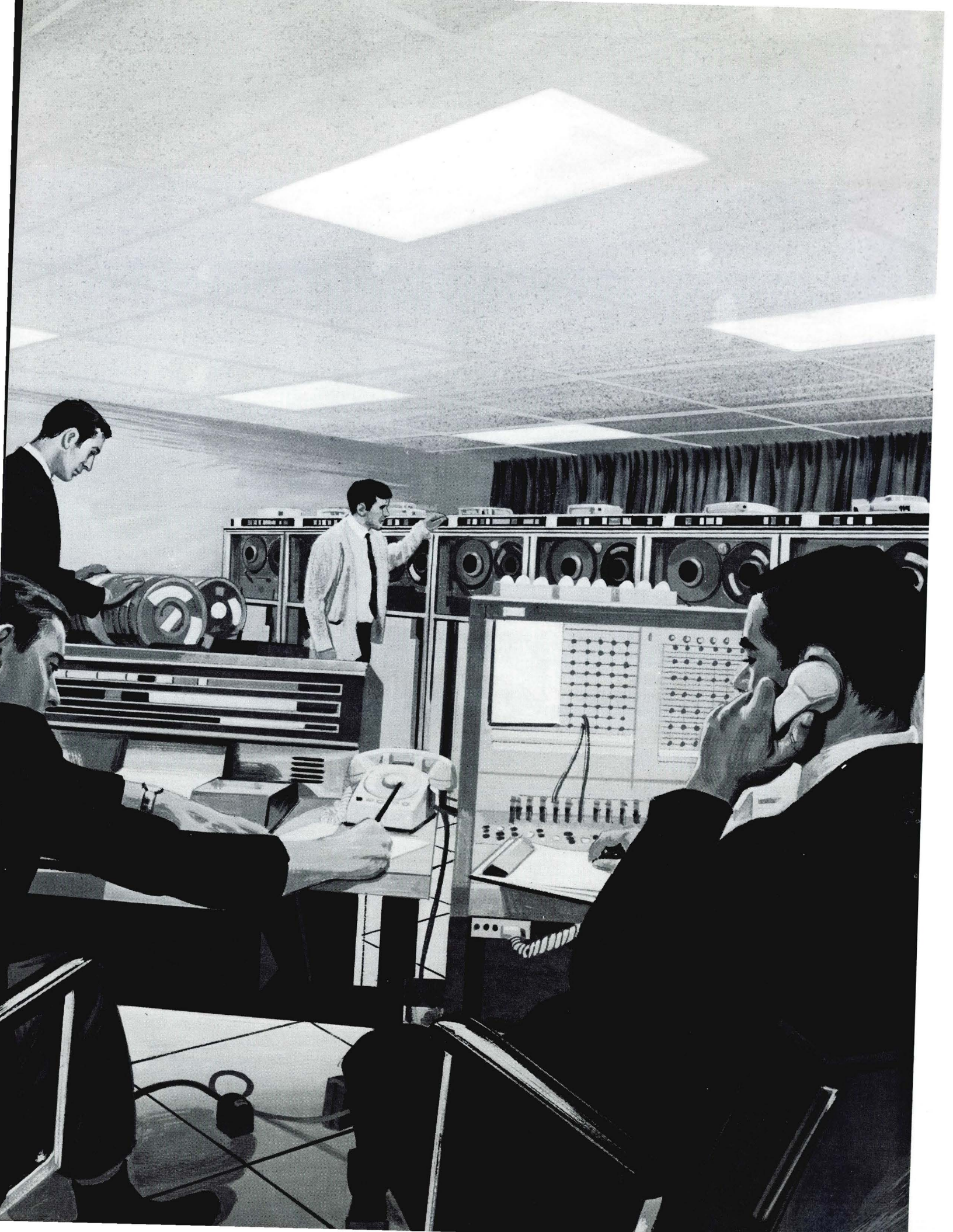
Circle No. 197 on Inquiry Card.

DATA SET

The Model L2202C data set enables voice-band, full-duplex transmission of data at speeds up to 1800 bits-per-second between customer-owned business machines and data processing equipment. A built-in six-button key telephone auxiliary set provides for alternate voice and data communication between tele-

phone stations in both the exchange and toll switched voice message (DDD) network and in private or leased lines. The unit is fully compatible with the W.E. "202C" and meets the requirements of EIA standard RS-232B. *Lynch Communication Systems, San Francisco, Cal.*

Circle No. 207 on Inquiry Card.



360, 1108, 6000 users...

Free your big system's resources...

go COPE!®

Don't overload your super computer with communications and peripheral tasks. Free it to do what it was designed to do, unhampered by time-and-memory-consuming chores that can be performed more economically and efficiently. How?

Go COPE! With COPE (from Communications Oriented Processing Equipment) systems, you can reduce the use of systems resources, core storage and data channels and still expand the number of readers, printers and remote terminals. The complete communications subsystem provides extensive software and hardware advantages. For example, one COPE Communication Controller can handle up to 30 peripherals and/or COPE remote terminals as well as multiple central processors.

The UCC COPE family of programmable remote terminals offers industry's best cost/benefit ratio. This family includes seven members, allowing you to select the reading/printing combination best suited to your requirements.

You can grow with COPE as your data communication requirements grow. The COPE family can be field upgraded from the low cost COPE .30 series to COPE .41 status (1250 LPM, 600 CPM). And the top of the COPE line, the .45 (1250 LPM, 1500 CPM), is software compatible with all other COPEs.

COPE terminals feature dial-up flexibility, allowing them to access most large-scale computers in the United States through the standard telephone network by simulating the IBM 2780 and Univac 1004 terminals. COPEs also operate in the full-duplex (concurrent reading and printing) mode over voice-grade telephone lines utilizing 4800 or 9600 bps modems.

Speed, compatibility, flexibility, adaptability — these four words best describe the COPE product line. Need further convincing? Then contact: Marketing Coordinator, Data Communication Systems Division, 2659 Nova Drive, Dallas, Texas 75229, (214) 241-3501.

Terminal Type	Communications Mode		Input/Output Device Speeds (Maximum)	
	Half Duplex	Full Duplex COPE	Reader C.P.M.	Printer L.P.M.
C.30	ATT 201A/B	No	200	240
C.32	No	Yes	200	360
C.34	Option	Yes	300	360
C.36	Option	Yes	300	480
C.38	Option	Yes	600	480
C.41	Option	Yes	600	1,250
C.45	No	Yes	1,500	1,250

UCC

UNIVERSITY COMPUTING COMPANY

DATA COMMUNICATION SYSTEMS DIVISION

2659 Nova Drive / Dallas, Texas 75229

CIRCLE NO. 47 ON INQUIRY CARD

NEW SOFTWARE AND SERVICES

ECONOMIC EVALUATION SYSTEM

CUES (Computer Utilization Economics System) provides the manager with necessary information to evaluate an investment proposal, including present value, internal rate of return, payout period, number of times investment returned, and other measures. The user provides cost estimates and income projections, and the system calculates depreciation, tax credits, federal corporate income tax, cash flows, etc. The time-sharing version of CUES contains a rerun option with conversational mode data modifications, allowing the manager to ask "What if?" questions and obtain immediate results. *Computer Utilization Inc., Austin, Texas.*

Circle No. 258 on Inquiry Card.

MEDICAL ACCOUNTING SYSTEM

The Medical Institutions Financial Accounting System (MIFACS) is applicable to hospitals, nursing homes, and other medical institutions, and is based on the IBM SHAS programs. MIFACS consists of 5 separate subsystems (Patient Billing, Accounts Receivable, Inventory, Payroll/Personnel, and Accounts Payable) written in RPG, Assembly Language, and COBOL. In a non-teleprocessing environment, the programs will run on a 48K or larger S/360. The teleprocessing version requires a 128K or larger system. Peripheral requirements vary depending on volumes and file sizes, however, minimum requirements would include two tape drives and three 2311 disk storage units. The entire system is priced at $50,000, less maintenance. Prices for each subsystem are also available. *Executive Computer Systems, Inc., Oakbrook, Ill.*

Circle No. 244 on Inquiry Card.

REMOTE BATCH BUSINESS PACKAGES

RBBP, a Fortran IV remote batch business package, is designed for use on most popular computers supporting Fortran IV. The package, which is offered in addition to the company's Time-Sharing Business Package, will perform the basic accounting functions of payroll, accounts payable, accounts receivable, inventory control, journal, general ledger, profit and loss, balance sheet, transaction-checking; and preparation of invoices, statements, and mailing labels. In addition, a variety of information handling routines are supplied. Price of the package ranges from $20,000 to $40,000, depending upon the computer and operating system, and includes installation, training, and complete systems and operators documentation. *Computing Corporation of America, Inc., Englewood, Colo.*

Circle No. 236 on Inquiry Card.

FINANCIAL T-S PACKAGE

The Financial Business Package (FBP) is a group of Fortran IV programs that have been written to operate on most time-sharing computers. By merely entering ledger disbursements, the FBP will generate: detailed general ledger, year-to-date profit/loss statements, current period profit/loss statements, balance sheets, disbursement vouchers, and a variety of charts. The package will operate with any appropriate terminal device supported by time-sharing utilities. 33ASRs with coupler or modem are adequate for many operations. Paper tape, magnetic tape, or cards may be used for disbursement inputs. *Computing Corporation of America, Inc., Englewood, Colo.*

Circle No. 237 on Inquiry Card.

COMMUNICATIONS SYSTEM

A generalized communication system of modular design, called Telecommunication Information Management Executive (TIME) will run on an S/360 Model 25 or larger, OS or DOS. It will handle any data bank using any type of IBM-supported terminal devices in any desired combination. Application modules can be written in COBOL or FORTRAN as well as assembler language. The system is offered at a cost of $10,000 to $18,500 depending on the terminal control modules required. Present operational terminal support includes IBM 2260 CRT, IBM 1050 Data Communications Terminal, and IBM 7770 Audio Response. The design of TIME is such that modules to support additional terminal types can be easily added. *Shaw Systems Associates, Houston, Texas*

Circle No. 249 on Inquiry Card.

INCOME TAX PROGRAM

INSTA-TAX, a computer program for calculating individual income tax for the 1969 tax year, performs all calculations required for the 1040 form and associated schedules. Utilizing time-sharing computers, INSTA-TAX allows tax services, CPA firms, and other specialists to prepare their returns in minutes within their own offices. The returns are prepared in finished format ready for filing. *Shared Applications, Inc., Ann Arbor, Mich.*

Circle No. 248 on Inquiry Card.

TERMINAL INPUT SOFTWARE

Custom-designed terminal software programs for name, address, and demographic information utilizing on-line terminal input, optical scanning, or keypunch include input/output, name, address, zip, selection factors, edit programs, and quality control under the IBM full operating system. Arrangements may be made to provide for installation, implementation, and training. *Dart Industries Inc., Market Compilation Bureau, No. Hollywood, Cal.*

Circle No. 242 on Inquiry Card.

FUND RAISING PACKAGE

GRIPS, a Gift Reporting and Information Processing System, is available to support fund-raising campaigns of colleges and universities, and to maintain alumni and prospect records. The system maintains a set of data files related to donors, accounts, and statistics for gift processing and selective mailing. In addition, it will produce acknowledgements and pledge reminders as well as management and analytical reports. *International Data Applications, Inc., Montgomeryville, Pa.*

Circle No. 240 on Inquiry Card.

UNIVAC SOFTWARE

Three programs recently developed for use with Univac computer systems consist of a linear programming system for Univac 9000 series computers; a mathematical programming system, designed for the Univac 494 system, and a functional mathematical programming system for the Univac 1108 and Univac 1106 large-scale computers. The packages are suitable for use in such areas as investment planning, production scheduling, dynamic capital budgeting, advertising media selection, job shop scheduling, fleet assignment, and fleet composition. *Univac Div. of Sperry Rand, Philadelphia, Pa.*

Circle No. 238 on Inquiry Card.

INTERACTIVE DATA MANAGEMENT

DS/1, an interactive data management system operates under DOS on S/360s beginning with the Model 30 (min. 32K core) and with either 2311 or 2314 disk storage. DS/1 accepts inquiry, updating, or error-correction commands typed in standard English phrases and responds similarly. The user can count how many entries in the file meet criteria he specifies at the terminal, print the entire contents of the qualifying entries, or print selected information in any order he desires. Basic monthly lease price is $350. *System Development Corp., Santa Monica, Cal.*

Circle No. 250 on Inquiry Card.

MEASUREMENT SERVICE SYSTEM

Measurement Service System (MSS) operates on any IBM S/360 using DOS. It allows users to account for the instruction execution time for each program running in each partition of memory. For each program run, MSS records the start, stop, wait, supervisor, and problem partition times. Also indicated are idle time by partition, abnormal termination codes, test or production run indications, and other relevant data. The system does not disrupt normal data processing operations, alter the logic, nor degrade the execution of the DOS supervisor to any significant extent. *Webster Computer Corp., Danbury, Conn.*

Circle No. 251 on Inquiry Card.

OCR SELECTION SERVICE

A highly-specialized new service — OCR Evaluation and Selection — is designed to aid in the selection of OCR equipment. The procedure entails: (1) an in-depth study and report of the client's requirements; (2) a request to manufacturers for a proposed system; (3) evaluation of each proposal based on price, application, etc.; (4) preparation of a report listing and comparing pertinent features; (5) determination of the most appropriate system for purchase. The company can also assist the client after the purchase, with programming, systems analysis, etc. *Recognition Technology Inc., Phila, Pa.*

Circle No. 253 on Inquiry Card.

INVESTMENT MANAGEMENT

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Our team of market experts with computer-based research will manage your individual account worth $5,000 to $10,000 for $200 a year. (And even lower percentages for larger accounts.) You own the stocks. But we do the research, make buy and sell decisions, aim for aggressive capital growth. And if you find we're not well worth the money, you can discontinue at any time.

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CIRCLE NO. 48 ON INQUIRY CARD

NEW LITERATURE

PDP-11 HANDBOOK

Digital Equipment Corp.'s new 16-bit PDP-11 computer is described in a 108-page handbook which provides a comprehensive overview of the system structure, the instruction repertoire, I/O programming, peripherals, general interfacing, software, and console operation. *Digital Equipment Corporation, Maynard, Mass.*

Circle No. 312 on Inquiry Card.

EDUCATIONAL SERVICES

Brochure describes courses for managers and computer systems professionals. Professional services include the guidance and training necessary for the development of successful integrated in-house educational capabilities. *Wiley Systems, Inc., Bethesda, Md.*

Circle No. 322 on Inquiry Card.

"SYNERGETIC" PROCESSOR

A 4-page brochure describes Redcor's RC 77 system, incorporating two processors, each with its own memory, so that real-time and batch jobs can be run simultaneously. *Redcor Corp., Canoga Park, Cal.*

Circle No. 319 on Inquiry Card.

COBOL TRAINING

Literature describes an educational program designed to evaluate and train COBOL programmers. The twofold program is designed to: (1) evaluate the COBOL proficiency level of a programmer/analyst, and (2) train the analyst in any weak areas that may exist. *CGA Computer Associates, Inc., E. Orange, N. J.*

Circle No. 306 on Inquiry Card.

THE OUTSTRIPPER

NEW DATALINE DESK TOP STRIP PRINTER REDUCES LINE TIME.

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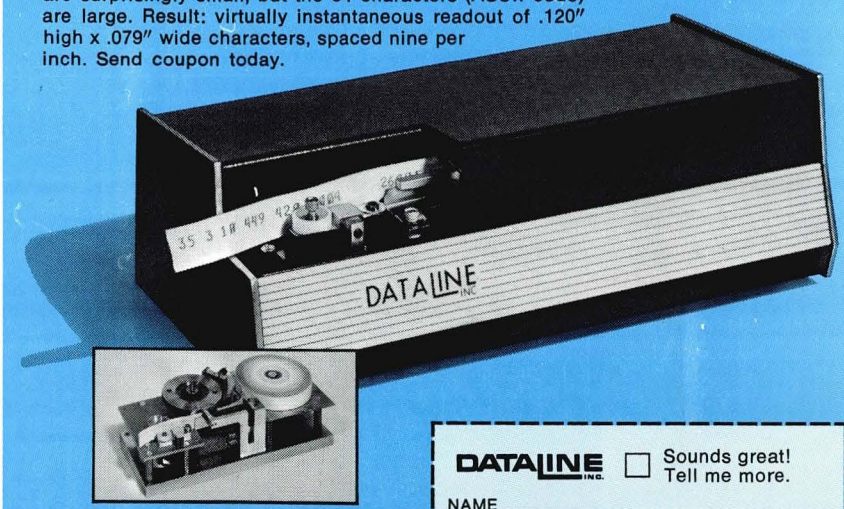

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ALPHANUMERIC READOUT

A 6-page illustrated technical brochure and supplementary product data sheet describe the key features of a new alphanumeric display, including its ability to present numerals, letters, foreign alphabets and characters, symbols, and other types of characters. These can be displayed in varying sizes or character styles, at viewing angles up to 160°. *Madatron Corp., Whippany, N. J.*

Circle No. 315 on Inquiry Card.

SIGNAL PROCESSING SYSTEM

The CompuSignal System-3 digital signal processing system (CSS-3) is described in an eight-page, 2-color brochure. Included are typical performance spectra, technical specifications, and areas of application. The CSS-3 is an off-the-shelf approach featuring analog input sampling to 50 kHz, digital conversion, a programmed 16-bit digital computer with 4K memory, two 10-bit D/A output channels, an X-Y display, a teletypewriter with tape reader and punch, a programmed sample-rate controller, a desk and control console, and complete software. *Computer Signal Processors, Burlington, Mass.*

Circle No. 307 on Inquiry Card.

CASSETTE TAPE UNITS

A 4-page brochure details in text, diagrams, and photos the operation and application of a new line of read/write serial, true incremental digital cassette tape recorder/reproducers. The publication also describes the various models in production for different signal sources. *Mobark Instruments Corporation, Sunnyvale, Cal.*

Circle No. 316 on Inquiry Card.

RECORD STORAGE GUIDE

"Guide To Better Record Storage Systems" simplifies the selection of record storage systems compatible with the needs of various organizations and departments. The 22-page guide covers equipment for the storage of letters, legal forms, checks, tab cards, deposit slips, ledger sheets, invoices, vouchers, sales slips, microfilm, and other "hard copy" records. Special equipment for filing tab cards and binding/filing EDP printouts is also included. *Bankers Box/record storage systems, Franklin Park, Ill.*

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CIRCLE NO. 50 ON INQUIRY CARD

NEW LITERATURE

CREDIT UNION SYSTEM

Three-color, ten-page brochure describes CUTLAS (Credit Union Techniques for Loans and Shares), a specially-designed system for the computerized control and analysis of credit union operations. The brochure illustrates 21 reports which provide the credit union with data to conform to governmental regulations and, more importantly, to achieve efficiencies and reduce operational expenses. *Comstec, Inc., Jenkintown, Pa.*

Circle No. 309 on Inquiry Card.

OCR FORMS

A 4-page brochure illustrates the various types of OCR forms manufactured by Acme Datagraphic Business Systems, Inc. Described are cut forms, continuous forms, and unit sets. *Acme Datagraphic Business Systems, Inc., So. Hackensack, N. J.*

Circle No. 300 on Inquiry Card.

PRODUCTION TYPING AIDS

Brochure describes the Moore Formaliner unit and the Moore Manual and Electrical Vertical Spacers. The Formaliner adapts to electric typewriters and computer console units for continuous forms writing and long run production. The Electrical Vertical Spacer provides automatic spacing of forms past vertical non-write areas to speed up forms typing operations. Programming for skips can be accomplished with unique bead chain elements which can be easily interchanged. *Moore Business Forms, Inc., Niagara Falls, N. Y.*

Circle No. 318 on Inquiry Card.

SCHEDULING AND PRODUCTION CONTROL

Four-page brochure introduces new computerized production control and scheduling services for job-shop manufacturing and assembly plants. The brochure lists the outstanding features of the system which include scheduling, location of parts in process, priority lists, delivery promise dates, and long and short term management information. In addition, it lists the types of reports generated and the various applications for which it was designed. *Creative Logic Corp., Paramus, N. J.*

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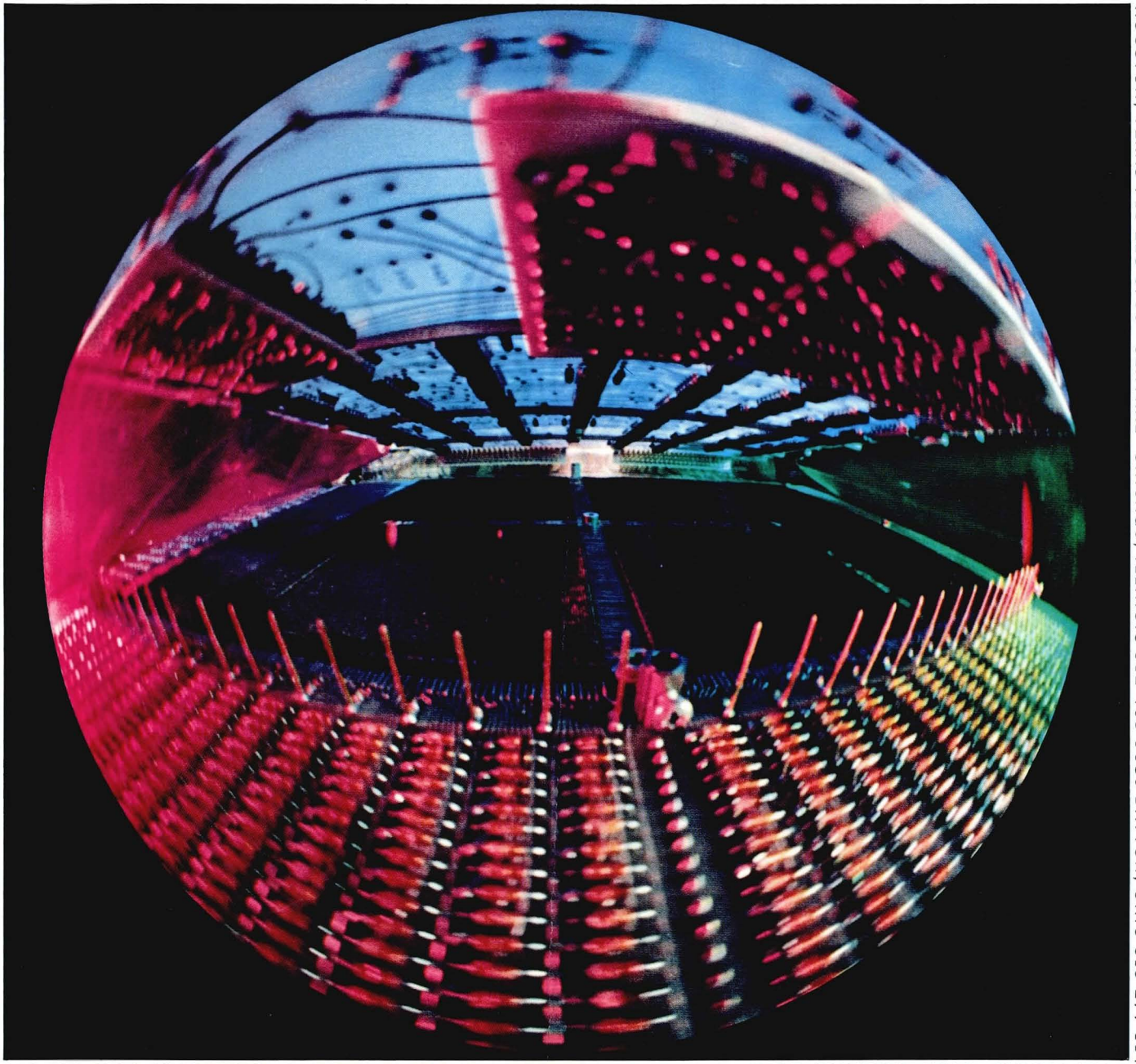

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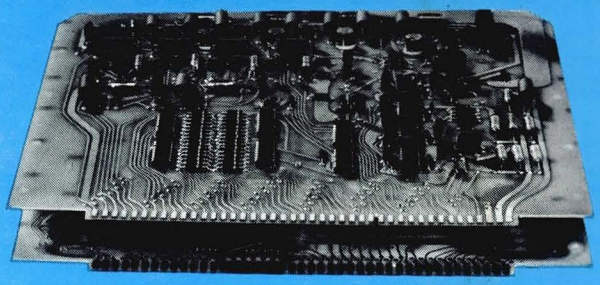

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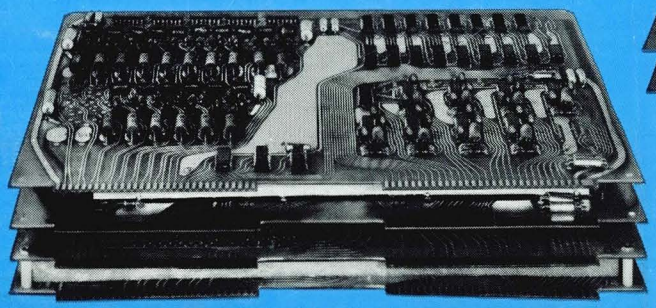

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