MODERN DATA

APRIL 1970

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MODERN DATA

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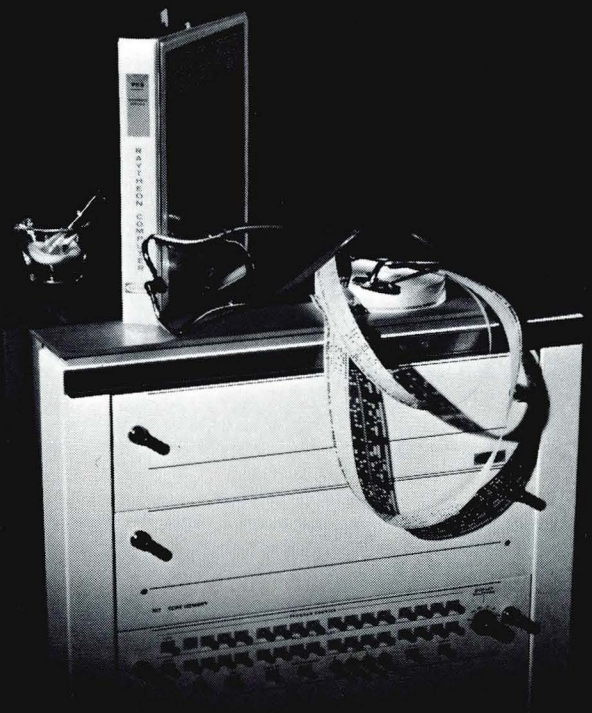
If you think you need a giant computer for multi-programming, you don't know about Raytheon Computer.



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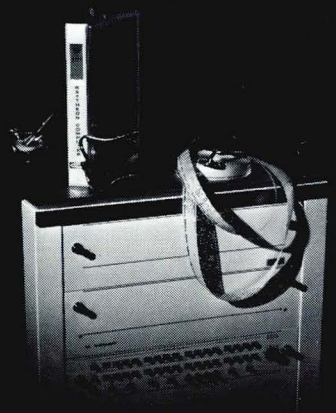

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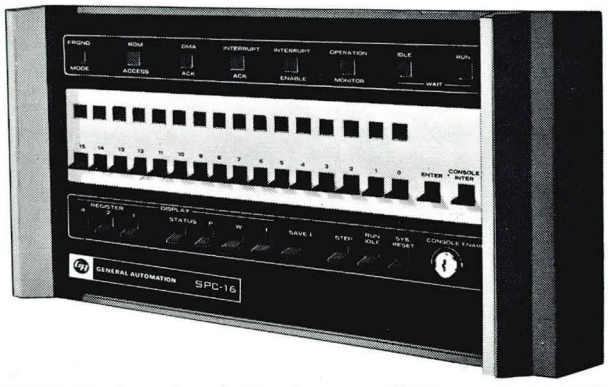

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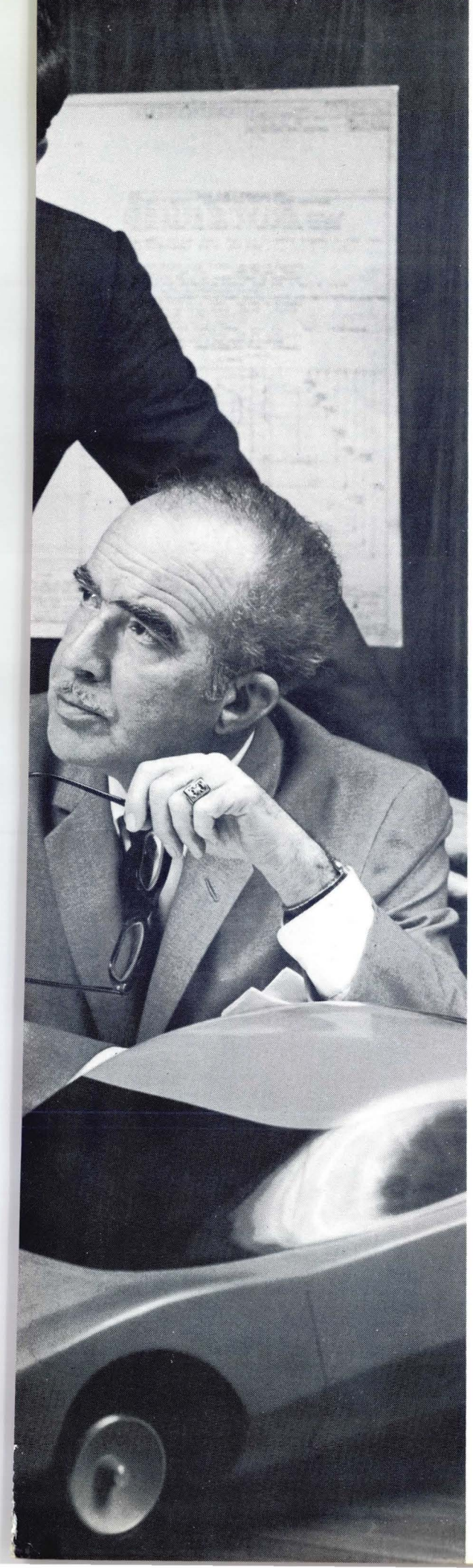

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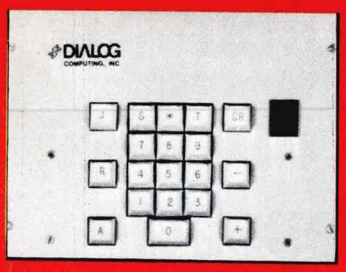

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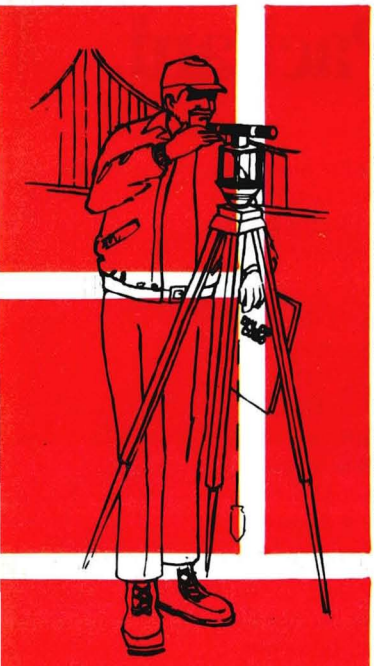

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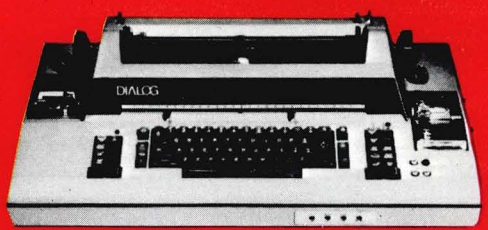

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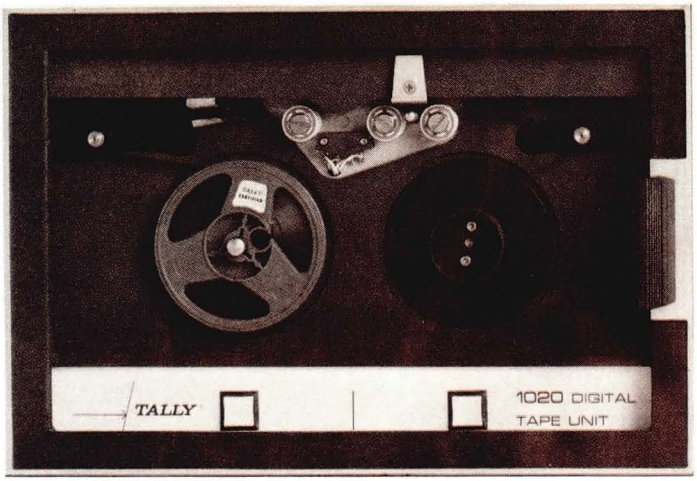

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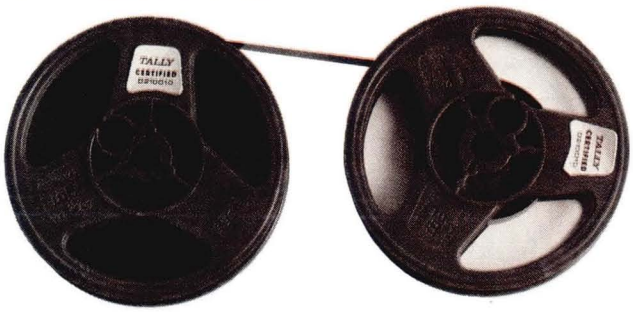

☐ Now, we come to the latest controversy in data handling, reel-to-reel versus cassette. Tally's prediction: both will share a part in an ever growing market. Parenthetically, our view is illustrated by the home entertainment field. Although cassettes are in the limelight, for full fidelity recording and reproduction, nothing beats reel-to-reel handling of music tapes. ☐ When we add up the key factors, we find both cassettes and reel-to-reel offer distinct advantages in a data handling environment. ☐ Reel recording offers greater storage capacity, faster continuous transfer rates to and from the CPU, and faster asynchronous transfer rates to and from the communications lines. Reel recording offers high speed incremental recording and a history of proven reliability. The cassette offers easy loading and ease of handling, and it doesn't require a precision drive. Cassettes require less physical room and are more manageable in a less than ideal environment. ☐ So our advice to you when you design a working storage device into your data system is to choose the method best suited to solve your application problem. ☐ For information on the Tally 1020, as well as other Tally products, please write us for our interface specifications at Tally Corporation, 8301 South 180th Street, Kent, Washington 98031. Phone (206) 251-5500.

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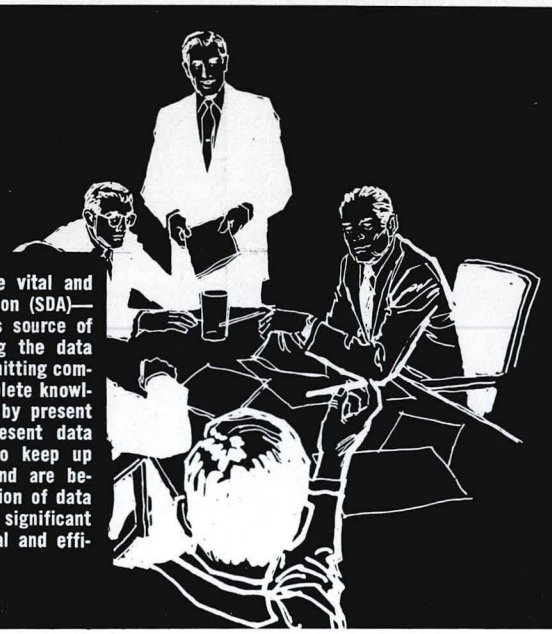
The basic concepts of SDA—how they can be applied to your EDP operations—this seminar is specifically directed to executives and managers who have to make decisions on the applicability of SDA to their EDP operations.

This seminar is directed towards the vital and timely topic of Source Data Automation (SDA)—a technique for capturing data at its source of origin and automatically transforming the data into a machine readable language permitting computer processing. The need for a complete knowledge of SDA is vital as exemplified by present data processing input problems. Present data preparation techniques are unable to keep up with the data processing progress and are becoming too costly. By proper automation of data destined for the computer system significant savings can be achieved in economical and efficient aspects.



SEMINAR OUTLINE

Introduction To Source Data Automation

Fundamental principles of the Source Data Automation design concept: definition of terms; basic purpose; design philosophy; interface with the EDP system; benefits; how it can fit into your system.

Source Data Automation State-of-the-Art

A discussion of the various types of SDA equipments available, their characteristics, manufacturers, their strong and weak application areas. Types of devices to be described will be:

- Optical Character Readers
- Mark Sense Readers
- Bar Code Readers
- Remote Scanners
- Magnetic Readers
- Keyboard-To-Tape Devices
- Portable Data Recorders
- Alphanumeric Display Terminals
- Touch-Tone Telephone

Economics Of Source Data Automation

A quantitative comparison of various Source Data Automation devices considering total system costs, volume of data, error rates, operating factors and various data preparation complexities. Specific breakeven points will be presented graphically.

Decision-Making Criteria In Source Data Automation

Description of factors that need to be considered in SDA device selection; a quantitative methodology for SDA selection given with specific examples.

Implementing And Operations On SDA System

Description of actual SDA application in which problems and solutions in operating an SDA system will be discussed.

Trend Analysis Of Source Data Automation

A discussion as to the SDA State-of-the-Art technology for the 1970's including technical breakthroughs, equipment marketing, and application areas.

SDA STATE-OF-THE-ART REPORT

Included with the seminar will be a newly-published Source Data Automation State-of-the-Art report describing present commercially-available SDA equipment and their characteristics. The text will cover the topics discussed at the seminar in full descriptive form and contain SDA equipment comparisons in terms of performance and cost. Included in the price is a one year updating of report so as to include newly-announced equipment. Updating frequency will be at least quarterly or sooner depending upon SDA equipment news.

INSTRUCTORS & SPEAKERS

Lawrence Feidelman, Director & Principal Instructor

The seminar will be under the personal direction of Mr. Lawrence Feidelman, who is a noted authority in the Source Data Automation field. He has performed Source Data Automation studies for the government as well as industry. He has written numerous articles and lectured on the Source Data Automation field. He is a frequent lecturer for the American Management Association, has lectured on SDA for American University and various professional societies. He is presently Assistant Vice President and Manager of the Cherry Hill office of FAIM Information Services, Inc. He received his B.A. degree from New York University and his M.S. degree in Computer Information Science from the University of Pennsylvania.

Bennett Landsman, Instructor

Mr. Landsman, a senior systems analyst with Faim, has recently completed a Source Data Automation study for the Department of Agriculture and an equipment Source Data Automation design analysis for a data processing company. He is a major contributor to the Faim SDA State-Of-The-Art report.

REGISTRATION

Registration for the seminar, including the SDA State-of-the-Art Report with a one year equipment updating, is $210. Checks should be made payable to Faim Information Services, Inc. and forwarded with the registration coupon below. Your registration will be acknowledged by return mail.

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Cherry Hill, New Jersey 08034

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☐ Boston	July 14 & 15	Hotel Sonesta

Hours: 9 A.M.-5 P.M.

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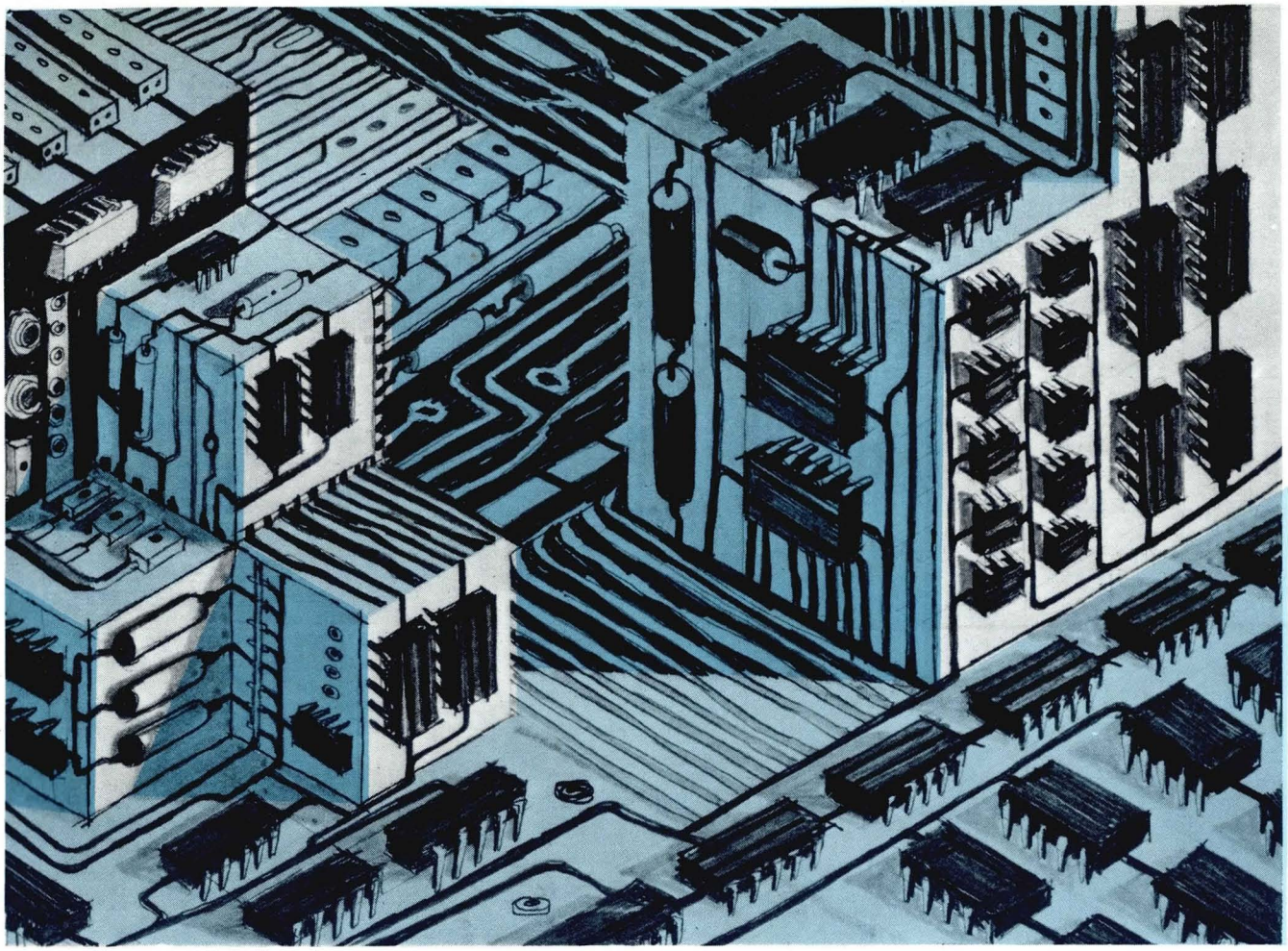
Important Note: There will be a late cancellation fee of $25.00 if cancellation notice is not received at least one week prior to start of seminar.



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This is true because the 714 Disk Drive is technologically new: (1) it utilizes an electromagnetic actuator to access the heads, instead of the conventional hydraulic actuators; (2) it uses precision servo-feedback electronics to position the heads, instead of the conventional mechanical detent and gear assemblies; (3) it uses Read/Write heads, manufactured at ISS, that go beyond the strict requirements of disk drives; (4) it has an absolute filtration system that keeps the drive and your data free of contaminants.

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For maximum flexibility, the 714 can also be used by itself, providing the ability to build it into a control system of the user's design.

And, where size is important, the combination of control unit and nine drives takes up less floor space than an IBM 2314.

We'd like to tell you even more: Write for additional literature, or arrange to see our full-color film on the equipment, or see it at the SJCC May 5-7, Booth #11008-10.

Marketed to IBM 360 end-users through the Telex Corp., 6422 E. 41st St., Tulsa, OK 74135.

CIRCLE NO. 15 ON INQUIRY CARD

LETTERS TO THE EDITORS

To the Editor:

I have just read Mr. Feidelman's article, in the March, 1970 issue of MODERN DATA, on SDA. The article is enlightening in that I have not previously read nor heard of SDA. I will be looking forward to your subsequent articles on this subject—especially those regarding the concepts of SDA and the equipment available in this area.

Richard R. Zotz
Software Analyst
City Public Service Board
San Antonio, Texas

To the Editor:

I agree wholeheartedly with Mr. Feidelman's article, in the March, 1970 issue of MODERN DATA, regarding SDA (Source Data Automation) and its impact on systems. Three words in that article, however, make me take pen in hand: "fourth-generation concept."

SDA is more like a first (possibly second)—generation concept that is finally coming of age. What with the new equipment being offered, the potential is tremendous. But ten years ago the U.S. Department of Agriculture conducted a seminar on ADP in which it said: "Source Data Automation (SDA) simply means applying the techniques of automation to the source areas—where information begins."

The impetus of new equipment will definitely provide the heavy impact he has indicated.

Russell A. Meier
Lexington, Mass.

To the Editor:

In the Jan. article, "The Systems Scene—Tuning For Performance," you estimate below 30% CPU efficiency for 360 installations when they are up. But your interesting question: *"How efficiently do systems run in general?"* was not answered for non-IBM machines. You say "Multiprogramming is like a new toy . . ." and "IBM has a new Job Stream Management Package that will replace the engineer deck stacker." Burroughs B5500s (medium-sized; general-purpose), have been operating with multiprocessing/multiprogramming as a normal mode since the early sixties.

All B5500 I/O operations and memory accesses are done through multiple paths under complete control of the Master Control Program (MCP), which efficiently handles more than 7 jobs in the mix simultaneously. Operators are kept busy loading cards to the pseudo-reader at card reader speed (for MCP handling), mounting tapes (for MCP reference by name), and printing files from the printer back-up disk.

The MCP handles scheduling, priorities, I/O control, and back-up (such as the printer back-up disk) automatically. As far as waiting for spare parts goes, B5500s are designed for graceful degradation—if a peripheral, a memory mod, an I/O channel, or even a processor goes down, it is a simple matter to tell the MCP what it is missing and it goes merrily along without that piece of hardware (a little less efficiently maybe, but not down). Partitions are not needed since the MCP dynamically overlays and rearranges core to be most efficient. More core is not needed so often since the MCP automatically utilizes virtual memory on disk. Maybe some of the 30 percenters should visit Detroit for some better ideas in throughput.

Warren Brown
(a happy B5500 user)
Livonia, Mich.

To the Editor:

Your article, "Computer-Controlled Data Acquisition Systems," in the January, 1970 issue was very informative. However, in order to add information on DEC's systems, I would like to mention "INDAC-8," an integrated hardware-software package designed for Industrial Data Acquisition and Control.

M. Shah
Sr. Applications Analyst
Digital Equipment Corp.
Maynard, Mass.

To the Editor:

The article entitled "Computer Controlled Data Acquisition Systems" in your January, 1970 issue contains a few errors about our PDP-12.

First, although the article does not say so, the computer described is our PDP-12A. There are two smaller versions available at a substantially lower price. The PDP-12A is currently priced at $29,900.

With regard to the specs, I would like to make the following corrections:

The sampling rate of A/D is 50 KHz, not 5KHz as stated. And it is standard equipment.

The D/A is also standard and has two output channels, each of 9 bit accuracy, and range 0 to −5 volts.

The statement below the specs says, "The PDP-12 . . . uses the PDP-8 as a basic computer". This statement is not correct. The PDP-12 has a unique processor and is not a derivative of any other computer, including the PDP-8. It has the capability of executing two different order codes, namely the PDP-8 and LINC order codes.

The article obviously was beneficial to our product and company for which we are grateful.

Lorrin G. Gale
PDP-12 Engineering Manager
Digital Equipment Corp.
Maynard, Mass.

Get more out of your 360

Give this to your typist types

You're looking at the Bunker-Ramo 2206 Data Display Station. It lets your fast typists feed or retrieve information from your computer. Quickly. Because it's fitted with a standard typewriter keyboard. This desktop unit also has editing keys and 16 programmable function keys. Your employees read their questions or answers in plain English on its TV-style screen.

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The Bunker-Ramo 2212 Data Display Station is unique among CRT terminals because of its block-alpha keyboard. This keyboard speeds even the slowest hunt-and-peck inquiry or input. The 2212 also features a block-numeric cluster and 24 editing and programmable function keys. It is a podium-style unit for standup use in warehouses, ticket counters, etc., and is ideal for entry of brief messages and inquiries.

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Find out how manufacturers, utilities, airlines, department stores, hospitals and others are using Bunker-Ramo CRT systems to get more out of their computers. Write or call Mr. Guy Mallery, Vice President, Business and Industry Division, The Bunker-Ramo Corporation, Stamford, Connecticut 06904. Phone (203) 348-4291.

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LETTERS ..... Cont'd.

To the Editor:

Let me first say that I appreciate the fact that APL-Manhattan was listed in MODERN DATA's February, 1970 Technology Profile of Commercial Time-Sharing Companies. We did, however, note that you did not include Mass., N.J., Pa., Fla., and Washington, D.C. as "States Presently Served." Also, the information not provided in the columns headed "Number of Simultaneous Users" and "Minimum Charges" should have been "60" and "none," respectively.

APL-Manhattan is the largest supplier of APL time-sharing services and we have plans to open three more locations in other major cities.

Joel J. Weisenfeld
Dir. of Mktg.
APL-Manhattan
New York, N.Y.

To the Editor:

In your March, 1970 issue of MODERN DATA you indicate that Boston Computer Software Corp. is the author of DOCUMATIC, the 360 RPG documentation system. BCS is the DOCUMATIC marketing agent. Data Usage Corporation developed and still maintains the system.

Gary Mokotoff, Pres.
Data Usage Corp.
Fort Lee, New Jersey

To the Editor:

In the January, 1970 issue of your magazine, there was a discussion of the Interplex time-sharing system (The Interplex System 1). In that article, it stated that the system was the least expensive available. Our FOCAL Language is much like their BASIC, and in fact, might be more versatile. A four-user FOCAL system costs $22,700. The price of the seven-user system is $41,500.

Dennis C. Goss
Digital Equipment Corp.

Editor's Reply: *DEC is justified in chastising us for the error. The sentence Mr. Goss refers to should have been worded: "It (the Interplex System I) is, however, the least expensive BASIC time-sharing system currently available." FOCAL is a simplified JOSS-like language; the per-station cost of a PDP-8 FOCAL system can run as low as $5,300, including Teletype terminals.*

The article on the Wang 3300 BASIC time-sharing system (MODERN DATA February 1970) was based on information released after the Interplex article was printed. A Wang 3300 four-Teletype system is priced at $21,250.

To the Editor:

In your January, 1970 issue, you featured an article under the title of "ICL's Problems." I would like to draw your attention to the errors of fact contained in the article.

1. You stated that the British Government had nationalized the U.K. computer industry, represented by International Computers Ltd. (ICL).

ICL is not now, nor ever has been, nationalized by the British Government. I assume that your reference implied that the British Government has both a majority shareholding, and control, of the company's operations. Neither is the case. Both English Electric Ltd. and Plessey Ltd. hold single ownership blocks of shares substantially larger than the British Government's 10.49%. Additionally, individual shareholders, and banks and financial houses, each hold larger share blocks than the Government. The British Government has one nominee director (out of 12) on the holding board, and none on the operating company board.

2. You stated that one of the companies which merged to form ICL was International Computers and Tabulators (I.C.T.)—"a former Ferranti subsidiary." In 1963, I.C.T. took over the computer department of Ferranti Ltd., leaving Ferranti as an entirely separate electronic and electrical engineering company. Neither company has ever owned or controlled the other.

3. You refer to the International Reorganization Corp. (I presume you mean Industrial Reorganization Corp.) and the Ministry of Technology combining the interests of the merging companies. The initiative for ICL's 1968 merger came from I.C.T. and English Electric Computers and the negotiations were between the main shareholders. The British Government merely "blessed the wedding" with funds for R&D in exchange for a minority holding.

4. Your comment that the Ministry of Technology "retained" 10% of the shareholding implies that they had, all along, had holding in ICL. As I have pointed out, this was not the case.

5. ICL does not have a "conflict of interests" with our component suppliers. ICL has always, as matter of policy, freely bought components from the best available source to ensure the high quality of our product. This policy still stands.

6. Finally, you refer to ICL's "only moderate success." In the first complete company year since the merger (September, 1968 to September, 1969), ICL's world-wide results were as follows: Turnover up to 25%; Sales up to 40%; Pre-tax profitability up to 47%. Our first quarter results for the current year continue the same trends.

We do not consider this performance "only moderate success."

Harvey Dodgson
Marketing Support Officer
International Computers Ltd.
New York, N.Y.

Core Memory:

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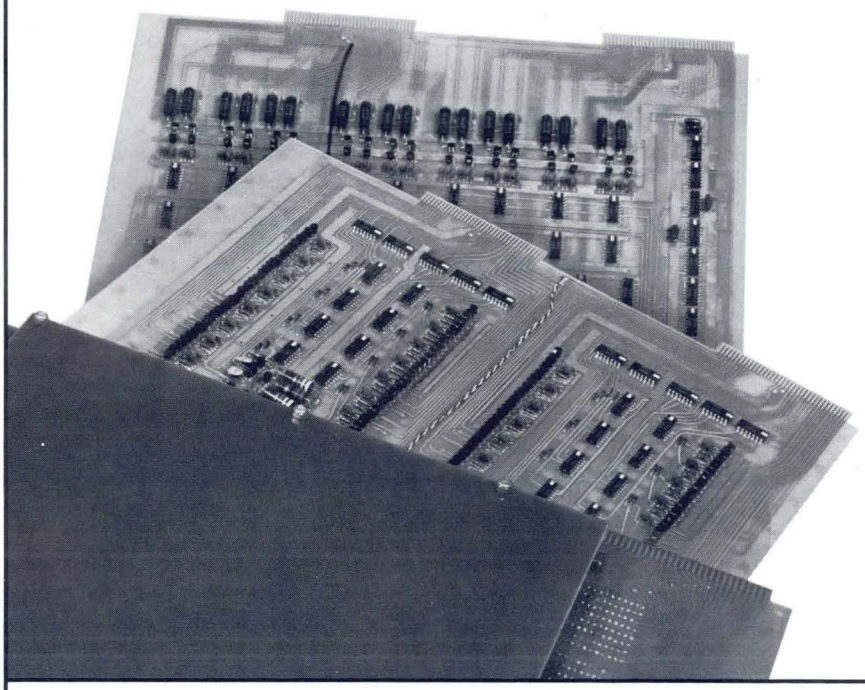

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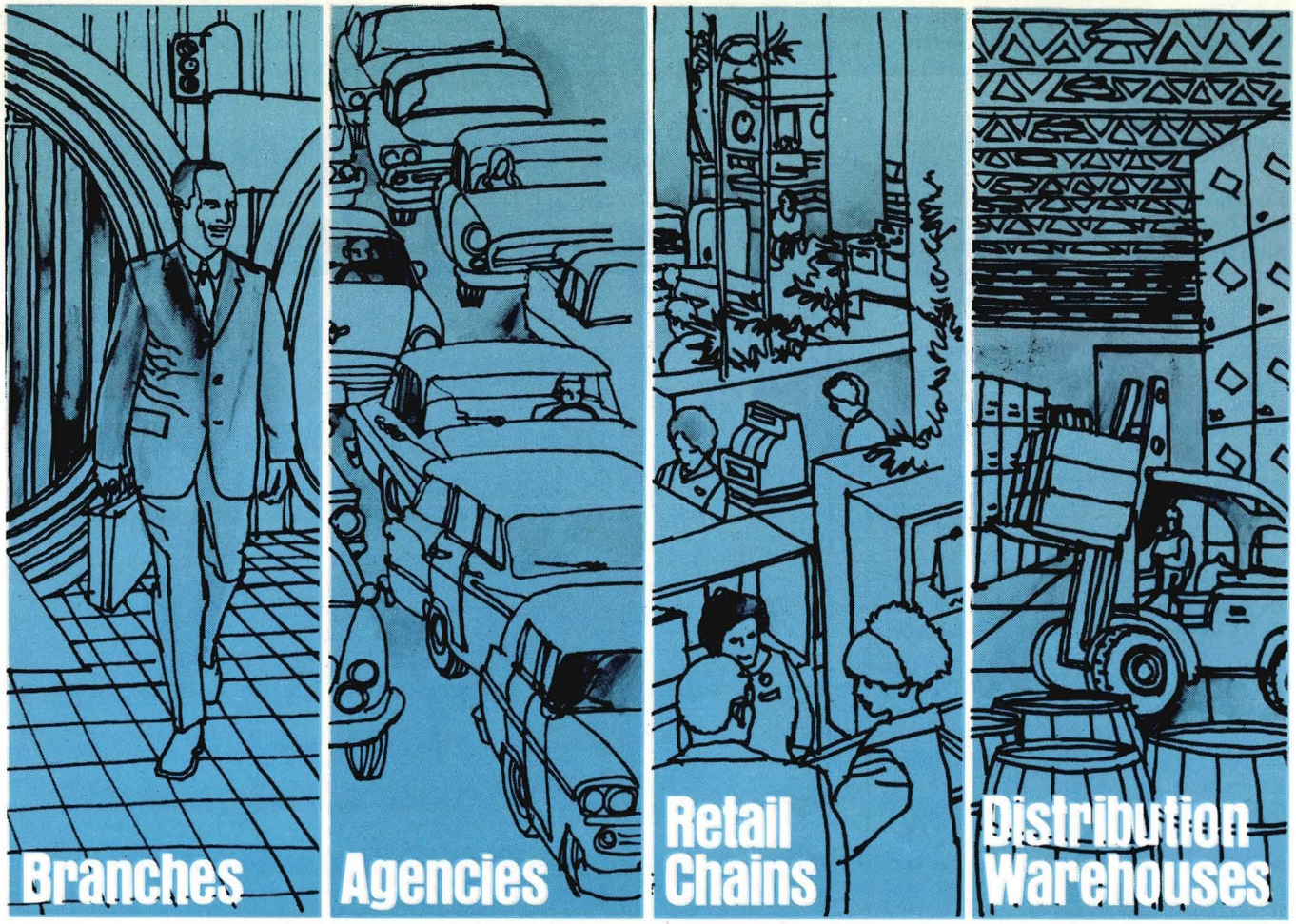
Editor's Reply: *The news item to which Mr. Dodgson refers (ICL's Problems—p. 36) was based on information contained in a report transmitted from the U.S. Embassy in London.* MODERN DATA *erred in its use of the word "nationalization," which was "rationalization" in the text of the report. We did not state that "one of the companies which merged to form ICL was ICT," but we accept Mr. Dodgson's statement that "neither company (ICT or Ferranti) has ever owned or controlled the other." Mr. Dodgson's third and fourth points are matters of interpretation. However, we did not mean to imply all that seems to have inferred. Mr. Dodgson's fifth point refers to our mentioning the possibility of a conflict of interest. Finally, we did not say that ICL had "only moderate success," but only that it had "problems." Certainly ICL is no different in this regard than any other company. We accept the impressive performance figures submitted by Mr. Dodgson as an indication that ICL is solving its problems with considerably more than "moderate success."*



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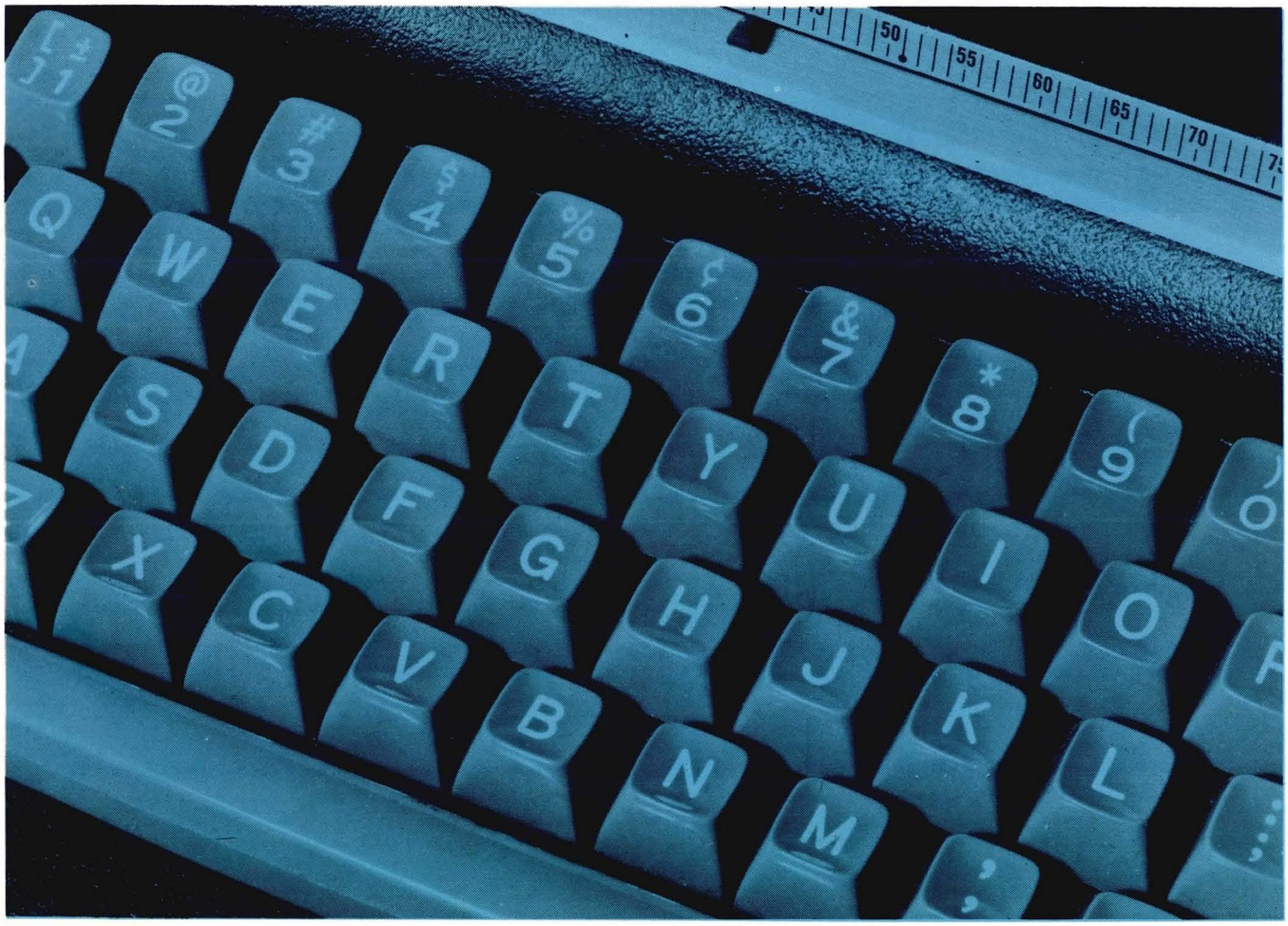

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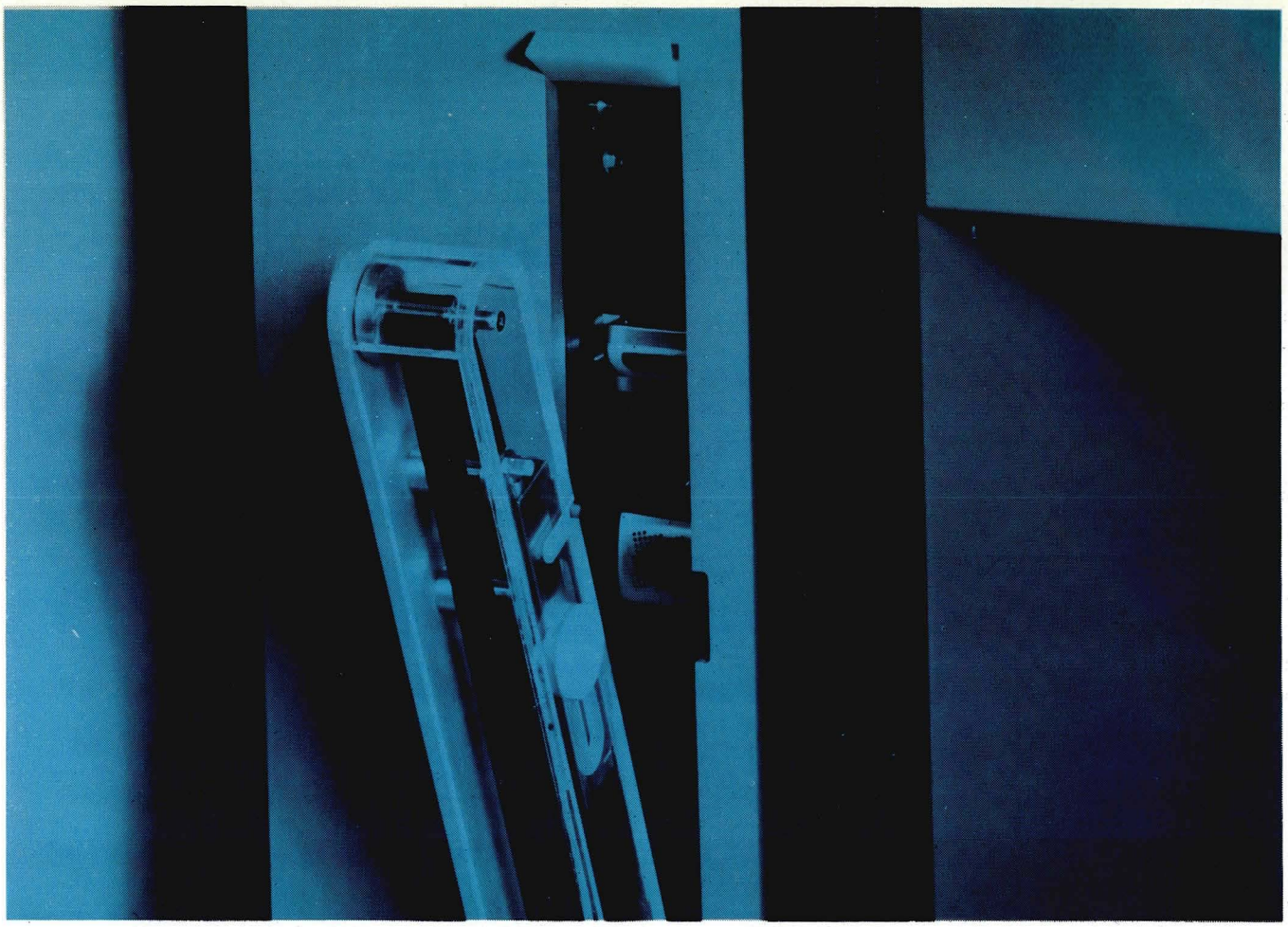

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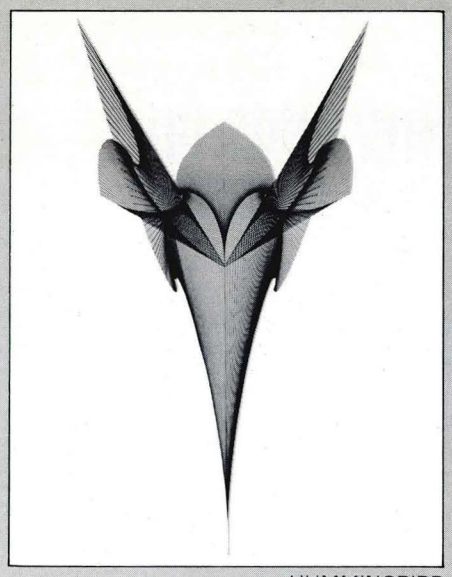

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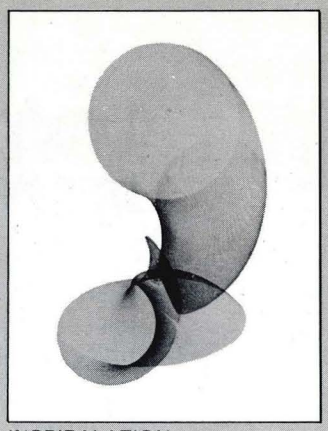

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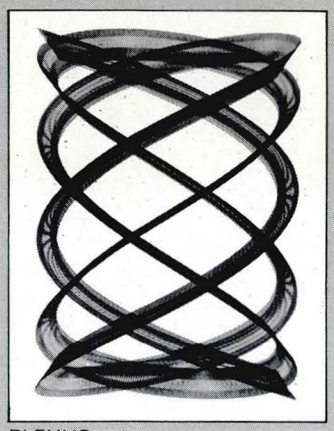

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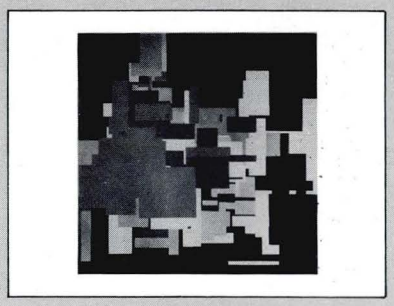

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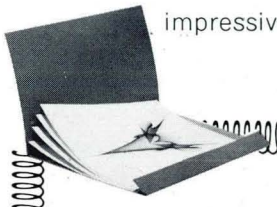

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■ **AL/COM NETWORK SERVICES** reach across the country. Our Service Center personnel and AL/COM Associates offer you local expertise to help make time-sharing productive for you. Technical support, applications programming skills and user training programs are available locally to help you solve problems in science, engineering, and banking. Or in operations research, marketing and statistical analysis, and bridge building...in management information, investments, and manufacturing.

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APPLIED LOGIC CORPORATION
One Palmer Square
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Call me ☐ Send data ☐

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AL/COM Service Centers

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San Francisco, (415) 989-1587
San Jose, Calif., (408) 292-9857
Washington, D.C. Area, (301) 654-8444

AL/COM Associates

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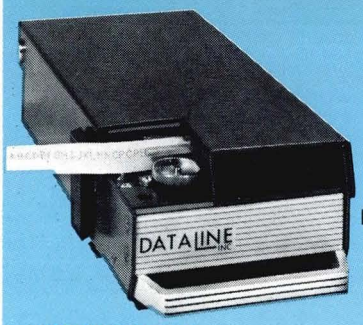
Computer Dynamics, Inc. (617) 357-8170
Buffalo
Computer Task Group (716) 634-9090
New York City Area
Computer Solutions, Inc. (201) 678-6300
Philadelphia Area
Information Management Corp. (609) 665-6088

See us in Atlantic City at SJCC Booths 114-115

CIRCLE NO. 21 ON INQUIRY CARD

DO-IT-ALL STRIPPERS!

A FASTER DATALINE STRIP PRINTER FOR EVERY TERMINAL APPLICATION



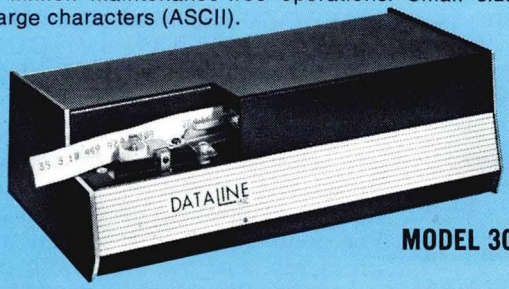
STRIPPER-ON-THE-GO

Mobile Strip Printer. Printout in police cars, buses–any moving vehicle. Compact. 100 million maintenance-free operations. 64 large characters (ASCII).

MODEL 3064-M

THE OUTSTRIPPER

Desk Top Strip Printer prints out more message in less line time. Minimum 100 million maintenance-free operations. Small size, but 64 large characters (ASCII).



MODEL 3064-C

NOW...THE 2-WAY STRIPPER

Portable Printing Terminal. Perfect I/O for computer time-share users, salesmen, engineers. Operates through any standard dial telephone. Includes an integral 103-type modem. Typewriter keyboard. 100 million maintenance-free operations. 64 large characters (ASCII).

MODEL 3064-DT

DATALINE INC.

The Best in Printed Copy Data Terminals

181 SO. BORO LINE RD., KING OF PRUSSIA, PA. 19406 • 215/265-6340

WATCH THE STRIPPERS AT SJCC. BOOTH NO. 50003.

DATALINE INC.

Most interesting! Tell me more, per my checkmarks.

- ☐ Model 3064-M
- ☐ Model 3064-C
- ☐ Model 3064-DT

NAME_____

TITLE_____

COMPANY_____

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Dept. MD

CIRCLE NO. 22 ON INQUIRY CARD

Become a Master of Science in Science Communication

at Boston University

The engineer who communicates moves ahead

Knowing your field is not enough. Communication skills are as important as knowledge. Technology uncommunicated is technology lost.

An undergraduate degree with a major or strong minor in science, engineering or mathematics qualifies you for this special program. An M.S. in the Journalism Division's Science Communication Program can broaden your career or enable you to move toward the management of engineering projects.

For more information, write or call Mrs. Kathryn Healy, Graduate Admissions Officer School of Public Communication, Boston University 640 Commonwealth Ave., Boston, Mass. 02215 Telephone (617)353-3450

How much is this flight costing you?

UCC's Computer Utility lets your engineers work...not wait.

When your computer facility bogs down from overload, give your engineers a work plan, not a flight plan. Just plug into the UCC Computer Utility Network — through your own terminal, a UCC COPE, or other compatible system.

Put the pencil to what an engineer's down time costs you while he's waiting to get to the computer, and the economics of the Utility stand out clearly.

Our nationwide network of UCC 1108's quickly puts an end to the ever-growing queue in computing.

Let your engineers work, not wait. Simply write or call your nearest UCC Computer Utility Center today.

the total service Computer Utility company

UCC

UNIVERSITY COMPUTING COMPANY

1949 North Stemmons Freeway, Dallas, Texas 75207

Computer Utility Centers in: Boston, Chicago, Dallas, Denver, East Brunswick, N.J., Houston, Kansas City, Los Angeles, New Orleans, New York, Palo Alto and Tulsa.

CIRCLE NO. 23 ON INQUIRY CARD

EAI datalinks

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

KEEPING PACE WITH DAC

Except for things like money, martinis and marriage, which occur in meaningful and memorable increments, we live for the most part in an analog world. In an effort to quantify and control this variable ambiance, digital techniques, some marvelous, some complex, have been devised. In industrial control, a large number of analog signals of varying value and mode have to be acquired, conditioned, converted, processed, and the resultant data-- digital, analog, or both-- analyzed for purpose of increased control or wisdom. EAI's experience in this begins, appropriately, in the beginning. A quarter-of-a-century's worth of analog-signal acquisition and conditioning. Now implemented with our proven, dependable EAI 640 digital computer in a number of basic configurations and with a number of useful peripherals. Together with flexible software that includes standard programs and routines, the 640 provides the digital interface to the analog world of measurement and control. We call the whole thing our PACE Industrial Data System. For detailed dissertation on its problem-solving capabilities, address "DAC", Dept. 206S. Money, martini or marriage problems need not apply.

WHEN TO AUTOMATE YOUR GCS

With the conviction that the dollar sign is not the least important symbol used in engineering, we've completed a cost analysis of when one should consider automating a GC installation. Very conservative estimate shows one technician earning $8400 can handle four GCs. This works out to $2100/GC/year/shift. When you have 8 GCs in operation, you must seriously consider installation of an EAI PACE system. Equally conservative estimate yields PACE cost of $2247/GC/year figuring 5-year amortization period, for 8 GC system. And savings increase rapidly beyond 8 GCs. Savings realized from increased efficiency of chromatographer, full 3-shift utilization of GCs, reduction of human error, of system downtime and of delayed analyses have not been taken into account. Nor increased benefits of getting analysis in a more reliable format. Get a copy of this comptroller-convincing cost study; write "GCost", Dept. 206S.

WELCOME, SYDR, WHATEVER YOU ARE

Automatic drafting has a name here at EAI. We call it SYDR, a compaction of System Drawing. Heretofore there was difficulty in providing flexible ways of man/machine interface. Now SYDR provides true automatic drafting. Its general-purpose structure renders any drafting chore in standard format, and is flexible enough to automate highly-complex layouts. Use your digital computer, our unique 430 Dataplotter and SYDR. This intoxicating marriage frees creative manpower for other fruitful work. Economies that translate days into hours, make gimlet-eyed money-watchers shout huzzas from their desk-tops. Draw on our experience with a note to "SYDR", Dept. 206S.

DISA & DATA

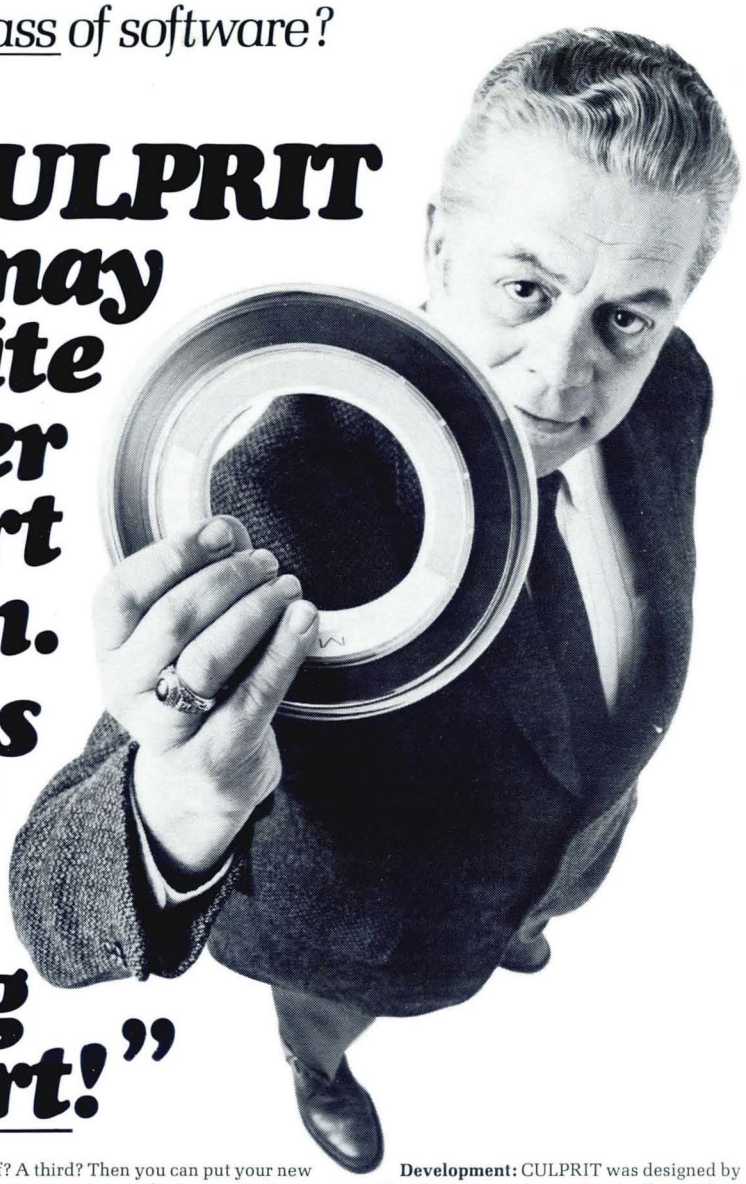
An expanded description of EAI doings is published every couple of months or so and mailed to interested parties. Those currently deprived should write, "DATALINKS", Dept. 206S. Our new updated Applications Reference Library Index is off-press and available. It lists simulation and other computer-applications texts in 15 broad fields that we'll be happy to share with you in hopes of mutual benefit. Address "ARL", Dept. 206S. In addition all EAI sales offices have available for your inspection new Central Applications File Index, a definitive (almost exhaustive) bibliography on subject of analog/hybrid applications. A first scan here could help you get through your problem a bit faster. PACE and EAI are registered trademarks of Electronic Associates, Inc., West Long Branch, New Jersey 07764.

An equal-opportunity employer with unequalled employment opportunity.

EAI®

An entirely new class of software?

"With CULPRIT you may never write another report program. It'll be as out of date as writing a sort!"



CULPRIT (CULL and PRINT) is the first of a new class of software. Think of it as a report *utility*. The concept has been used only rarely before and never with the tremendous versatility of CULPRIT.

If you've been considering the use of any kind of report generator and information retrieval system, you're thinking in the right direction. But beginning today, anything you might have looked at is woefully out of date!

Many report generators can produce only one report from one pass of the data file. Others produce a Cobol program which must be compiled, link edited and run before they produce a report. Some even have both problems. That's Model T designing!

CULPRIT is a parameter-driven program. No compiling needed. The program is kept on the core image library like a utility and produces a report as directed by the parameter coding. Highly efficient, it produces many reports (up to 99) with a single pass and can extract from multiple input files.

CULPRIT requires from 1/10 to 1/40 the normal coding time. This means that the most junior-level programmer can request and get a simple one-time report in minutes. Or many complex reports in *one pass* . . . with just a few hours of coding. Not weeks. Hours! But fast reports are not all new CULPRIT can do for you.

New Systems: When you design a new system, how much of it is made up of report editing programs? Half? A third? Then you can put your new system on the air nearly one-third to one-half sooner by simply plugging new CULPRIT into the system to handle the reporting requirements. You not only save programming time, but the machine time usually needed for debugging this part of the system.

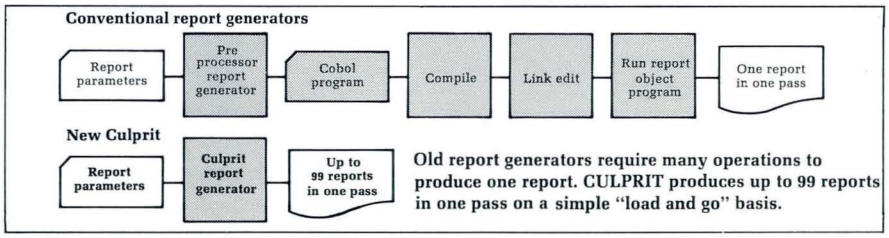
Processing speeds are close to those for well-designed and laboriously hand-coded programs. Remember . . . this isn't an ordinary report generator. You just load and go.

Features: CULPRIT has multi-line output for address labels, notices, etc. Other options include header variables; multiple-lines in headers, detail and totals; separately specifiable total lines; calculation ability on both detail and total levels; use of mnemonics for working fields; and many others. Output may be printer, punched cards, tape or disk . . . permitting program and test file creation and conversion.

Development: CULPRIT was designed by Gilbert F. Curtis and Anna Marie Thron. These are the same people who designed, implemented and installed some of the most successful application systems ever produced . . . systems now in use by many scores of major corporations.

Support: When we provide user and management briefing, hands-on instruction, or modification and backup, we work from an intimate knowledge of your day-by-day business needs as well as from a strong technical EDP base. Our people are experienced in dozens of major industries. You won't find a green hand or an ivory tower type on the Cullinane staff!

It's your move now! Send us a routine inquiry and you'll get a complete 14-page technical report. But if you're *really* interested, call us at (617) 742-8656 and discuss CULPRIT with a member of our technical staff.



Old report generators require many operations to produce one report. CULPRIT produces up to 99 reports in one pass on a simple "load and go" basis.

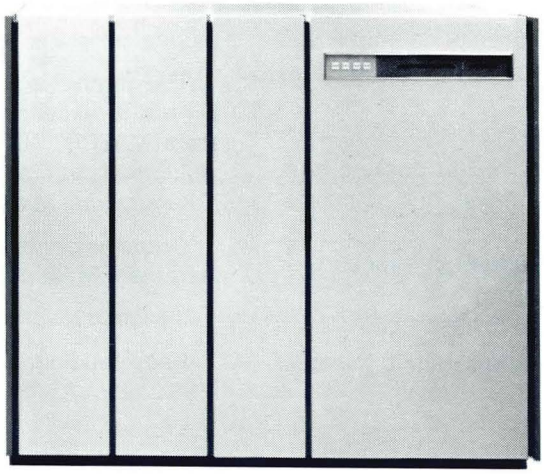
Cullinane Corporation

Cullinane Corporation

60 State St., Boston, Mass. 02109 Phone: (617) 742-8656 Other offices in New York, St. Louis, and London.

It Had To Happen

YOUR 360 NEEDS A FRIEND



THE NEW ASTRODATA ELECTRONIC DATA SORTER

Your System 360 is probably operating at low efficiency because it's spending up to 60% of its time sorting data. No more! Astrodata's new 1561 Data Sorter will store, sort, and return sorted records to the computer at high rates, giving the 360 CPU that much more time for real computing.

Plus: The 1561 frees core formerly assigned to sorting functions, permitting more work, greater throughput.

Plus: The 1561 produces string lengths, 20 to 200 times longer than present methods, meaning fewer merge passes, less CPU time and less I/O time for each sort.

Plus: The advantage of the 1561 increases with key length for it sorts over long keys as quickly as short.

Plus: The 1561 holds 65,536 records at a time, a total string length of 2.6 million bytes. That's real capacity.

Plus: It's plug-to-plug compatible with all 360s running under OS, and is delivered with "bundled" software that fits directly into OS Sort.

And: Wonder of wonders, the 1561 actually documents its own justification. Part of the software is the Astrodata Sort Usage Monitor — ASUM — that records the amount of sort time utilized, the increased efficiency of the 360, and the relative savings in $.

NEW BROCHURE

There's a new brochure available on the 1561 Data Sorter — a copy will be forwarded on request. If you need immediate information, please call (714) 772-1000 and ask for Sorter Sales.

ASTRODATA

ASTRODATA INC., 240 E. Palais Rd., Anaheim, Calif. 92803; (714) 772-1000

Matrix or

The Printer.

It's made especially for the mini- or midi-computer and CRT terminal user who can't stand the inefficiency of a 30 line-per-minute impact printer.

Or the cost of a high speed printer.

The new MATRIX SERIES non-impact printers from Versatec fill an important gap in the EDP and communications field.

MATRIX 300 delivers 400 characters per second for $5,500.

MATRIX 600 doubles the speed for $6,700.

You can list your most complex program in minutes. Routine programs are handled in a jiffy.

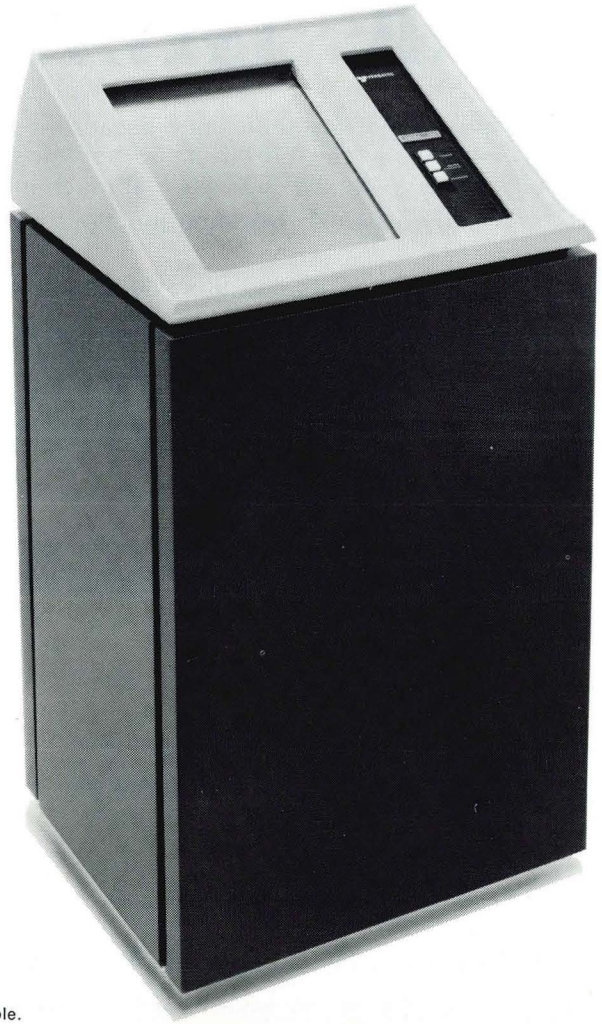
The printer is silent, highly reliable, and produces records of excellent quality. Graphics capability is offered. MATRIX SERIES printers and plotters also find applications in time sharing, batch processing and non-EDP communications.

Output is printed as perfectly formed 5 x 7 dot-matrix characters in 80 columns on 8½ inch wide paper.

Intrigued?

Keep reading. We're not done yet.

Now–a $5,500,* 300 line-per-minute printer with fantastic systems capabilities.



* Quantity One. Excellent discounts available.

Multiplus

The System.

Every important breakthrough has its revolutionary applications.

The LSI circuit made possible a "computer in a suitcase."

The MATRIX electrostatic printer has created the MULTIPLUS high speed distribution system.

Briefly, here's the story.

Unlike impact printers, the greatest cost in a non-impact printer is the electronics and not the printout mechanism. Thus, MATRIX slave terminals can be made available for $3,000 each or less depending on quantity. The master printer, alone, contains most of the electronics.

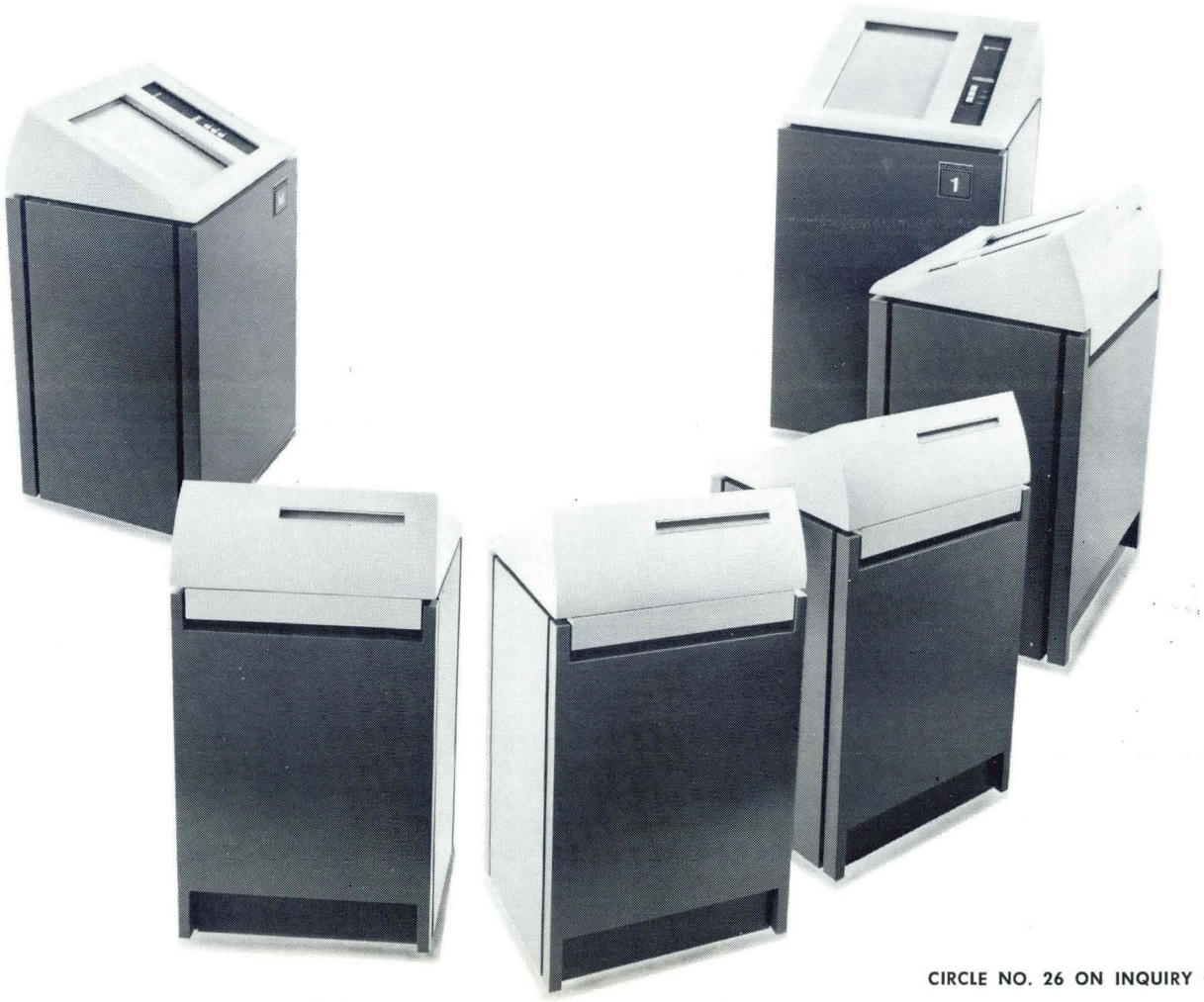
With a MULTIPLUS system a newspaper can get copies of a fast breaking story direct from the wires to a dozen desks — simultaneously! And economically.

A large production facility can reach any or all corners of its plant without using a messenger. Ditto a brokerage firm. Ditto NASA (are you listening?).

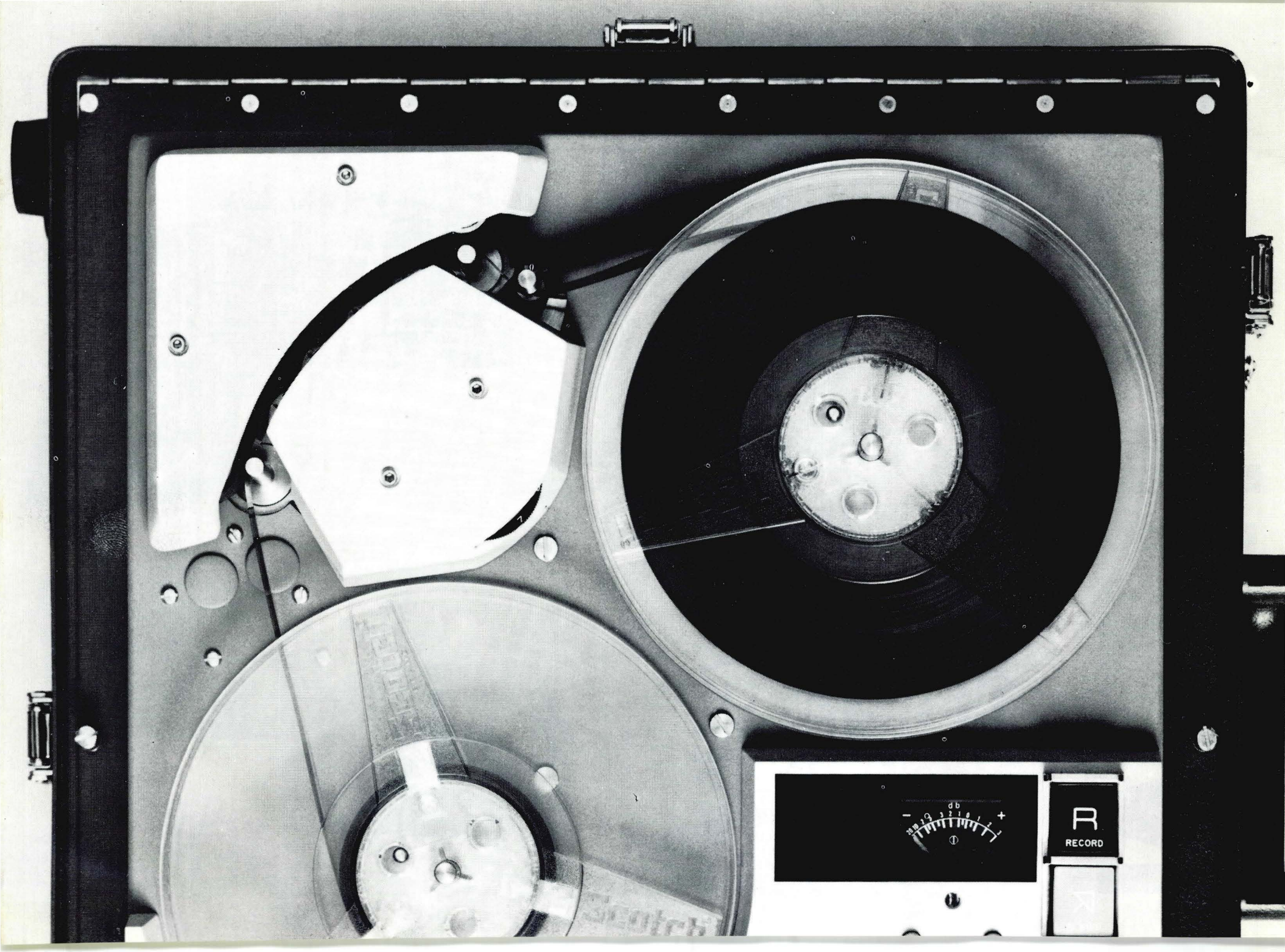
In fact — *we* have the system, *you* tell us how to use it.

For information on the new MATRIX SERIES printers . . . and on the MULTIPLUS system . . . contact Versatec, 10100 Bubb Road, Cupertino, California 95014. (408) 257-9900. **See us at SJCC, booths 116 and 117**

VERSATEC



CIRCLE NO. 26 ON INQUIRY CARD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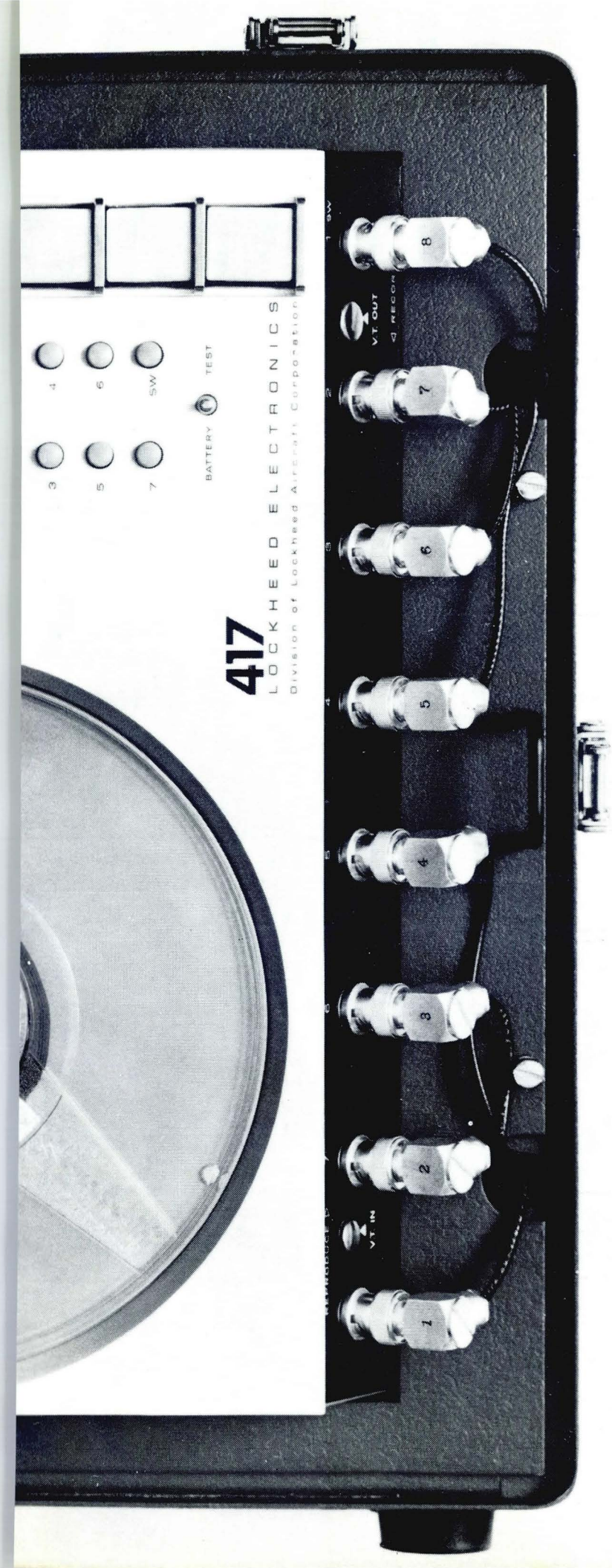
RECORD



The 417 is twice this size. And 28 lbs. heavier.

Data recording in the field is light work with the 417. For you. As for it: shake it, bounce it, bump it, stand it on end. It still records as accurately as if you'd lugged a large rack machine along. On seven channels, IRIG compatible.

Inside its standard case (15″ x 14″ x 6″) or the rugged environmental case shown (17″ x 15″ x 7″), beats a heart with 200 Hz to 100 KHz direct frequency response. (FM frequency response is DC to 10 KHz.) In either case, it fits under an airliner seat.

The stoic 417 needs little attention—fewer adjustments and less maintenance than any other portable recorder. For power, it normally needs only 13w. And that can come from its self-contained battery. Accessories can use it on any power: 12 to 28v DC, 110 to 220v AC, or 50 to 400 Hz.

So don't bring the data to the recorder. Bring the 417 to the data. (And if there's ever a problem, bring it to any of our 35 offices in the U.S.) The portable 417. You can get away with it for as little as $7,000.

For more specs, write: Frank Pike, Dept. 413-10, Lockheed Electronics Company, Plainfield, New Jersey 07061. Or call him at (201) 757-1600.

LOCKHEED ELECTRONICS
A Division of Lockheed Aircraft Corporation

CIRCLE NO. 27 ON INQUIRY CARD

This is the model 816/716
Disc Drive System from
Peripherals General. It interfaces
IBM compatible disc drives directly
to non-compatible computers.
No other hardware is needed.
The drives use 1316 disc packs and a
thoroughly proven design.
The sixteen bit controller can
handle two drives, and we
tailor it to your interface.
The basic system
is in the $20,000 range. In OEM quantities
it is considerably less.
We start delivering them in
July.

(SJCC: Booths 10012-10013)

Peripherals General, Inc.

CHERRY HILL INDUSTRIAL PARK, CHERRY HILL, N.J. 08034 (609) 424-2010

An open letter to AT&T

from the company who will let a lot of your data communications customers do you out of $100,000 a year.

Undoubtedly your first reaction to us will be a sense of irritation at a certain loss of revenue.

If that's your only reaction, you'll be making a big mistake.

Allow us to explain.

We, the Dynelec Systems Corp., have developed a unique approach to data communications that is, by conservative estimate, 400% more efficient than that used in other systems now operating.

With our equipment, up to 120 mixed-speed data terminals can be accommodated simultaneously over each voice-grade line.

This is 4 times as many as in any other system.

Which means that multi-location data communications customers will be able to concentrate and send far more data, more economically, to and from their computers than they ever could before.

But substantial reductions in leased line and modem costs alone are only part of the story. Great additional savings are made through use of our equipment.

For example, our basic, low-cost communications multiplexor, the ™DyneCoM 70W, grows as customer needs grow.

Because of its modular design, a user can start off inexpensively with as few as 2 channels and plug in additional circuit boards to handle up to 64 mixed-speed terminals.

Other 70W features include the unit remaining operative despite channel failure, simple visual diagnostics, self-service maintenance, up to 4 speeds and any code, and automatic speed selection.

Total annual savings can easily exceed $100,000.

The Dynelec approach opens such vast new vistas in data communications that they far outweigh any AT&T revenue loss that results from the savings we can help customers enjoy.

For full details, write us or call: (201) 447-0900.

Dynelec™
SYSTEMS CORP.

139 HARRISTOWN ROAD, GLEN ROCK, N. J. 07452

SEE US AT THE SJCC BOOTH DD

CIRCLE NO. 29 ON INQUIRY CARD

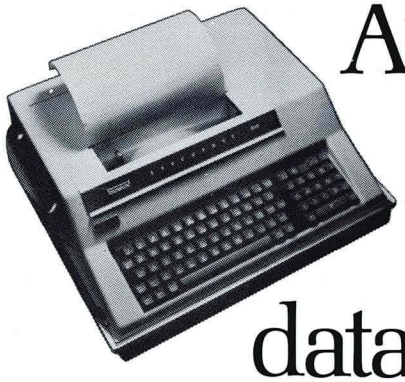
FOR MORE INFORMATION ON THE PRODUCTS ADVERTISED ON THE FOLLOWING PAGES CIRCLE NO. 30 ON INQUIRY CARD →

The Computer Store.

Welcome to the Bloomingdale's of the computer industry. If you're shopping around at the SJCC for something nice in the way of a mini, drop in at the BIT booth. No.46020. You can get a swell little model right off the rack. And take it home with you. And if you're anything like a lot of OEM's we've been talking to lately, it should be a perfect fit. Our mini is the BIT 483. A fast number. With less than one microsecond speed, nobody's ever said, "Sam, you made the cycle time too long." And it's built like a brick one, too. It's fantastically reliable and ought to give you much less down time than some of those stripped-down models on the market. What's more, for all its power, the 483 is really quite a simple machine and easy to learn how to run. (If you're looking for that sort of thing, you may be interested to know it was one reason BIT recently decked a well-known competitor for a big order with a big manufacturer.) Other reasons why

the BIT 483 is a general purpose digital computer to contend with: proven design performance and unparalleled problem solving capability; BYTE orientation; variable word length; cycle stealing data channel; expansion to 32K memory within the same box; binary and decimal arithmetic; priority interrupt; and a complete line of I/O options. These are what make the BIT 483 the price/performance champion of the minis. And as the company that's popping them off our production line like so many two-pants suits, we're here to say we stand behind our merchandise. We produce in volume and we service what we produce. Come into the Computer Store for a little shop talk, a little demo. And maybe you can walk out with a little computer under your arm.

BIT, INCORPORATED
5 Strathmore Road
Natick, Mass. 01760



All you need to take our data transceiver anywhere at all is a dime for the telephone.

Execuport 300

...the portable one!

Wherever business may take you, take along your Execuport 300. It's your indispensable link with the home-office computer.

Execuport 300 is the thermal page-printing data transceiver that's ready to go to work anywhere.

It's a high-speed printer: The operator selects 10, 15 or 30 characters per second. It's so quiet that all you ever hear is the unobtrusive tapping of the printhead. Solid-state circuitry promises a new level of maintenance-free reliability.

And Execuport 300 **is** the portable one. Keyboard, thermal page printer, solid-state control logic, telephone coupler, data access jack and interface, plus a universal interface for peripheral accessories — **all** components are enclosed in an attractive, integral carrying case.

Total weight is about 27 pounds. Including the dime for the telephone.

COMPUTER TRANSCEIVER SYSTEMS INC.
123 Pleasant Avenue, Upper Saddle River, New Jersey 07458

To see and hear for yourself, visit Booths 203-204-205 at the 1969 Spring Joint Computer Conference in Atlantic City, May 5-6-7.

CIRCLE NO. 31 ON INQUIRY CARD

Make your own mini computer.

You can build your own mini computer, or you can buy from us. There is no other way to give your system a perfect fit. True, the market has plenty of mini computers. Most are good and have features which seem ideal for a given system. But there is always something wrong. You settle for what is wrong to get what is right. Compromise becomes the rule, not the exception.

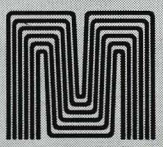
We developed the Micro 800 Series to eliminate compromise. Everything is there to choose from. Yet you pay for and receive only what you need. First we saved you money by stripping away all but the essential hardware needed for a dedicated application. Then we gave you versatility by coming up with two unique mini computer features—modularity and microprogramming.

Modularity lets you expand or reduce the core memory from 0 to 32,768 bytes and the ROS from 256 to 1024 words simply by plugging in boards. You can even add five interface boards to the main chassis. Through microprogramming, you can literally design your own proprietary computer. You can define your own instructions, input/output and interrupt capabilities.

A complete software system guides you from flow-charts to symbolic assembly, through interactive simulation to a read only memory map. Just mount the required diodes on a printed circuit board and plug it in. You've optimized a computer for your particular application. That could be anywhere from a hardwired controller to a complete software programmable, macro level, general purpose computer.

Take advantage of the fact that Micro 800 commands are read out of ROS every 220 nanoseconds, permitting execution of up to 4.5 million operations a second. Or that I/O interface and processor oriented functions can be put into firmware to increase performance, minimize hardware, and significantly reduce costs. Develop your own benefits. Be as creative as you like because there is a lot to work with.

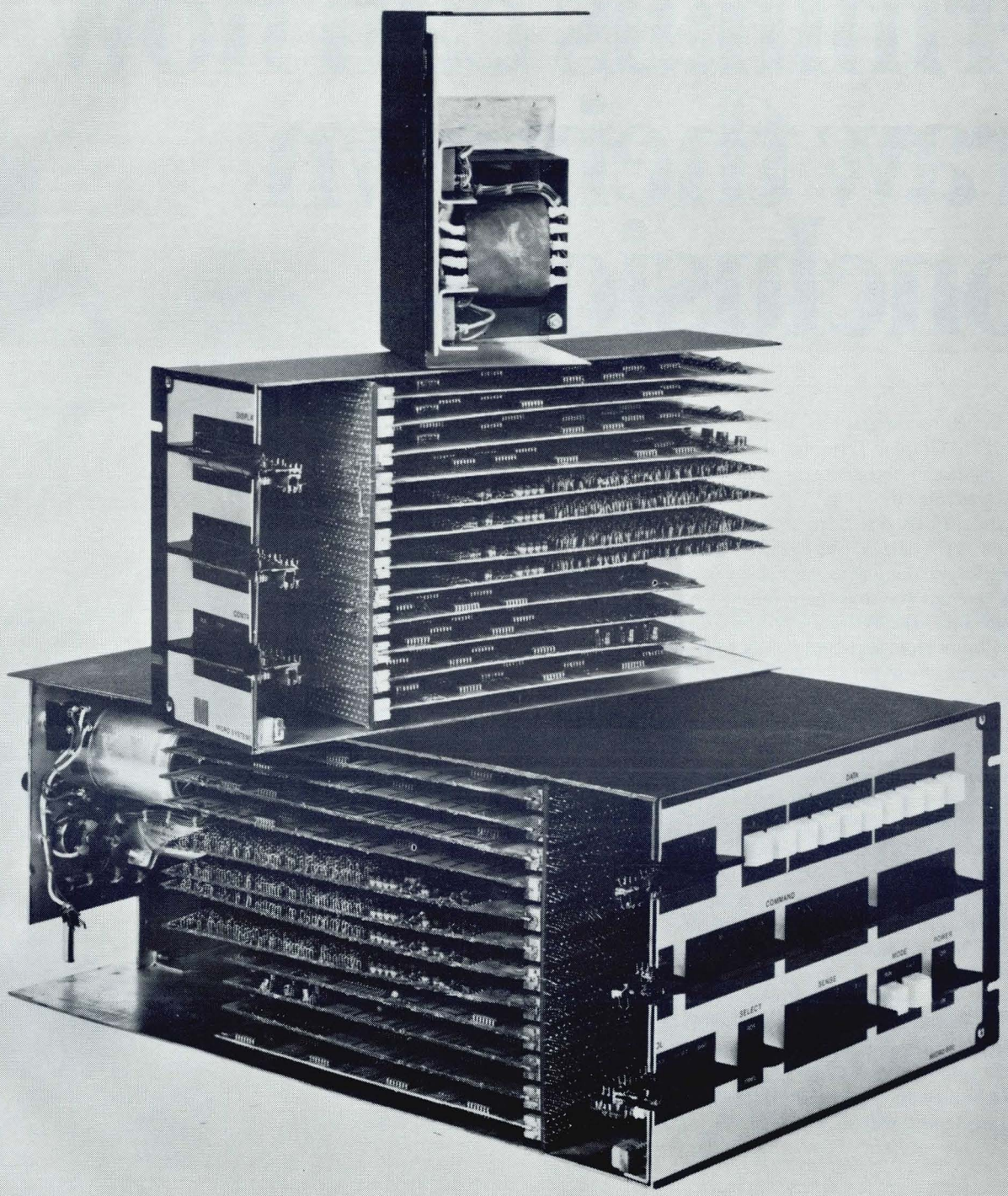
If you are in the market for a mini computer, start with the irresistible Micro 800 Series. Prices begin at $3200. Write for details and our application note, "Introduction to Microprogramming." Micro Systems. 644 E. Young Street. Santa Ana, California 92705. Telephone (714) 540-6730.



Micro Systems
A Microdata Subsidiary

See us at SJCC, Booth 24001

Use our parts.



CIRCLE NO. 32 ON INQUIRY CARD

Time-share terminals can now draw their own conclusions.

Now you can get instant graphics. From the new Hewlett-Packard Graphic Terminal, the most functional advance in time-share capability since the Teletypewriter itself.

Feed standard EIA ASCII inputs to the Graphic Terminal and as the data arrives from the computer, it can be plotted right along with the Teletypewriter printing. When data transmission is finished, so is the graph. Plugged into the Teletypewriter, the Graphic Terminal will plot from keyboard inputs, or you can plot with the Teletypewriter silenced by a switch. No more waiting. No more wading through a swarm of digits. Clear, sharp graphs help you get the picture every time — on the spot. And give you faster, more direct comprehension of computer solutions.

The HP terminal is simple to operate but provides sophisticated results. No special programming knowledge is needed. Numbers become points, curves, circles, lines, ellipses, contours. Or business graphs like bar or pie charts. Check out trends, study the behavior of input functions, compare one result with another. Design graphically with figures from computer-resolved data.

Add a new dimension to your in-house capability. Put a Hewlett-Packard 7200A Graphic Plotter next to your Teletypewriter and draw a more functional picture of the cold hard data. Your time-share service has the facts. If they don't yet offer the 7200A, have them get in touch with us.

HEWLETT hp PACKARD

GRAPHIC RECORDERS

11909

CIRCLE NO. 33 ON INQUIRY CARD

7200A GRAPHIC PLOTTER
HEWLETT PACKARD
PEN DOWN
LOWER LEFT
UPPER RIGHT
GRAPH LIMITS

NEWS ROUNDUP

OHIO BELL WITHDRAWS PROPOSED TARIFFS

The Ohio Bell Telephone Co. has withdrawn its proposed new tariffs against information systems using Ohio Bell's access lines to communicate data. The telephone company referred the proposal to AT&T for further study. The Association of Data Processing Service Organizations (ADAPSO) and the Business Equipment Manufacturers' Association (BEMA) had protested the proposal several months ago when it was originally submitted to the Ohio Public Utilities Commission for approval. Since the new charges would apply regardless of whether the transmissions originated or were terminated at out-of-state locations, ADAPSO and BEMA argued that the proposed **intra**-state charges were also charges against **inter**-state service. ADAPSO had filed a petition to that effect with the Ohio Public Utilities Commission, claiming that the proposed tariffs were discriminatory to data processing organizations and, in any case, beyond the jurisdiction of the Ohio P.U.C.

MATCHING SERVICE FOR DOGS

A computer matching service for *real* dogs has been formed to assist people having trouble finding suitable mates for their pets. Bruce Kusens, an industrial engineering student at the University of Miami, leases time from the university's computer center for his "doggie match" service. Local kennels provide him with candidates. Mr. Kusens said that although his service has produced many successful matches, it's "not exactly a howling success."

ADAPSO WINS COURT DECISION

The Association of Data Processing Service Organizations, Inc., (ADAPSO) won a reversal on the issue of whether data processing companies could sue on claims that national banks are illegally competing with them. The 6-2 decision, which reverses a previous decision of the U.S. Court of Appeals, permits ADAPSO to pursue its case against the American National Bank of St. Paul and the U.S. Controller of the Currency. ADAPSO instituted suit against the American National Bank of St. Paul in 1967, challenging a 1966 ruling by the Controller that authorized banks to provide EDP services "incidental to banking." ADAPSO filed in the Federal District Court in Minneapolis, seeking to have the St. Paul bank desist from offering these services and asking for a ruling that the Controller's authorization was illegal. The District Court ruled that ADAPSO lacked standing to sue and dismissed the case. The Association appealed the decision to the U.S. Court of Appeals and was again denied. The Supreme Court first heard the argument of the Association's attorneys in Oct., 1969.

TELEPROCESSING FOR SYSTEM/3

IBM has announced a communications adapter for its new System/3 business computer that will enable it to exchange data with remotely-located System/3s and most System/360s. The adapter will provide an automatic answering capability and, optionally, an automatic dial-up capability under program control. Also optional — a programming support feature for use with RPG II that includes a fill-in-the-blanks specification sheet through which the user can describe his communication tasks. This information is then punched into the system's 96-column cards and fed into the computer along with other RPG II instructions which comprise the user's application program. The adapter, which will utilize an IBM-developed binary synchronous transmission technique to transfer EBCDIC or ASCII data at rates up to 50,000 bps, will rent for $265 a month, or may be purchased for $12,985. An adapter attachment is required at $35 a month, or $1,725 purchased. The RPG II telecommunications feature will be licensed for $35 a month. Availability is scheduled for the first quarter of 1971.

BUSINESS PROGRAMMER EXAMINATION

A registered business programmer examination developed by the Data Processing Management Association will be given October 10. All applications for the exam must be filed by August 1 with DPMA International Headquarters, 505 Busse Highway, Park Ridge, Illinois 60068. In development since 1967, the new examination, which includes 150 questions and requires 2-½ hours to complete, is the work of DPMA's certification council and is designed to measure the ability of an applicant at the senior programmer level. DPMA plans to give the examination annually in approximately 100 test sites, usually college or university campuses, across the U.S. and in Canada.

TIME-SHARING VIA SATELLITE

Time-sharing via satellite was demonstrated recently during the Third Hawaiian International Conference on System Sciences at the University of Hawaii Monoa Campus. Computer Communications, Inc. provided a remote CRT terminal at the Hawaii campus which exchanged data at 2,000 bps via the Lani Bird Satellite with an IBM S/360-91 computer operated by the Campus Computing Network at UCLA. The transmission was "technically excellent and the demonstration was extremely successful," according to UCLA spokesmen attending the conference.

We'll ship you a fully encoded solid-state keyboard in 30 days...at no charge

If you plan to use production quantities of data input keyboards, all you have to do is: **1.** Request our Keyboard Specification Kit **2.** Return the appropriate form with your detailed specifications **3.** Fill out the Shipping Label enclosed.

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CONTROL DEVICES, INC.

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Unique solid-state switching technique* and new design concept provides — Low Cost (fully encoded keyboards for less than $100) • Low Current Draw (less than 200 ma at 5 Vdc) • Low Profile (as little as ¾ inch bottom of keycap to bottom of circuit board) • Low Downtime (keyboard impervious to liquids spilled directly on it)

* Patents pending

NATIONAL POLLING SYSTEM

Peter James, philanthropist, Republican candidate for Governor of the State of Maryland, and chairman of the board of Photo Magnetic Systems, Inc., has announced a plan that would link 5 million Touch-Tone telephones to a $2 million telephone-computer system currently being installed by IBM and the Chesapeake and Potomac Telephone Company for Computer Telephone Corp., a wholly-owned subsidiary of Photo Magnetic Systems. The "Peter James Polling System" was offered to H. Ross Perot, chairman of Electronic Data Systems, Dallas, as a solution to Perot's desire to provide a means for all Americans to react instantaneously to national issues from their home or business Touch-Tone telephone. Mr. James plans to utilize the polling system in his 1970 gubernatorial campaign.

RELIGIOUS INFORMATION NETWORK

DSI Systems, Inc. of Rockville, Md. is reported to have been awarded a $1 million contract by the Christian Research Institute (CRI) of Wayne, N.J. to provide DSI's data retrieval service to religious institutions across the country. The CRI-DSI system would link a vast data base of cross-referenced religious information to terminals located in colleges, biblical institutes, and seminaries. Queries initiated by the terminal operators regarding the whereabouts of selected portions of religious texts would be answered in the form of a reference to one of many microfilm cassettes stored at the terminal location. Placing the cassette in the terminal would automatically cause the relevant text to be retrieved and displayed for viewing. A strip printer would output changes or special notes which pertained to the text being viewed. DSI currently has orders for nine terminals, but expects to have 300 more installed for this purpose by 1975.

HONEYWELL EXPANDS SERIES 16

Honeywell Inc. has strengthened its Series 16 computer product line by adding nine new peripheral devices, with complementing software, and doubling the maximum memory capacity on all minicomputer models. T. Paul Bothwell, v.p. and gen'l. mgr. of Honeywell's Computer Control Division, said that three moving-head disk drives with controllers, four low- to high-speed buffered printers, a magnetic-tape drive and control, and memory extensions to 32,000 16-bit word-length capacities will be available with second-quarter computer deliveries.

INDEPENDENT PERIPHERALS

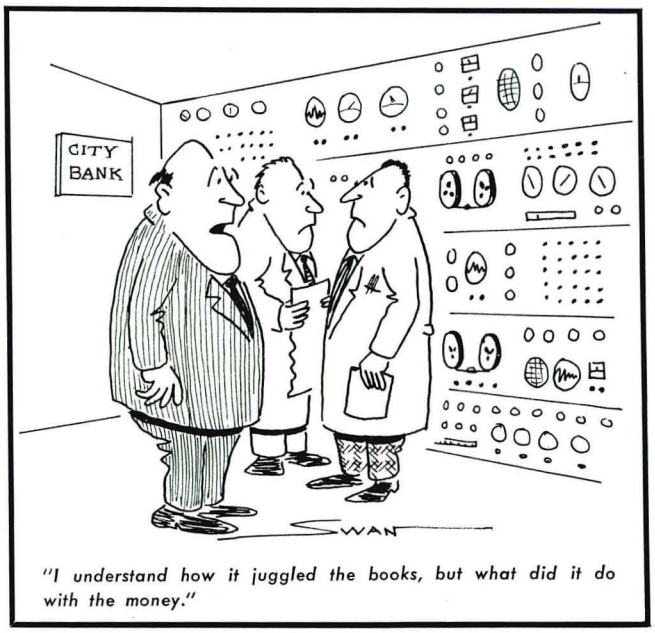
Speaking before a meeting of the Chicago Securities Analysts, Leon Staciokas, president of Digital Information Devices, Inc., pointed out that peripheral equipment sales by independent manufacturers approached $3 billion in 1969. Mr. Staciokas predicted an annual growth rate of 30%, which would bring this figure to $7 billion by 1975.

AMA IN FAVOR OF AMHT

Dr. Gerald D. Dorman, President of the American Medical Association, said that the AMA favors the integration of Automated Multiphasic Health Testing (AMHT) into the existing medical care system. Dr. Dorman said that AMHT is neither designed to, nor capable of, replacing the evaluation of a patient's health by a physician. However, he hailed it as an "effective new technique for providing physicians with data which can aid them in making more rapid and accurate diagnoses, thereby improving the delivery and quality of health care services."

Automated Multiphasic Health Testing is the term applied to systems which combine automated equipment and computer technology with clinical tests and procedures to measure an individual's health status. This information is then integrated by the physician with the patient's history and his physical examination to evaluate the patient's health status.

Dr. Dorman, whose organization represents the majority of the nation's physicians, made his statement in a paper delivered at a symposium on Automated Multiphasic Health Testing held in New York City by the Westchester County Medical Society. Dr. Dorman said that the growing shortage of physicians, coupled with the increasing demands for medical care in the country, made development of additional techniques for improving health care coverage and more efficiently utilizing the physician's time "of the most vital importance."



"I understand how it juggled the books, but what did it do with the money."

COME SEE US AT SJCC
BOOTH NO. 1510-1511

Meet the new one that tells twice as much at one glance

Our stand-alone VST/2000 CRT Data Terminal for Time Sharing Gives You a Two-Page Display ...2,596 Characters with a 72 Character line

The Big Brother of Video Systems' VST/1000 tells the story – 2,592 Characters in 36, 72 Character Lines.

It replaces any loud-mouth teletypewriter, yet speaks as eloquently to any computer, without any hardware or software modifications.

The VST/2000 shows you 1,296 characters on one page, and has yet another 1,296 character page in storage ready for display automatically when the first display is filled.

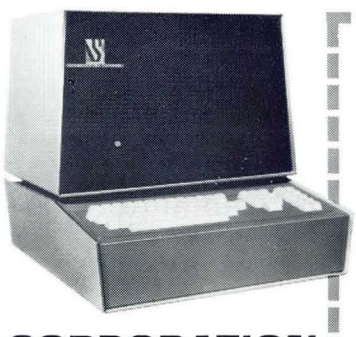
Keyboard cursor takes care of OOPS. Standard teletype keyboard and 10-key adding machine configuration takes care of secretaries who aren't familiar with other input arrangements.

An all-in-one unit with optional built-in acoustical or hard wire coupler. Output for standard printer, too.

The VST/2000 does a lot for very little. If you're a Time Sharing or a Leasing Company, our new big baby in the family of Quiet Ones can mean big things for you.

We can tell you twice as much if you write or call.

VST/1000 CRT
12" Screen, Folded logical 72 Character Line, 18 Line/Page. Two Pages – A quiet price, too.



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Pennsauken, New Jersey 08110

Please tell me twice as much about your new CRT data terminal that costs so little.

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INTERNATIONAL NEWS

SOUTH AFRICAN INSTALLATIONS — The Republic of South Africa is expected to have 520 computer installations this year, says the U.S. Dept. of Commerce. By 1973 as many as 1,000 computers may be installed in the Republic. Since no significant production of computers in South Africa is considered likely within the next five years, the Republic will have to rely on foreign suppliers for its computer needs. Six such firms — IBM, International Computers, Ltd., English Electric-Leo-Marconi, Burroughs, NCR, and CDC — currently supply some 65 percent of the total South African market.

COMPUTERIZED TRANSPLANTS — Hospitals in Montreal, Canada, are cooperating in a clearing house for possible donors of organs that can be used for transplants. UPI reports that the new organization, Metrotransplantation, seeks to match donor and recipient according to organ tissue similarities. Possible donors and recipients are "tissue typed" with the information being fed into computers for fast future reference.

MALAYSIA TOP SE ASIAN MARKET — The market for computers in Malaysia is bigger than any other Southeast Asian country, the Bernama news agency reports. Walt J. Milas, Far East Manager for Mohawk Data Sciences Corp., believes this is due to "the rapid industrialization program that the government is currently pursuing." The number of computers used in Malaysia is likely to double in the near future, he believes.

COMMUNICATIONS COMMON MARKET — Robert W. Sarnoff, Chairman and President of RCA has called for the creation of a global "Common Market of Communications" that would transcend narrow national interests. He warned in a Paris speech that failure to act promptly on a common global communications policy could result in chaos and cost the nations of the world at least $100 billion a year over the next decade.

HONG KONG OUTLOOK — Except for computers and the American-dominated components field, growth prospects for sales of U.S. electronic products in Hong Kong "are cloudy" because of heavy competition from Asian producers. The American Consul in Hong Kong reported that the electronics industry is the third most important export earner for the Colony. Assuming the U.S. demand (about 75% of production) continues, it is expected that the industry will grow despite a tight labor market and mounting shortage of factory space. A major export is computer memory arrays, which showed the best component performance in 1968 with exports rising 26 percent to $13.8 million.

Hong Kong's market for computers is small but expanding. Imports of EDP equipment totaled $2.5 million in 1968 — up 54 percent from the preceding year. U.S. products amounted to close to $2 million of this total. While computer users thus far have been limited to large banks and industrial concerns, Hong Kong's increasing economic sophistication suggests, the American Consol said, "more sales growth in the future, particularly in time-shared arrangements."

GERMAN POST OFFICE — The German Post Office has gone into the time-sharing business. Together with two leading computer manufacturers — Siemens AG and AEC Telefunken — it has founded Datel GmbH in Munich. Although the Post Office has made its telephone and telegraph facilities available for DP applications in the past, the new company will supply complete time-sharing services, including terminal facilities and software. Datel GmbH seems to represent both an attempt to assist German businesses in taking advantage of computer technology and the involvement of the Post Ministry in the efforts of the German-owned computer industry to gain and hold a major share of the German market.

GE OVERSEAS — General Electric's computer operations overseas in 1969 "made rapid strides toward profitability," according to Hilliard W. Page, v.p. and group executive for GE's Information Systems Group. "GE Information Systems Italia (GE I.S.I.) is profitable now" and the French affiliate, Bull-GE "very soon will be." Installed value of GE information systems equipment world-wide is now more than $1.3 billion. GE believes the world market for on-time-sharing is expected to reach $1 billion by 1973, and double that by 1975. The company estimates that its service network will consist of more than 75 systems serving 100,000 time-sharing users in 21 countries on five continents before 1971.

AUSTRALIAN MARKET — By mid-1969, there were 813 digital computers in Australia and an additional 222 on order, reports the American Consul in Sydney. Nearly two-thirds of the top 800 Australian firms have not yet been committed to the computer age.

QUICKLY AROUND THE WORLD

Computer Data Enterprises, Inc., Jenkintown, Pa., a software and facilities management corporation, has entered into an association with INTECH Australia, Ltd., Melbourne, an on-line systems specialist. They plan to begin their efforts by implementing passenger check-in systems for several airlines and airports in Southeast Asia.

Collins Radio has received a lease contract from the Mexican Government for a Collins C-System which will be used initially to process all motor vehicle registrations and related tax functions in Mexico.

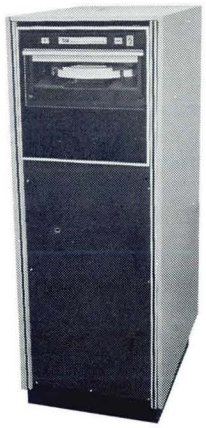
A new $1 million Univac real-time computer system, contracted for by the Totalisator Agency Board (TAB) of the Australian Capital Territory (ACT), will provide bettors on horse and dog racing events with better service when it becomes operational in 1971.

IBM has introduced its System/3 computer in Germany and expects to have it ready for sale by April or May. This makes the first time IBM has quoted its German customers separate prices for hardware and software.

When top international skiers rush down the ski-runs of the Grodnertal, in the Italian Dolomites, the representatives of the press will be instantly provided with comparative speeds calculated by a computer in Munich.

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

IMMEDIATE DELIVERY FROM STOCK



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.

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CIRCLE NO. 36 ON INQUIRY CARD

ORDERS AND INSTALLATIONS

SofTech, Inc., a software development firm located in Waltham, Mass., has been awarded a one-year contract by the Air Force to distribute, maintain, and enhance the Automated Engineering Design (AED) software system which was developed, with Air Force and industry sponsorship, by the Computer Applications Group of MIT's Electronic Systems Laboratory. The system was released last July by the government for public use. SofTech will also be responsible for preparing additional user documentation and organizing an AED Users Group that will sponsor further development and assistance after the Air Force contract terminates.

The signing of two computer leases having a combined value of $3.74 million was announced by Systems Capital Ltd., London, a wholly-owned subsidiary of Systems Capital Corp., of Philadelphia. Both leases involve GE I.S.'s GE-615 computer systems. One contract, valued at $1.84 million, is with Ford Motor Company Ltd. The other, valued at $1.9 million, is with Sanaco Computer Services, one of Britain's largest service bureau organizations.

Taiyo Bank of Tokyo is completing installation of three Univac 418-III real-time computer systems valued at approximately $5.8 million. The computers will be used in an on-line mode for processing bank data transmitted from more than 200 terminals installed at tellers' stations in up to 145 branches located throughout Japan.

Mobark Instruments Corp. of Sunnyvale, Cal., has announced receipt of contracts for more than $384,000 for incremental digital magnetic tape-cassette recorders from Eldorado Electrodata Corp., of Concord, Cal. The order calls for several types of Mobark digital recorders and reproducers to be incorporated in Eldorado's line of computerized data terminals and other peripheral systems.

With the sale of its fifth general-purpose computing system to Jacobi Systems Corp., total Interdata orders received from Jacobi now exceed $255,000. The Jacobi orders are for the purchase of Interdata's Model 3 and 4 computers with field expansion for use in Jacobi's Minits I & II small time-sharing system.

Scotland Yard, the British law enforcement agency, has placed a $4.8 million order for a large-scale Burroughs B6500 computer system. The purchase of the B6500 is the initial equipment acquisition for a massive $40 million law enforcement information network recently announced by the British Home Secretary.

Optical Scanning Corp. has announced the rental of seven "OpScan" optical mark reading systems valued in excess of $250,000 to the Social Security Administration. One of the systems will be used at the Administration's headquarters in Woodlawn, Md., which is said to have the world's largest computer installation under one roof.

Ampex Corp. has received contracts totaling approximately $450,000 from Systems Engineering Laboratories, Ft. Lauderdale, Fla., for digital tape drives and core memory stacks to be used in Systems' 800 Series real-time computers.

Inventory Management Systems, Inc., of Los Angeles, which has been testing its Marketron computer terminal in a west coast supermarket chain, has awarded a $9.7 million contract to Honeywell's Tampa Division for production of major portions of the automated system. The Marketron is an on-line terminal designed to speed customer grocery check-out while providing a real-time computerized inventory and sales record.

The Federal Aviation Administration has awarded a $210,000 contract to Information Displays, Inc., of Mount Kisco, N.Y., for equipment and services in connection with a nine-month evaluation of an oceanic air traffic control graphic display.

The California State Colleges, which constitute the largest educational organization in the world, have purchased 10 Control Data computer systems valued at approximately $7 million.

Digital Equip. Corp. announced that it received more than 150 orders for its newest small computer, the PDP-11, in the four days that followed its introduction.

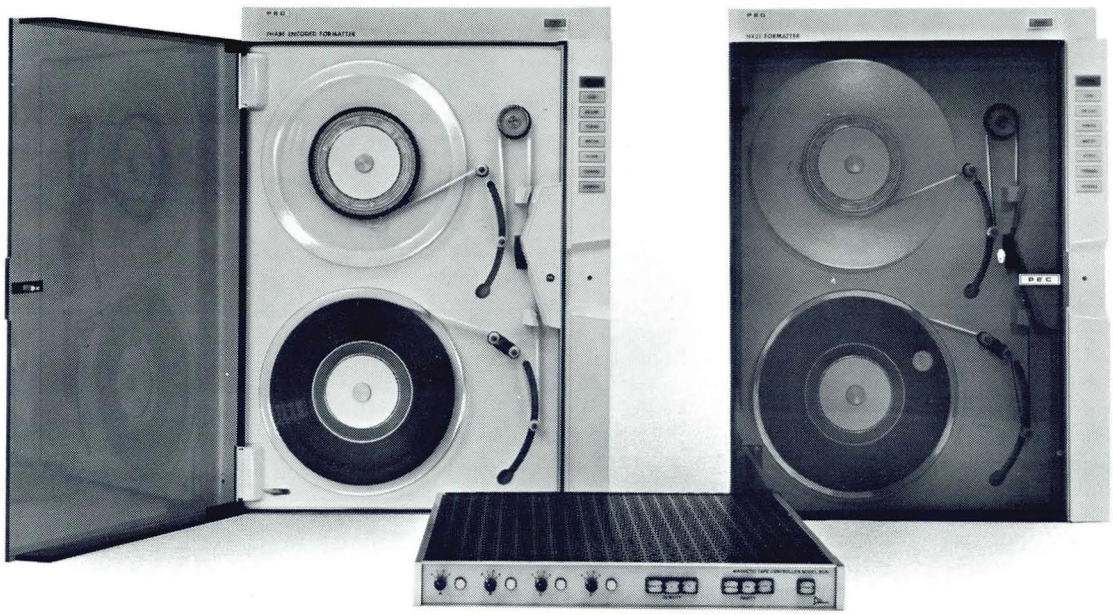
The first European installation of Digital Equipment Corp.'s small TSS-8 general-purpose time-sharing system was completed recently at Cambridge University in England. It has been installed in the school's Dept. of Applied Mathematics and Theoretical Physics and will be used primarily by students.

Applied Data Research, Inc. has leased its 1000th Autoflow automated flowcharting program to Hayden Stone, Inc. It was installed at the stock broker's data processing center in N.Y.C., where it will be used in conjunction with 2 IBM S/360 Model 50s, 2 Model 30s, and 2 IBM 1410 and Univac Model 418 computers.

Datacraft Corp. of Ft. Lauderdale, Fla., has received an initial order from Recognition Equipment Inc. of Dallas, Texas for 60 DC 6024/3 computer systems. Value of the order is approximately $3.4 million. Eventual value of the contract will approach $6 million as Recognition exercises options on an additional 50 computer systems.

Digital Development Corp. of San Diego has announced receipt of a follow-on production contract approximating $1.5 million for its DDC 73-02 series of digital rotating memory systems. The contract was received from Inventory Management Systems, Inc., of Los Angeles.

PEC's new 1600cpi and 800cpi tape units work beautifully with the same controller.



Now you can use the same magnetic tape controller for 800cpi and 1600cpi. Without redesigning the controller. And for less cost.

We've taken the formatting electronics out of our transports, included data timing functions which you normally have to provide in your tape controller and packaged the whole works in two new data formatters.

So now with a PEC formatter, your controller can handle 7 and 9-track, 800cpi NRZI and the new 9-track, 1600cpi phase-encoded ASCII and IBM compatible formats. And each of our formatters handle up to four PEC tape transports. So you don't have to pay for formatting each time you buy a tape transport.

The real bonus of course is 1600cpi capability for your system. And we offer that in our new 6600 Series tape transports — ideal for data entry systems, data communications terminals, and minicomputers. The 6600 Series has all the features such as a read-after-write, dual-stack head, a 9-track phase-encoded IBM compatible recording mode, and tape speeds from 37.5 to 12.5ips with data transfer rates to 60KHz.

And like all PEC models, our 6600 Series has a single capstan drive which minimizes tape skew for increased data reliability and longer tape life.

PEC offers the industry's most complete line of low-cost synchronous and incremental digital magnetic tape transports — all IBM compatible — with dozens of models in three reel sizes. All available from our big new plant. And sales and service centers across the U.S. and abroad.

For more information on our 800cpi and 1600cpi tape units, plug-to-plug compatible with the same controller, just write Peripheral Equipment Corporation, 9600 Irondale Avenue, Chatsworth, California 91311. (213) 882-0030

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PEC

PERIPHERAL EQUIPMENT CORPORATION

CORPORATE AND FINANCIAL

PRICE CHANGES

Stromberg DatagraphiX, Inc., a subsidiary of General Dynamics, has reduced lease prices on its Model 4060 Micromation Graphic Recorder to $6920 per month—a savings of $700 a month over the previous rate . . . **InterAccess Corp.** of Palo Alto announced a net reduction in user time-sharing prices retroactive to January 1, 1970 which lowers cost from 20 to 50 percent in some cases . . . **Honeywell's Data Products Division** announced selective price increases for its Keytape input data preparation units, effective April 1. Rental prices are being increased for most Keytape models, with the average increase being less than 4 percent. . . . . Price reductions averaging 20 percent have been announced by Xerox Data Systems for its family of System Interface Units (SIUs), standard XDS-designed electronic subassemblies used to connect XDS computers with such analog and digital input and output devices as transducers, converters, multiplexers, recorders, etc. . . . . Anderson Jacobson announced that prices on its ADC 260 and ADC 300 Acoustic Data Couplers have been reduced about 20%. The new prices are $450 and $570 respectively. The company stated that the price reductions have been made possible through increased manufacturing efficiency obtained by the production and delivery of over 6,000 units.

CORNING ENTERS MARKET

Corning Glass Works, long recognized for its outstanding research as a company with considerable potential in the EDP marketplace, has finally taken the plunge with a product from its Corning Data Systems Division. The CDS 904 time-sharing terminal (described in this month's **On-Line** column) is an interactive terminal combining the features of graphic display, hard copy, and slide overlay.

DATAGEN OF CANADA

Data General Corp. of Southboro, Mass. has formed a subsidiary computer company in Canada. The new company, to be known as Datagen of Canada Ltd., will make and sell Nova and Supernova computers and related peripherals in the Canadian market.

CTC DENIES CONSPIRACY CHARGES

CTC Computer Corp. denied all allegations made in a suit filed in San Jose by American Micro-Systems, Inc. CTC, a Palo Alto-based computer systems firm, is one of several defendants named in the complaint. According to CTC, American Micro-Systems charged in the suit that it (CTC), through its financial interests in a new company called International Computer Modules, Inc., was a part of a conspiracy which could cause AMI "great and irreparable harm." International Computer Modules, Inc., recently formed to manufacture computer MOS devices, was said to have hired four former employees of American Micro-Systems. CTC interprets AMI as charging that these employees, and CTC by its financial backing, "recruited other AMI employees," and "gave instructions to gather and make copies of AMI confidential and proprietary information for the use of the defendants." William R. Conklin, general counsel for CTC Computer Corp., denied that CTC was involved in recruiting AMI employees to join ICM. "The founders of International Computer Modules came to us seeking financial backing. They had talked with other people before they met with CTC, and the nucleus of their company was already formed before we had any involvement with them. We categorically deny that there is any basis for including CTC Computer Corporation among the defendants," Conklin said.

MERGERS AND ACQUISITIONS: **Brandon Applied Systems, Inc.**, announced an agreement in principle for its European subsidiary, **Business Intelligence Services, Ltd.**, to acquire **Industrial and Commercial Techniques Ltd.**, a business education organization with operations in Britain and continental Europe . . . **Computer Sciences Corp.** has acquired **Commonwealth Services Inc.** of New York. Acquisition of **Commonwealth Services International,** a subsidiary company, is still pending . . . **Computing and Software, Inc.** and **Pacific Plantronics, Inc.** jointly announced an agreement in principle for C & S to acquire PPI, a manufacturer of voice communication equipment. C & S also announced acquisition of **The Title Insurance Company of Idaho,** an innovator in the development and operational use of microfilm systems for retrieval of property information from data files . . . **Data Network Corp.** has announced an agreement in principle to acquire **Logistic Distro Data, Inc.** and its subsidiary, **LDD Computer Services, Inc.**, for an undisclosed amount of stock . . . **Digital Data Systems Corp.** of Pennsauken, N.J. recently announced that it had purchased the assets of **National Laser Products Ltd.**, Montreal, Canada. National Laser had been marketing DDS' Creditmaster retail credit control system . . . **Executive Computer Systems, Inc.** announced the acquisition of the business and assets of **Occidental Computer Corp.** of Riverside, Cal. . . . **Management Data Corp.** and **Gamut Systems, Inc.** jointly announced an agreement in principle providing for the acquisition of Gamut by MDC. Gamut provides a time-shared hospital accounting system . . . **National Information Systems Corp.**, a facilities management subsidiary of the **National Liberty Corp.**, has acquired a majority interest in **Mastech Computing Systems, Inc.**, a consulting, systems design, and engineering services firm located in Chicago . . . **TRAVCOM, Inc.**, a wholly-owned computer services subsidiary of the **Travelers** (Insurance) **Corp.**, has purchased the assets of **Computer Power, Inc.** of Philadelphia. Computer Power provides accounting and record keeping services for small- and medium-sized businesses . . . **Tymshare, Inc.** of Palo Alto and **Dial-Data, Inc.** of Newton, Mass. have agreed in principle to merge. T. J. O'Rourke, Tymshare's president, stated that "The merger between these privately held companies will result in the third largest time-sharing company in the country, ranking just behind General Electric's and IBM's time-sharing subsidiaries" . . . **University Computing Co.** has acquired **Micromation Systems & Services, Inc.**, former division of Micromation Technology Corp. of New York. UCC also announced acquiring **Computer Industries, Inc.** of Sherman Oaks, Cal. Computer Industries was previously a publicly-held subsidiary of UCC . . . Directors of **U.S. Time-Sharing, Inc.**, metropolitan Washington, D.C.-headquartered time-sharing services firm, and **Optimum Systems Inc.**, a Palo Alto-based computer services and software company, have agreed to merge. OSI will be the surviving company . . .

Nortec's line printer for mini computers is successfully launched.

The people who make typewriter-type printers and the people who make big-computer line printers have lost a very lucrative market:

The people who make mini computers.

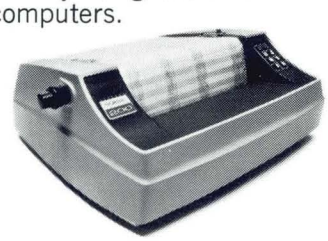
They've lost this market to the people who make a line printer especially for mini computers: Us.

Our mini line printer isn't too slow, like the typewriter-type printers.

And it isn't too expensive, like the big-computer printers.

It's just right for mini computers.

Nortec's mini line printer.



Nortec 200 is 132 columns, prints at 200 lines per minute, produces crisp type on up to 6 copies. The entire unit, with all electronics including buffer controller, easily interfaced with any computer, is as low as $6000 in large OEM quantities. It's just a little larger than an electric typewriter. The $6000 price includes these standard features: IBM-compatible vertical format unit, front-opening yoke assembly for easier forms loading and ribbon changing, self-test feature for testing electronics and mechanism. Nortec Computer Devices Inc., a Consumer + Technical Co., Ashland, Mass. 01721, (617) 881-3160.

BOX SCORE OF EARNINGS

Company	Period	Revenues	Net Earnings (Loss)	Earnings (Loss) per Share
Ampex	9 mos. 1/31/70	229,601,000	11,444,000	1.06
	9 mos. 1/31/69	207,554,000	9,620,000	.97
Appl. Data Research	Yr. 12/31/69	6,151,405	104,139	.11
	Yr. 12/31/68	4,775,230	352,849	.39
Astrodata	9 mos. 12/26/69	14,772,000	(635,000)	(.34)
	9 mos. 12/27/68	16,163,000	151,000	(.03)
Computer Exchange	6 mos. 12/31/69	2,069,878	63,889	.09
	6 mos. 12/31/68	950,555	32,859	.06
Computer Sciences	39 wks. 12/26/69	62,783,000	7,858,000	.65
	39 wks. 12/27/68	48,434,000	4,435,000	.37
Comress	Yr. 12/31/69	4,979,000	536,000	.08
	Yr. 12/31/68	3,213,000	236,000	.04
Control Data	Yr. 12/31/69	570,766,145	53,336,487	3.62
	Yr. 12/31/68	468,833,451	44,092,730	2.99
Data Design Labs.	6 mos. 12/31/69	3,300,605	124,900	.12
	6 mos. 12/31/68	2,404,376	112,480	.11
Datatron	6 mos. 12/31/69	2,673,028	197,177	.12
	6 mos. 12/31/68	2,052,743	75,683	.06
Digitronics	9 mos. 12/31/69	13,201,118	440,573	.15
	9 mos. 12/31/68	11,980,368	748,267	.25
Electronic Assoc.	Yr. 1/2/70	41,223,859	(2,222,076)	(.86)
	Yr. 1/3/69	43,917,664	245,530	.10
Elect. Memories & Mag.	Yr. 12/27/69	84,440,000	4,983,000	.87
	Yr. 12/27/68	66,168,000	3,792,000	.57
Fabri-Tek	9 mos. 12/26/69	15,025,016	399,664	.13
	9 mos. 12/27/68	11,846,491	199,277	.06
Foxboro	Yr. 12/31/69	119,625,422	4,424,103	1.05
	Yr. 12/31/68	113,374,340	2,459,176	.58
Gerber Scientific	9 mos. 1/31/70	7,145,637	539,954	.54
	9 mos. 1/31/69	5,228,039	242,927	.25
Graham Magnetics	6 mos. 12/31/69	2,330,646	135,947	.20
	6 mos. 12/31/68	1,694,610	(11,940)	(—)
Greyhound Computer	Yr. 12/31/69	49,665,000	4,566,000	1.05
	Yr. 12/31/68	38,571,000	5,434,000	1.29
Honeywell	Yr. 12/31/69	1,400,000,000	62,500,000	4.15
	Yr. 12/31/68	1,300,000,000	50,500,000	3.41
Levin-Townsend	9 mos. 12/31/69	48,894,000	(15,872,000)	(4.36)
	9 mos. 12/31/68	52,297,000	8,683,000	2.41
Mngmt. Data	9 mos. 11/30/69	5,982,340	564,478	.59
	9 mos. 11/30/68	3,384,786	308,071	.40
Memorex	Yr. 12/31/69	77,692,000	6,902,000	1.87
	Yr. 12/31/68	58,295,000	4,939,000	1.35
Milgo Electronic	3 mos. 12/31/69	2,985,000	644,000	.85
	3 mos. 12/31/68	1,378,000	230,000	.32
Mohawk Data Sciences	6 mos. 1/31/70	50,835,000	4,085,000	.75
	6 mos. 1/31/69	35,730,000	2,515,000	.46
Nat. Cash Register	Yr. 12/31/69	1,254,641,000	44,115,000	4.11
	Yr. 12/31/68	1,127,150,000	37,584,000	3.67
Programming Methods	Yr. 12/31/69	4,287,266	401,575	.48
	Yr. 12/31/68	2,309,605	248,646	.36
Redcor	6 mos. 12/28/69	4,163,200	107,900	—
	6 mos. 12/29/68	3,284,800	85,100	—
Sycor	Yr. 12/31/69	797,500	(3,638,700)	(—)
	Yr. 12/31/68	none	(1,574,800)	(—)
Sys Associates	Yr. 12/31/69	844,489	71,682	.15
	Yr. 12/31/68	277,056	(265,609)	(.82)
Technitrol	Yr. 12/31/69	13,100,000	550,000	.40
	Yr. 12/31/68	8,895,736	(135,980)	(—)
Tracor	Yr. 12/31/69	83,435,000	2,670,000	1.25
	Yr. 12/31/68	81,268,000	2,504,000	1.22
University Computing	Yr. 12/31/69	108,000,000	16,826,000	2.50
	Yr. 12/31/68	60,000,000	9,986,000	1.57
URS Systems	Yr. 10/31/69	26,400,000	1,396,000	.71
	Yr. 10/31/68	22,300,000	1,292,000	.67
Viatron Computer Sys.	Yr. 10/31/69	716,241	(9,471,615)	(3.39)
Western Union Intn'l.	Yr. 12/31/69	36,673,000	4,115,000	1.52
	Yr. 12/31/68	30,745,000	3,502,000	1.30

RECENT ENTRIES IN THE COMPUTER FIELD: **Applied Computer Marketing Corp.**, Torrance, Cal., will offer professional sales and marketing services . . . **Athena Systems, Inc.** has been formed in Bedford, Mass. to provide low-cost devices for reading existing credit cards . . . **Censtat,** a newly-formed division of Public Data Processing Corp. of Chicago (a subsidiary of Brandon Applied Systems, Inc.), will offer refined demographic statistics from the 1970 Census . . . **Com/Code Corp.** has been formed in Washington, D.C. to provide specialized software and related services in the field of structural engineering . . . **Digital Resources Corp.,** based in L.A., will comprise four subsidiaries of Scientific Resources Corp. The new company will manufacture analog/hybrid computer systems and computer peripheral equipment, offer complete seismic data processing systems, and develop specialized software for selected manufacturing and processing activities . . . **Electronic Marketing Specialists,** an OEM and peripherals manufacturers' representative firm, was recently formed with offices in three California cities . . . **Eric Knutsen Associates, Inc.,** NYC and Yorktown Heights, offers management consulting, systems design, and custom software services . . . **Katun Corp.,** a computer management company, will be headquartered in San Francisco . . . . **K/Tronic, Inc.** of Cupertino, Cal. will manufacture computer tape cassettes . . . **M & M Computer Industries, Inc.,** Orange, Cal., has been formed to develop and produce a line of digital communications and computer systems products . . . **Metacomputer Sciences, Inc.,** a "full-service" company located in Irvine, Cal., has staked out the printing and publishing industry as a special field of interest . . . **Peters Associates** Wyckoff, N.J., will act as east coast regional manager for a number of computer-oriented firms. The "new concept" company will perform all of the services a normal factory office would provide, such as training rep. salesmen and working with the reps. on major orders . . . **USS Engineers and Consultants, Inc.** will provide services in the areas of proprietary computer programs, systems design, time-sharing, batch processing, consultation, applied mathematics, and educational seminars. The company is a subsidiary of U.S. Steel Corp. . . . **Varian Associates,** Palo Alto, has formed **Varian/ADCO** to produce computer-controlled automated equipment for information storage and retrieval.

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TEC's new 520/40 Remote Batch Terminal is intelligent enough to connect with any big computer. It's programmable; you configure it the way you want it. And it performs functions the expensive terminals haven't even thought of yet.

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CIRCLE NO. 39 ON INQUIRY CARD

Harold V. Semling, Washington Editor

DC DATASCAN

TECHNOLOGY TRANSFER — Senator Jennings Randolph (D.-W.Va.), chairman of the Senate Subcommittee on Science and Technology, believes that the Federal Government has a responsibility to see that small businesses participate fully in utilizing new technologies developed at government expense. He pointed out that a third of the R&D contracts go to about ten corporations, while the entire small business community is awarded only 3½%. The result is that the advantages are highly concentrated. Sen. Randolph's subcommittee has twice called for a coordinated federal technology transfer mechanism, but, the W.Va. Senator said, "there has been no visible response to these initiatives, and, in fact, existing programs have been sharply reduced."

AIR TRAFFIC CONTROL — "A maximum commitment of American management and technological genius is essential to avoid a disastrous breakdown in the nation's air traffic control system," Rep. Jack Brooks (D.-Tex.) warns. He urged "the full resources of the nation and the cooperation of all segments of the aviation industry to support FAA efforts to perfect the air traffic control system the nation so desperately needs." Hearings by the House Government Activities Subcommittee, which he chairs, indicate that FAA's new computerized air traffic control system is 3 to 5 years behind schedule due to fund shortages, technical problems, and inadequacies in contractor support.

NEW TELECOMPLAN — President Nixon proposes to establish a new Office of Telecommunications Policy in the Executive Office of the President, abolishing the office of the Director of Telecommunications Management. The plan, which automatically becomes effective unless disapproved by one House of Congress, is considered as a move to centralize government telecommunications activities. Under the plan, the new office would have responsibilities that would include the development of government-wide standards for equipment and procedures, recommendations to the Budget Bureau concerning the funding of communications systems and R&D programs, and preparation of guidelines for the most economical procurement of federal telecommunications services.

NSF COMPUTING ACTIVITIES — The Federal Budget for F.Y. 1971 includes $511 million for the National Science Foundation, of which $4.5 million will be used for computer resources "with marked emphasis on the development of multi-institutional centers to serve major research users and innovative cooperative approaches to meeting educational and research computing requirements." The level of support for computer-oriented research and educational activities will be sustained at $10.5 million, which will enable the NSF to award approximately 175 grants for projects in computer science and computer-assisted instruction.

CONSTITUTIONAL RIGHTS — Senator Sam J. Ervin (D.-N.C.) has called upon Secretary of the Army Resor to explain reports of an Army data bank on civilians. Sen. Ervin, who is chairman of the Senate Constitutional Rights Subcommittee, said he has had many complaints about the data banks. "The Army," he believes, "has no business operating data banks for surveillance of private citizens; nor do they have any business in domestic politics." He wants to know by what legal authority the data is gathered and what relevancy the files have to the responsibilities of the Army. The Senate Constitutional Rights Subcommittee is directing similar types of queries to other federal agencies in an effort to find out how many data banks containing information on the personal lives of individuals have been developed so far, and whether constitutional rights are being respected in the construction of government information programs.

MIGRANT CHILDREN — Seven states (Arkansas, Colorado, Kansas, Missouri, New Mexico, Oklahoma, and Texas) will soon be testing a new data system designed to enable school and health officials to trace the frequent movements of migrant children. All 48 mainland states will eventually be phased into the system. Because migrant children move so frequently it has been difficult to keep track of their whereabouts, educational levels, and special needs. Extensive debugging is being done in Little Rock, Ark., where the Uniform Migrant Student Record Transfer System is being developed under a contract between the U.S. Office of Education and the Arkansas Dept. of Education. The new system is expected to be ready by July 1, at which time the seven states will be hooked into the system on a pilot basis. Other states will join the system after 6 months.

IN BRIEF

The mentally retarded should be trained in EDP and in other fields usually thought to be beyond their reach concludes a study done by the President's Committees on Mental Retardation and Employment of the Handicapped.

A 141-page review of the literature (1962-1968) on chemical structure information handling has been published by the National Academy of Science, 2101 Constitution Avenue, N.W., Washington, D.C. 20418. It may be purchased for $5.75.

NASA has published a "Grant Handbook," which prescribes policies, procedures, and regulations relating primarily to the award and administration of its research grants. The handbook will be amended by the issuance of loose-leaf changes containing revisions or additions. It can be purchased for $4.50 a copy from the:

Supt. of Documents,
U.S. Government Printing Office,
Wash., D.C., 20402.

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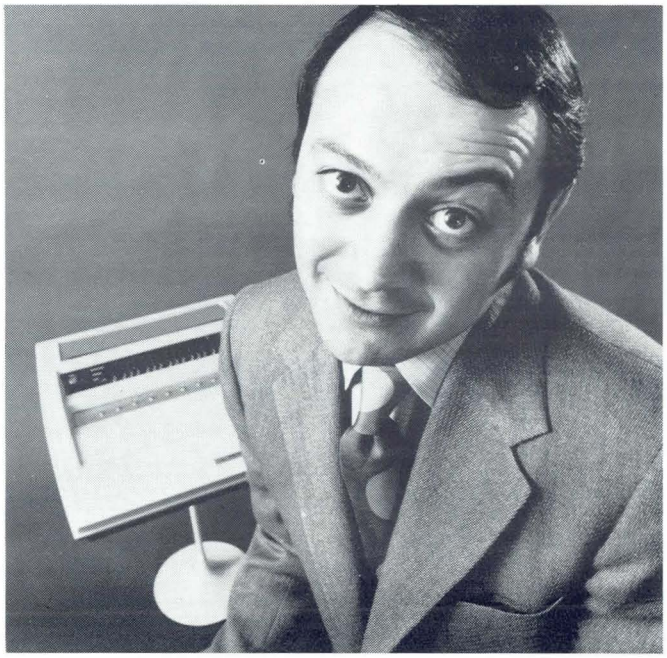

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COMPUTER STOCK TRENDS

	COMPANY	EXCH.	VOL. (SHARES IN 100's)	1970 HIGH	1970 LOW	PRICE 3-6-70	NET CHG. FROM MONTH AGO	EARN./SHR. (LATEST 12 MONTHS)	P/E RATIO
SUPPLIES & ACCESSORIES	ACME VISIBLE RECORDS	OTC	--------	47.0	31.0	38.0	– 1.0	1.88	20
	ADAMS MILLIS	NY	430	22.3	11.2	13.4	1.5	0.96	13
	BALTIMORE BUS. FORMS	OTC	--------	27.4	16.0	17.0	– 1.4	0.92	18
	BARRY WRIGHT	AM	734	29.2	13.3	15.2	– 3.0	0.86	17
	CAPITOL INDUSTRIES	AM	374	56.2	29.0	46.7	3.7	1.82	25
	DATA DOCUMENTS	AM	356	44.4	26.0	32.5	2.3	1.77	18
	DATA PACKAGING	OTC	--------	30.2	17.6	22.4	– 0.4	0.77	29
	DENNISON MFG.	NY	1044	54.7	16.5	19.1	0.5	1.53	12
	DUPONT	NY	2583	165.4	92.4	99.1	3.0	7.35	13
	ENNIS BUS. FORMS	NY	299	19.0	15.2	16.6	– 1.0	0.92	17
	GENERAL BINDING	OTC	--------	43.0	25.4	27.0	– 2.0	0.76	35
	GRAPHIC CONTROLS	OTC	--------	28.6	13.6	14.4	– 0.4	1.10	12
	LEWIS BUS. FORMS	OTC	--------	23.0	16.0	16.6	0.0	0.86	18
	MEMOREX	NY	6975	173.7	65.0	122.5	2.3	1.83	66
	3 M	NY	3110	118.4	94.0	106.4	6.2	3.21	33
	MOORE CORP. LTD.	TSE	--------	38.0	34.5	36.2	2.2	1.26	29
	REYNOLDS & REYNOLDS	OTC	--------	48.4	30.0	47.0	3.4	1.27	37
	SAFEGUARD INDUSTRIES	AM	616	25.4	10.0	16.0	1.4	0.52	30
	STANDARD REGISTER	OTC	--------	31.0	23.0	28.6	– 0.2	1.93	14
	UARCO	NY	217	39.2	25.3	36.4	– 1.0	2.21	16
	WALLACE BUS. FORMS	OTC	--------	40.4	27.4	40.0	3.2	2.16	18
SOFTWARE & SERVICES	APPLIED DATA RESEARCH	AM	2786	40.0	9.4	10.2	– 8.6	0.16	62
	APPLIED LOGIC	OTC	--------	24.4	10.2	10.2	– 4.4	0.07	146
	ARIES	OTC	--------	19.0	3.3	4.0	– 0.4	-------	----
	AUTOMATIC DATA PROC.	AM	1911	47.6	21.7	41.4	– 1.7	0.56	73
	BOLT, BERANEK & NEWMAN	OTC	--------	19.0	7.4	11.0	1.4	0.32	34
	BOOTHE COMPUTER	OTC	--------	45.4	20.6	23.4	2.4	1.62	14
	BRANDON APPLIED SYS.	OTC	--------	17.0	5.2	5.2	– 1.2	-------	----
	COMPUTER APPLICATIONS	AM	608	21.7	6.0	8.6	0.6	(d)1.74	----
	COMPUTER ENVIRONMENTS	OTC	--------	16.0	6.4	12.4	0.0	-------	----
	COMPUTER EXCHANGE	OTC	--------	18.0	4.0	6.4	0.2	0.08	75
	COMPUTER INVESTORS	AM	509	25.0	7.6	9.0	– 1.4	0.41	21
	COMPUTER METHODS	OTC	--------	12.4	1.2	1.6	0.2	-------	----
	COMPUTER PROPERTY	OTC	--------	15.0	9.0	14.6	1.4	0.76	19
	COMPUTER SCIENCES	NY	9163	34.6	19.4	24.0	– 4.2	0.74	32
	COMPUTER TECHNOLOGY	OTC	--------	36.0	5.2	6.3	– 0.1	0.12	50
	CTC COMPUTER	OTC	--------	24.0	14.0	13.4	0.4	-------	----
	COMPUTER USAGE	OTC	--------	40.0	5.4	6.0	– 0.6	(d)1.58	----
	COMPUTING & SOFTWARE	AM	1501	75.6	37.0	61.6	– 7.4	1.19	51
	COM-SHARE	OTC	--------	23.0	11.4	11.0	– 3.2	-------	----
	CYBER-TRONICS	OTC	--------	15.0	7.0	12.6	– 0.2	0.11	109
	CYBERMATICS	OTC	--------	15.0	6.4	14.0	3.4	-------	----
	DATA AUTOMATION	OTC	--------	30.2	13.0	19.6	2.6	-------	----
	DATA DYNAMICS	OTC	--------	16.0	3.4	3.7	0.0	-------	----
	DATA NETWORK	OTC	--------	10.4	2.0	2.5	– 0.2	-------	----
	DATA PROC. FIN. & GEN.	AM	1787	60.2	19.6	24.7	1.5	2.66	9
	DATA SYSTEMS ANALYSTS	OTC	--------	11.0	2.4	5.0	0.2	0.06	83
	DATRONIC RENTAL	OTC	--------	16.0	4.4	5.6	– 2.0	-------	----
	DEARBORN COMPUTER	AM	405	52.6	18.0	18.6	– 2.4	2.11	8
	DECISION SYSTEMS	OTC	--------	8.6	3.0	3.4	– 0.4	-------	----
	DIGITAL APPLICATIONS	OTC	--------	15.0	3.0	5.0	0.6	-------	----
	DIGITEK	OTC	--------	15.0	2.7	4.4	1.5	-------	----
	DPA, INC.	AM	527	13.5	6.4	7.1	– 0.6	0.86	8
	EFFICIENT LEASING	OTC	--------	15.4	2.4	4.6	1.2	-------	----
	ELEC. COMP. PROG. INST.	AM	277	38.2	7.6	10.3	1.1	0.14	71
	ELECT. DATA SYSTEMS	OTC	--------	157.0	34.0	157.0	13.0	0.39	402
	GREYHOUND COMPUTER	AM	371	28.5	11.4	12.4	0.6	1.05	11
	INFORMATICS	OTC	--------	30.2	11.0	16.4	0.4	0.09	177
	INTL. COMPUTER	OTC	--------	17.0	3.4	7.0	3.4	0.07	100
	INTL. COMPUTER SCIENCES	NAT	--------	7.7	2.2	2.5	0.1	0.20	13
	LEASCO	AM	5947	54.0	16.4	20.7	– 0.2	2.71	7
	LEVIN-TOWNSEND	AM	2396	57.4	9.6	12.4	– 0.6	4.03	2
	LMC DATA	OTC	--------	8.2	1.6	2.6	0.1	(d)0.01	----
	MGMT. ASSISTANCE	OTC	--------	14.7	2.0	3.1	0.0	(d)2.07	----
	NATIONAL COMP. ANAL.	OTC	--------	22.0	4.4	7.4	0.6	-------	----
	PLANNING RESEARCH	NY	1584	53.2	23.7	45.4	1.5	0.68	66
	PROGRAMMING METHODS	OTC	--------	27.0	13.0	22.4	0.4	-------	----
	PROGRAMMING SCIENCES	OTC	--------	37.0	11.4	29.0	– 1.4	-------	----
	PROGRAMMING SYSTEMS	OTC	--------	11.4	3.2	4.4	0.2	0.16	25
	SCIENTIFIC COMPUTER	OTC	--------	8.4	2.4	3.3	– 0.1	0.12	25
	SCIENTIFIC RESOURCES	NY	2296	26.4	9.4	9.5	– 1.7	(d)0.78	----
	STRATEGIC SYSTEMS	OTC	--------	37.0	2.3	2.6	– 0.4	-------	----
	SYSTEMS CAPITAL	OTC	--------	34.0	5.0	5.4	0.0	-------	----
	TIME SHARE	OTC	--------	13.4	5.3	5.6	– 0.1	0.13	38
	URS SYSTEMS	OTC	--------	31.2	17.1	21.6	– 2.6	0.56	37
	UNITED DATA CENTERS	OTC	--------	7.0	3.2	5.0	0.0	-------	----
	UNIVERSITY COMPUTING	NY	6080	155.0	55.0	50.7	–12.0	2.50	20
	U.S. TIME SHARING	OTC	--------	16.0	5.2	9.4	– 2.0	-------	----

(d) Deficit
* New listing in this issue

All security prices and net change are expressed in dollars and 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)	1970 HIGH	1970 LOW	PRICE 3-6-70	NET CHG. FROM MONTH AGO	EARN./SHR. (LATEST 12 MONTHS)	P/E RATIO
PERIPHERALS & COMPONENTS	AMP	NY	1932	59.0	32.5	52.2	– 0.6	1.89	27
	AMPEX	NY	3809	49.7	32.4	34.3	– 6.4	1.44	23
	APPLIED MAGNETICS	OTC	-------	24.6	11.2	24.4	1.4	0.39	61
	ASTRODATA	AM	3026	36.3	10.1	10.5	– 4.5	(d)0.23	----
	ASTROSYSTEMS	OTC	-------	13.4	5.6	6.6	0.4	0.34	17
	BUNKER-RAMO	NY	3194	17.5	9.4	12.7	– 0.3	0.53	22
	CALCOMP	AM	2919	37.4	18.2	28.5	3.3	0.31	90
	CHALCO ENGRG.	OTC	-------	8.4	3.0	3.2	–1.6	-------	----
	CODEX	OTC	-------	47.4	15.0	20.4	– 3.0	0.26	76
	COGAR	OTC	-------	94.0	57.0	79.0	6.0	(d)1.27	----
	COGNITRONICS	OTC	-------	38.4	11.4	11.0	– 1.0	(d)0.22	----
	COLLINS RADIO	NY	1464	69.6	20.4	23.5	– 2.0	1.66	13
	COMCET	OTC	-------	50.0	27.0	38.0	– 1.0	-------	----
	COMPUTEST	AM	458	33.5	14.2	22.2	– 1.5	0.64	34
	COMPUTER COMM.	OTC	-------	48.0	30.0	32.0	5.0	-------	----
	COMPUTER CONSOLES	OTC	-------	26.0	8.0	17.2	– 1.2	-------	----
	COMPUTER INDUSTRIES	OTC	-------	52.0	12.0	22.0	0.0	-------	----
	CONRAC	NY	369	59.3	20.3	23.1	– 1.7	1.26	18
	DATA 100	OTC	-------	19.0	13.2	13.2	– 2.2	-------	----
	DATA PRODUCTS	AM	3867	27.7	12.3	18.5	– 3.3	0.35	51
	DATARAM	OTC	-------	16.4	8.4	14.0	3.4	(d)0.46	----
	DATASCAN	OTC	-------	32.0	15.0	21.4	– 3.4	-------	----
	DIGITRONICS	OTC	-------	22.4	9.2	9.2	– 3.6	0.18	50
	ELEC. ENGRG. OF CAL.	AM	89	28.3	10.0	11.0	– 0.3	0.10	110
	ELEC. MEMORIES & MAG.	NY	3021	42.3	21.4	29.2	– 6.4	0.87	33
	EXCELLO	NY	1210	37.3	22.0	26.3	3.4	2.63	9
	FABRI-TEK	OTC	-------	12.7	5.5	6.5	– 0.3	0.16	40
	FARRINGTON MFG.	OTC	-------	37.4	13.0	13.4	0.0	(d)0.06	----
	GERBER SCIENTIFIC	AM	293	39.3	20.2	33.2	– 1.6	0.68	48
	GRAPHIC SCIENCES	OTC	-------	70.0	23.4	24.4	– 5.4	(d)1.37	----
	HI-G	AM	-------	33.4	9.5	15.6	6.0	-------	----
	INFORMATION DISPLAYS	OTC	-------	21.4	9.4	18.2	1.6	-------	----
	ITEL	AM	-------	37.5	14.2	16.3	4.1	0.86	19
	LOGIC CORP	OTC	-------	23.0	7.0	11.0	– 1.6	-------	----
	MILGO	AM	6691	84.4	17.7	68.7	– 1.3	0.74	91
	MOHAWK DATA SCIENCES	AM	4175	89.1	59.6	65.0	–11.2	1.29	50
	NORTH ATLANTIC IND.	OTC	-------	22.0	5.4	7.0	0.6	-------	----
	OPTICAL SCANNING	OTC	-------	118.0	36.0	36.0	–11.0	(d)0.45	----
	POTTER INSTRUMENT	AM	4333	46.0	23.6	39.4	6.4	0.85	45
	RECOGNITION EQUIP.	OTC	-------	76.0	52.0	57.0	–14.4	(d)0.51	----
	SANDERS ASSOCIATES	NY	1479	61.7	16.2	18.5	– 3.1	0.59	30
	SANGAMO	NY	1485	43.4	19.2	24.0	– 2.2	0.60	40
	SCAN-DATA	OTC	-------	85.0	27.0	30.0	– 5.0	-------	----
	SEALECTRO	AM	159	15.6	6.6	8.4	– 1.0	0.20	40
	*SYKES DATATRONICS	OTC	-------	9.0	7.2	7.2	-------	-------	----
	TALLY	OTC	-------	36.0	15.0	21.4	2.4	(d)2.73	----
	TELEX	AM	6000	111.6	20.6	107.0	0.0	1.74	61
	TEXAS INSTRUMENTS	NY	3432	140.2	94.6	116.2	– 9.0	3.06	37
	TRACOR COMPUTING	OTC	-------	7.4	5.2	6.2	0.2	(d)0.47	----
	VARIFAB	OTC	-------	13.0	4.4	4.0	0.0	-------	----
COMPUTERS	BURROUGHS	NY	4575	172.6	120.6	145.5	– 8.3	3.32	43
	CONTROL DATA	NY	8838	159.2	58.0	63.7	– 5.1	3.19	19
	DATACRAFT	OTC	-------	20.0	6.0	14.4	0.4	-------	----
	DIGITAL EQUIPMENT	AM	2853	124.0	54.4	100.4	–14.2	1.06	94
	ELECTRONIC ASSOCIATES	NY	769	25.2	7.5	9.4	1.1	(d)0.86	----
	GENERAL ELECTRIC	NY	7632	98.2	67.5	74.3	4.2	4.21	17
	*GENERAL AUTOMATION	OTC	-------	42.0	33.4	33.4	-------	(d)0.63	----
	HEWLETT-PACKARD	NY	1955	114.5	75.2	94.2	– 6.4	2.02	46
	HONEYWELL	NY	2919	157.2	107.6	128.6	– 6.2	4.15	30
	IBM	NY	6293	387.0	291.6	325.2	–19.4	8.21	39
	LITTON INDUSTRIES	NY	5708	74.4	24.3	26.6	1.0	2.36	11
	NCR	NY	3132	171.6	108.0	136.3	– 6.1	4.11	33
	RCA	NY	9231	48.1	29.2	32.1	1.6	2.44	13
	RAYTHEON	NY	6770	50.2	26.4	27.6	– 1.6	2.35	11
	REDCOR	OTC	-------	49.0	25.0	33.4	7.0	0.14	235
	SCIENTIFIC CONTROL	OTC	-------	43.4	1.5	5.4	– 2.2	(d)2.43	----
	SPERRY RAND	NY	5293	55.4	33.6	37.2	1.1	2.27	16
	SYSTEMS ENGRG. LABS	AM	2064	53.7	26.1	36.2	– 7.2	0.76	47
	SYSTRON DONNER	AM	163	32.3	13.5	22.0	0.4	1.07	20
	VARIAN ASSOCIATES	NY	4291	37.2	22.6	26.6	1.4	0.93	27
	VIATRON	OTC	-------	58.0	14.2	31.6	– 6.0	(d)0.83	----
	WANG LABS	AM	1723	61.4	36.6	43.5	1.7	0.77	55
	WYLE LABS	AM	1290	20.2	6.3	7.2	0.0	0.53	13
	XEROX	NY	12165	115.6	85.0	93.6	– 8.7	2.03	45
AVERAGES	COMPUTER STOCKS			47.2	22.4	30.2	– 2.8%	0.95	31.5
	DOW JONES INDUSTRIALS			811.31	744.06	784.12	4.1%	3.58	13.8

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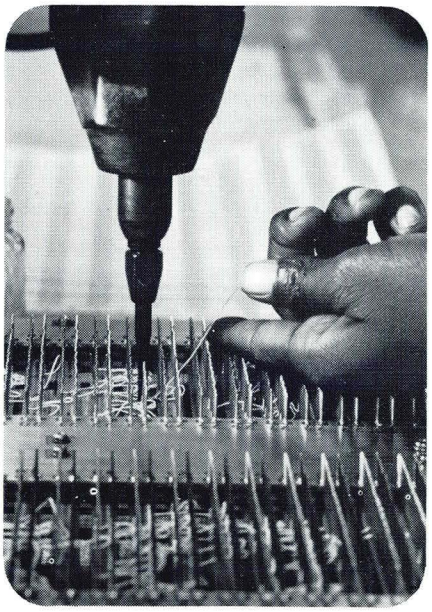

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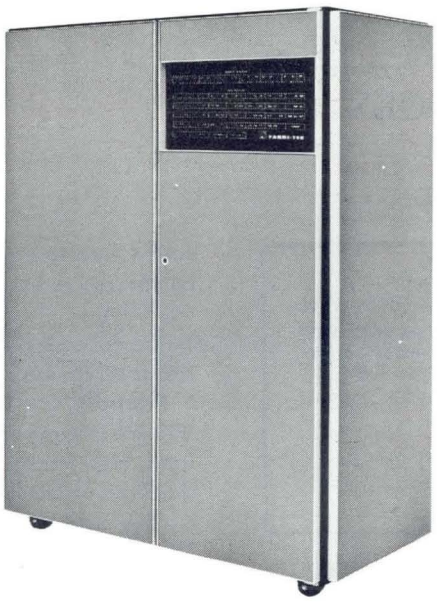

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STOCK TALK

FAST-FOOD 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.

Address questions to:
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As American culture has progressed further and further away from the stay-at-home style, and as the pace of mid-twentieth century life has quickened, the trend toward convenience products has pushed the fast-food industry to near the top of the list of the nation's fastest growing markets. Each year a greater proportion of personal income is classified as "discretionary spending power," and an ever-expanding part of this pocket money is being spent to feed the public away from home and usually on the run.

Fast-food service outlets range all the way from completely "take out" stores to "eat in" units, with a myriad of variations in between. Usually these establishments offer a limited or single-item-centered menu, for reasons of market impact as well as physical simplicity of output. In order of predominance, hamburgers are the favored item (35%) followed by ice cream and fried chicken (roughly 20% each), and hot dogs, donuts, pizza, and roast beef-steak at about 4% each.

In the last few years there has been an explosion of franchising in virtually every fast-food specialty and, until 1969, the stocks of these publicly-held entries were selling almost as fast as the hamburgers and donuts themselves. By last spring however, a combination of tight money and analysts' fears of over-saturation had begun to take its toll on the group's stocks.

Celebrities in all phases of public life were lending their names to a new chain. Joe Namath, Al Hirt, and Johnny Carson are but a few. The less established chains have seen their stocks skyrocket and then often plummet to half of the original offering price. The industry giants have moved in sympathy although less sharply, of course.

Basically, industry analysts feel a period of digestion is in order, one which will probably see a number of smaller chains fading out or being eaten up by bigger names. Despite the discomfort among those directly hurt, the overall industry will continue to grow a pace. For the present, it seems wise to concentrate commitments in well-established companies rather than to try to pick the long-shot recovery candidates.

The following is a review of three of the representative fast-food companies and their stocks.

Friendly Ice Cream Corp. operates a chain of over 200 ice cream and sandwich shops in central New England, New York, and New Jersey. Each shop offers a standardized menu featuring hamburgers, soups, fountain specialties, and a variety of ice cream dishes in many flavors. The company has sought to make "Friendly's" a household word by providing predictably friendly, speedy service in cheerfully decorated, spotless surroundings. Effective control over all aspects of the operation has been established through a non-franchising policy and heavy emphasis on the provision of in-house services from the company headquarters in Wilbraham, Massachusetts.

The stock of this company was first offered to the public in August, 1968 at $28 per share and was split 2-for-1 twelve months later. Of the 3,355,000 shares outstanding after the split, only about 15% are publicly held, with the balance being held by S. Prestly Blake and Curtis L. Blake (combined, almost ⅔), and by various other management and shop managerial personnel.

In November, the company filed a registration for a 570,000 share combined offering, including 150,000 shares for new financing. The stock has reacted to this and to the general market decline by slipping from its 1969 high of 36 bid. However, management capability plus tight control of completely non-franchised operations should enable the company to out-pace the industry and avoid the possible pitfalls envisioned for the lesser competition. Shares are attractive for long-term participation in an expanding field.

Probably the single most established name in the franchising restaurant field is **McDonald's Corp.** Presently there are over 1200 outlets in operation and plans call for the opening of at least 100 annually through 1972. About 85% of the outlets are independently-operated franchises on which the company receives rentals based on a percentage of sales, with a fixed minimum annually. Because of the nationwide scope of the business (forty-eight states plus Canada, Puerto Rico, and the District of Columbia), the company does not attempt to supply food items or supplies, but has maintained an extensive inspection program to insure high quality. The company is also creating and staffing an international operations division which is expected to open its first restaurant outside the United States in 1971. Revenues have risen 10-fold since 1962 and

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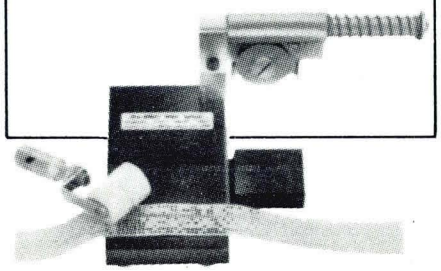
earnings have grown consistently at 30%-40% per annum. 1969 net should be $1.10-$1.15 per share versus $0.83 in 1968. A further gain to $1.40 is projected for 1970. While the stock is not cheap on a price-to-earnings ratio, it probably will continue to command a relatively high multiple based on uninterrupted growth foreseen in next several years.

Another large fast-food franchiser is **Kentucky Fried Chicken.** This company has developed a system of over 2700 units (largely franchisee-owned) specializing in the preparation and sale of its famous "Colonel Sanders' Recipe Kentucky Fried Chicken." Kentucky sells operators virtually every raw material and equipment item except the chicken, which is locally supplied for reasons of convenience and health. The chicken is prepared in accordance with a unique secret process involving a precise combination of heat, pressure, and working time.

In April, 1969, the company acquired, for common stock, Salt's Enterprises, an operator of 91 English Fish & Chips units. The company recently acquired Empire Plastics, Inc. an out-door sign fabricating concern, and on February 9, 1970 the company announced that its Colonel Sanders Inns, Inc. unit had acquired Tropicana Inn, a 206-room motel. Thus Kentucky is not only expanding its franchise operations but is also diversifying into other areas.

IDEAL

TAPE SPLICER



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The company estimates that full-year 1969 sales should climb to $160 million with per share earnings reaching $1.25. Prospects for further gains in revenues and net in fiscal 1970 should continue to earn the stock its historically high price-to-earnings ratio. Shares represent an attractive growth speculation for the long pull.

INCOMING MAIL

Q) I am interested in Bunker-Ramo stock. I would appreciate your opinion on this company's future. M. B.

A) Bunker-Ramo has been unable to buck the market downtrend despite an apparent earnings turnaround. For the nine months ended September, 1969, share earnings rose to $0.41 on a 6.4% increase in sales. Full-year earnings are expected to approximate $0.53 per share versus $0.35 in 1968. The combined companies derive over 50% of sales from electronics components and the remainder from computer-based systems, numerical controls, and deep-pile fabrics. The company holds contracts to supply terminal equipment for the Big Board's new Block Automation System and to build and operate a new quotation system for O-T-C securities similar to the already established Telequote System. In February, 1969, one such system became operative and another is expected to in 1970. Competition is increasing in some of BR's important product areas. However, a combination of earnings recovery and potential for the company's newer systems gives the shares long-term speculative appeal.

Q) We have shares of Phillips Petroleum. Would you advise us to sell? What is the company's future outlook? E.B.

A) Despite an improved third and fourth quarter, Phillips Petroleum reported a slight decline in full-year 1969 earnings to $1.73 from $1.78. Weak prices in some segments and plant start-up costs were adverse influences and narrowed profit margins for much of 1969. However, future prospects are encouraging. The company has one of the strongest positions, among the major domestic oils, in natural gas produced per common share. Thus, an increase in natural gas prices would greatly benefit Phillips, and with the recent reduction in the depletion allowance, the FPC is hard-pressed by the industry to do just that. Phillip's Artic Slope holdings could boost future earnings. Significant output from this area would lessen or even abolish the company's costly crude purchases presently required to meet the demand of its West Coast marketing territory. In the meantime, the objectives set forth by the new president may spark a reawakening for Phillips: exploration and profits are expected to be stressed. Shares may be held.

Q) I have a substantial number of shares in Diversified Growth of the Anchor Group. There has been a shrinkage in value. Are they worth holding? D.F.

A) Diversified Growth, like many of the other speculative growth funds, found the going quite rough in the 1969 market slump. In fact, for the first time in 6 years, this fund suffered a loss — 16.4%. While this drop in value is somewhat larger than the average decline of all growth funds, gains in prior years amply offset this. In rising markets such as 1967 and 1965, your fund achieved a 52% and 39% gain, respectively. A five-year record, 1964-1969, for Diversified Growth shows a total gain of 78%. Although this mutual fund has an above-average growth rating, its speculative portfolio is susceptible to market downturns. Given an improved market climate, this fund should work out. ▲

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CIRCLE NO. 44 ON INQUIRY CARD

CORPORATE PROFILE

Featured this month:

DATATRON INCORPORATED (over-the-counter)

1562 Reynolds Avenue
Santa Ana, Cal. 92705

OFFICERS AND DIRECTORS: **Arthur L. Purcilly,** Pres. and Chairman of the Board; **Dale E. Bevard,** Secretary/Treasurer; **Clyde J. Davis, Jr.,** V. Pres.-Marketing and Director; **Donald L. Degraffenreid,** V. Pres.-Engineering and Director; **William D. Mansfield,** V. Pres.-Manufacturing and Director; **Charles H. Minich,** Director; and **Leona M. Minich,** Director.

BACKGROUND: Datatron Inc. was formed in May 1967 to manufacture digital data products and timing instrumentation. The company soon added production of IBM compatible disk packs, video broadcast and radio control equipment, plus digital module testers. It also established a major division providing high volume testing of microelectronic parts for customers on a portal-to-portal basis.

Major emphasis today is upon producing high-performance, IBM-compatible disk packs, electronic test equipment, video broadcast control units, timing instrumentation, plus digital data systems. Newest major product developments include memory drums and disk packs for use in large data processing centers, a "Vidicue 5000" video tape editing and control system for broadcaster and production facility use, and a high-speed computer-controlled digital module tester. Latest significant financial event was a Feb. 28, 1970 100% stock dividend.

FACILITIES: The corporate headquarters are located in Irvine Industrial Complex, Santa Ana, Cal. By late summer 1970, a new addition will have increased its square footage from 23,000 to 44,600. This building accommodates 150 employees. Counting all divisions, Datatron employs 470 persons, and total square footage is 102,000.

Sales are made through the company's own sales force and by 19 manufacturers' representatives. Product and service offices are located in Santa Ana and Washington D. C. Customers total 150, with none accounting for more than 5% of total revenue.

PRODUCTS: The company's major products are ■ IBM-compatible, 6-high and 11-high disk packs, ■ computer-controlled digital module testers for firms desiring in-house component testing ability, ■ video broadcast control equipment with applications in program editing and preparation, ■ timing instrumentation to tag data for later correlation and indexing, plus ■ data acquisition and reduction systems for research and production use.

The company's divisions include: **Microelectronic Testing Laboratories; HFS Manufacturing; Shelly Associates Inc.; Bouse Manufacturing; Orbit Electronics; Micro-Avionics; and Nova Circuits.**

HFS's Datakote Division applies a proprietary nickel/cobalt coating instead of conventional iron oxide to its disk packs, thereby increasing packing density three to four times. **Shelly Associates** manufactures visual display components used primarily in computer peripheral equipment. **Nova Circuits** produces printed circuit boards and is mainly short-run and prototype oriented. **Bouse Manufacturing** develops electronic chassis, computer-type consoles, and equipment enclosures. **Orbit Electronics** and **Micro-Avionics** produce electromechanical devices for remote radio control of model airplanes, boats, and race cars. Recent applications include remote control of bulldozers in hazardous terrain and operation of movie cameras mounted on cars in filming the movies, "Grand Prix" and "The Winners." Micro-Avionics produces similar, yet lower-cost equipment.

Latest Datatron product is its "Vidicue 5000" tape editing and control system. Used in a broadcast or production facility, this unit enhances quadraplex VTR use by providing precise, economical control of program and commercial construction. Selling at approximately $36,000 each, the Vidicue frees a TV station's $100,000-plus recorder from routine tasks.

Another recent Datatron product is its computer-controlled digital module tester. This unit performs automatic functional check-out of integrated circuits, large scale arrays, printed circuit cards, and complete subsystems. Its internal computer provides flexibility in both testing and test-result logging. The system generates and monitors test patterns at rates up to 50,000 tests per second, enabling up to eight different test stations to be muliplexed, while 16 procedures or programs can be simultaneously stored. The standard system handles up to 100-pin devices, with expansion possible to 256 pins.

OUTLOOK: According to Datatron President, Arthur L. Purcilly, "the second half of fiscal 1970 should reflect substantial market penetration with the new IBM-compatible

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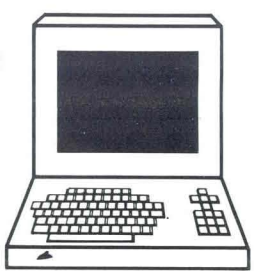

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disk packs, the computer-controlled IC tester, and the Vidicue electronic video tape editor." Purcilly believes that Datatron sales in microelectronic testing equipment and services should parallel the sales growth of miniaturized components and the increasing demand for component pre-screening. The firm only recently entered into production and marketing of IBM-compatible disk packs. Regarding this, Purcilly says, "our sales in this area alone should reach an annualized rate of $3 million by June 30. The national disk pack market is an estimated $300 million." Purcilly says Datatron plans on becoming a large corporation through internal growth and acquisition of other electronic manufacturing companies. He intends such growth not to be conglomerate but "congeneric," meaning all companies and products interrelate in one general field. While government sales totaled 70% in fiscal 1968, the company reduced this percentage to 46% in fiscal 1969 and expects further reductions to levels nearer 20% during the current fiscal year.

FINANCIAL SUMMARY: On March 14, 1969, Datatron made its first public offering of 200,000 shares at $7.50 per share. The offering was over-subscribed. In early January of 1970, the price had reached a high of $36. On February 28, a 100% stock dividend was paid, splitting the stock two for one. The company has announced its intentions of qualifying for a listing on the American Stock Exchange.

Total average shares outstanding are 1,647,604 with 440,000 publicly owned. Five million shares are authorized. First-half figures for fiscal 1969 show profits up 254% and sales increasing 218% over the same period last year. Two recent events have provided additional working capital for continued Datatron growth: (1) A million dollar private placement of lettered common stock, and (2) establishment of a million dollar bank line of credit.

As shown below, Datatron earnings per share during fiscal 1969 rose 500%, while net income increased by 626%. The company's fiscal year ends June 30.

Fiscal Year	Revenue	Net Income	Net Income Per Share
1968	$ 736,370	$ 28,033	$0.06
1969	2,179,227	203,672	0.36
1st half 1970**	2,673,028	197,177	0.12*
1st half 1969**	2,052,743	75,683	0.06*

*Adjusted to reflect 2-for-1 stock split to shareholders of record January 30, 1970.

**Includes Shelly Associates, Inc., Bouse Manufacturing Co., Inc., and Nova Circuits on a pooling of interest basis and the purchase of Orbit Electronics, Inc., effective July 14, 1969.

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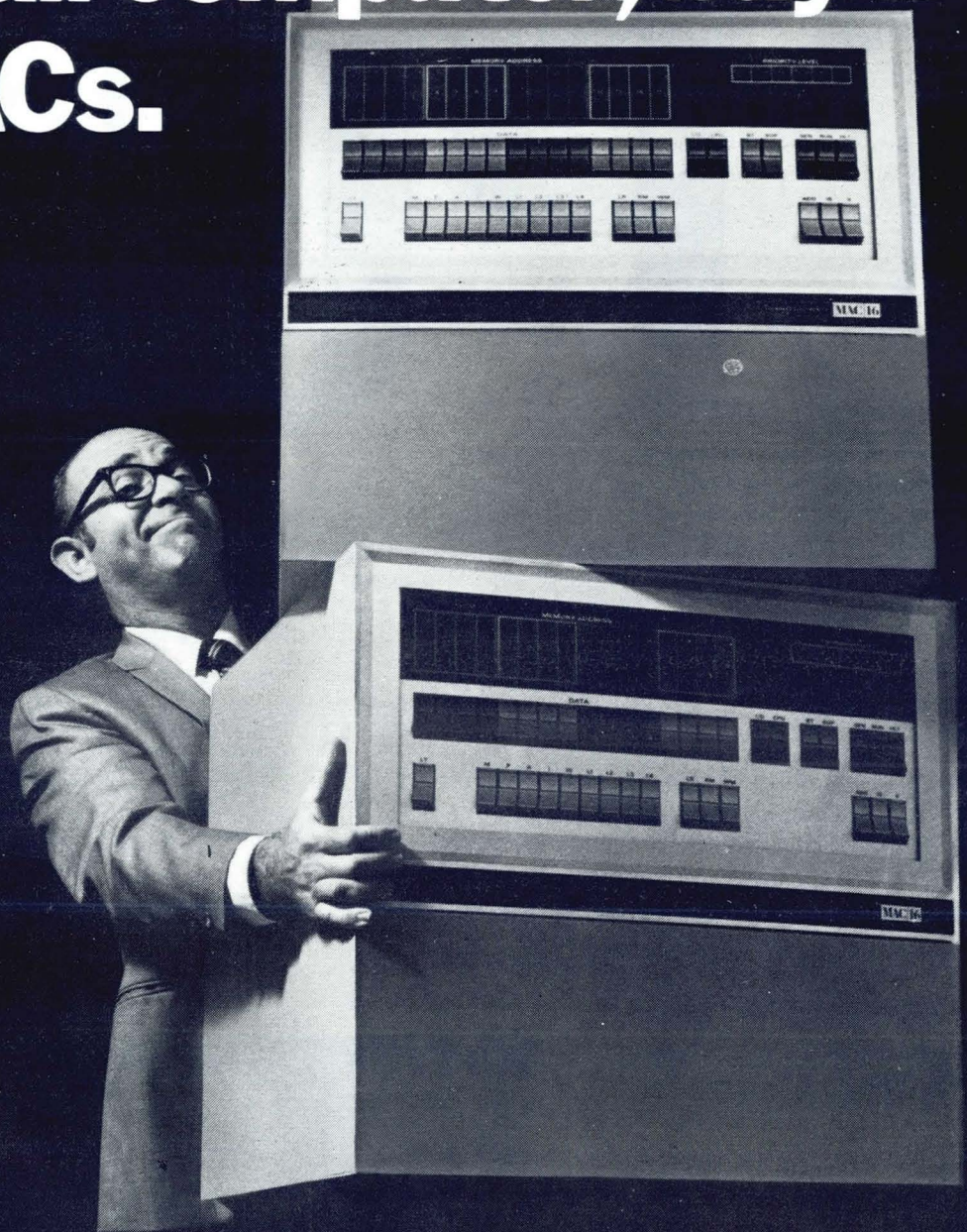

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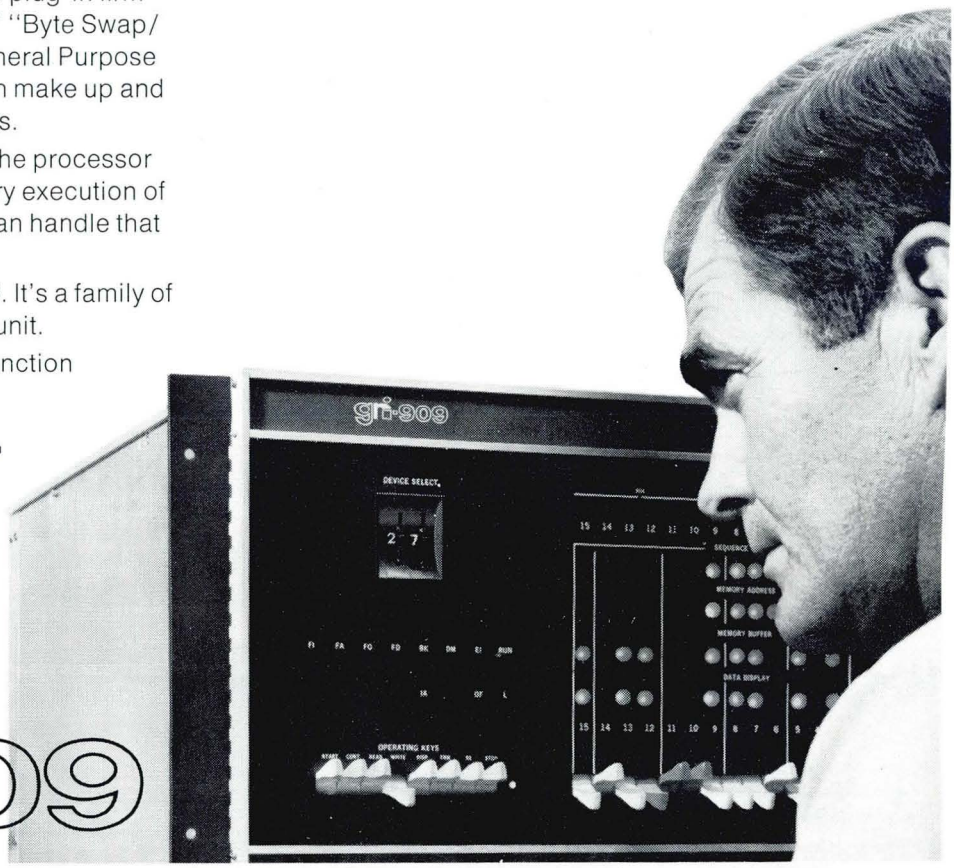

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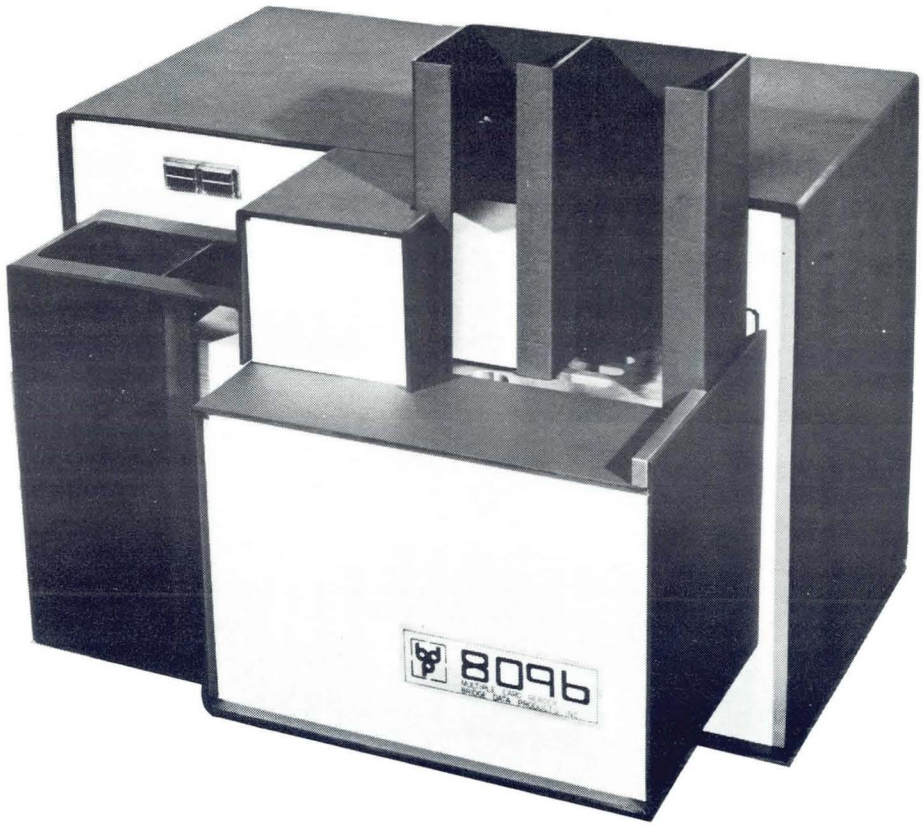
New: 80/96 multiple-card card reader



makes obsolescence obsolete.

Feeds, reads, and stacks the 96 column IBM System/3 card, and the 80 column card and its stub varieties.

Handles 96 column card at 500 CPM, 80 column at 300 CPM and its stub varieties at over 400 CPM.

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Desk-mountable unit measures less than 24″ high, 24″ deep and 26″ wide, weighs less than 50 lbs.

Unit is also offered in single capability versions for 96 column cards, 80 column cards, and stub varieties.

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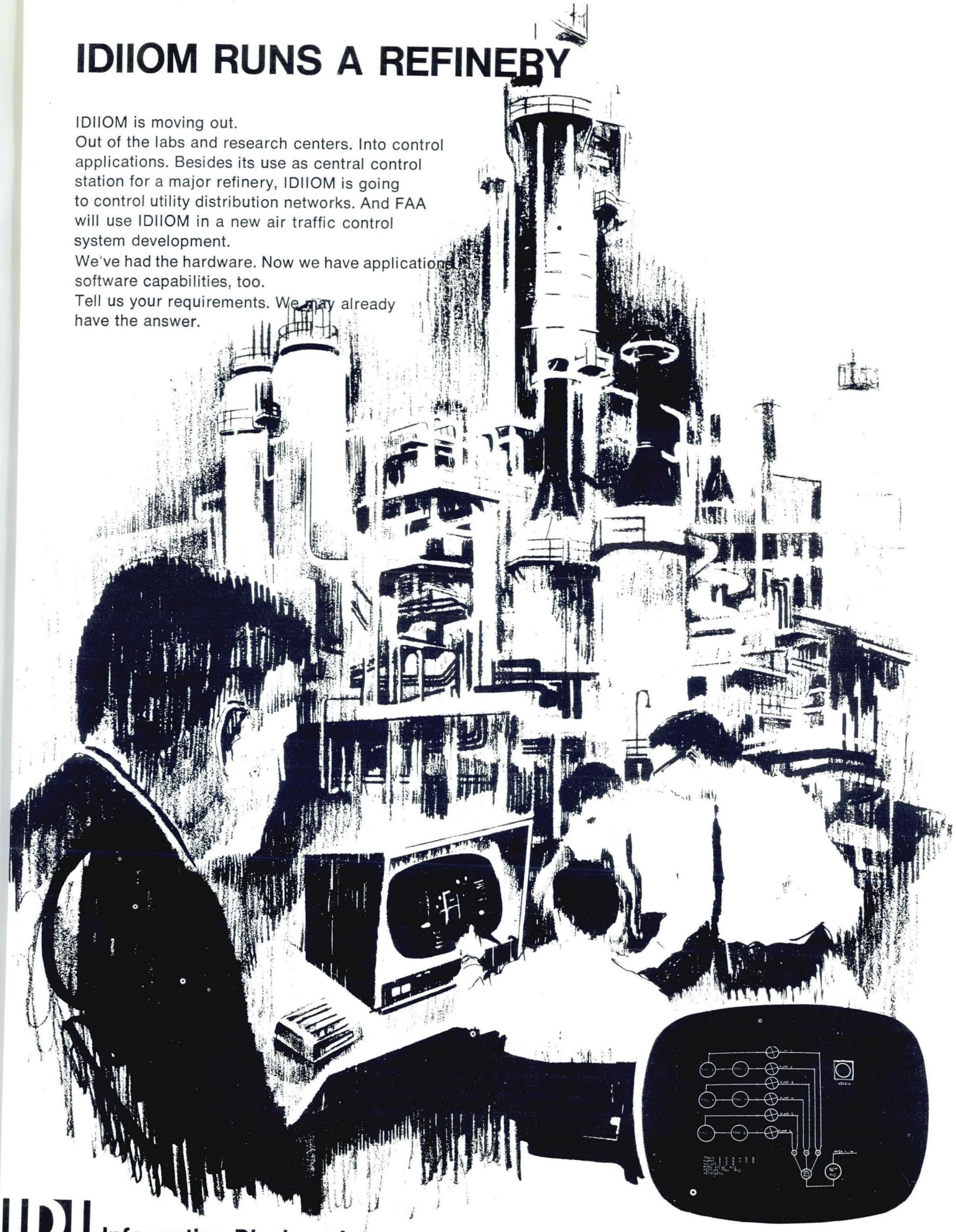

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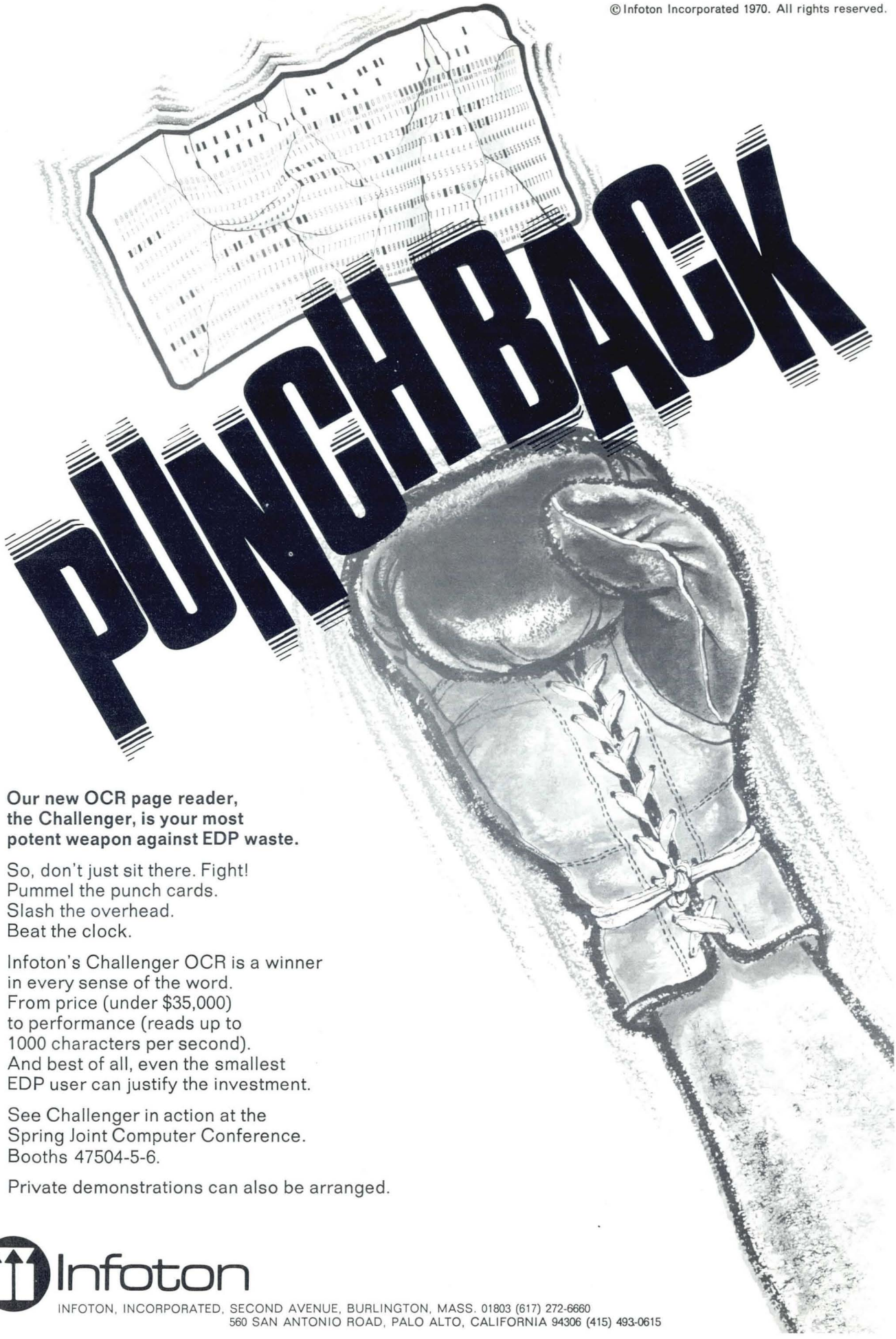

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SOURCE DATA AUTOMATION

SDA: THE CONCEPT AND THE EQUIPMENT

SOURCE DATA AUTOMATION is a monthly column written by Lawrence A. Feidelman and the staff of **FAIM Information Services, Inc.** Questions from readers on any aspect of SDA will be answered, as space permits.
Address all questions to: **SDA, MODERN DATA, 3 Lockland Avenue, Framingham, Mass.**

Source data automation is a technique for automatically capturing data at its source of origin and converting it into a particular machine format or code. The essential purpose of SDA is to eliminate unnecessary retranscription of data (particularly from punched cards) for machine processing. SDA represents a systems design approach rather than a hardware concept. The design of the equipment, procedures, and forms must be specified from user to computer.

There is a need for source data automation in both the government and industry. Because of the staggering amount of paperwork that threatens to engulf every business and government agency, clerical costs are rising drastically. An example of this paperwork explosion can be readily seen in the government, which uses approximately 360,000 different forms and prints approximately 15 billion copies a year. Approximately $60 million is spent to print these forms, and 20 times as much is spent on the clerical efforts involved in using them.

The input of data is a roadblock for data processing equipment because of the relatively unsophisticated input equipment used to handle the data. Because of the high speed of the computer and the relatively slow speed of the input equipment, the computer is inefficiently used.

It is apparent that a revolution in designing faster input equipment is already in progress. Equipment presently exists that will lead the way. But it is important to understand thoroughly the SDA concept, and to know what equipment is available, how it is used, and what benefits it provides.

THE CONCEPT

The SDA concept involves the preparation of data and its conversion into machine-readable form in the most efficient, accurate, timely, and economic manner. The ideal is to process data automatically with no manual intervention. Due to certain environmental and other restrictions, this ideal usually cannot be reached at this time. However, present SDA devices are meant to perform better than keypunches.

Keypunching, presently the prime computer input system, requires data to be punched onto cards for computer input. Little concern for the actual generation of data is necessary as long as it can be read by the keypunch operator. Keypunches are plentiful and low in cost. So why change?

A primary reason is that the large number of keypunch machines required at many installations results in high system cost. Furthermore, keypunching is slow and relatively inaccurate, data editing is extremely poor, and the use of cards as a computer input medium is inefficient. Finally, as a result of SDA, keypunching now represents an extra step in data processing that can be either eliminated or reduced.

SDA OPERATING CONDITIONS

The range of operating conditions applicable to SDA is extensive and is limited only by the user's ingenuity. The value of SDA, in addition to reducing cost and personnel errors, and increasing computer throughput, is to systemize data processing operations. This data integration process extends throughout the entire information flow of the company. Specific operating conditions to which SDA can be beneficially applied are:

1. Large data processing input volume;
2. Short response time requirements;
3. Excessive data handling;
4. Repetition in using some data;
5. High personnel requirements for data handling;
6. Excessive use of computer for input processing.

SDA EQUIPMENT

SDA equipment varies widely in complexity and cost. It covers the gamut from prepunched card tags to direct transmittal of written or vocal information to the computer. The basic types of SDA equipment currently on the market are described as follows.

KEYBOARD-TO-TAPE — devices consist of a keyboard (typewriter or keypunch), a buffer memory, and a tape unit (basically magnetic tape or disk). Source data is recorded directly on the tape by keying. In some devices, this operation provides a hard copy output as well as a magnetic tape input for the computer. In a direct one-to-one comparison with keypunches, keyboard-to-tape systems prove advantageous due to increased operator speed, reliability, and editing features.

There are many variations in the keyboard arrangements of keyboard-to-tape systems. The two basic keyboard arrangements are the card punch and verifier keyboards, and the standard typewriter keyboards. The former involves no basic change for the keypuncher and permits fast numeric entry. The latter is designed for typists and is much faster for entry of alphanumeric data.

OPTICAL READERS — represent the most efficient method for direct reading of typed, printed, or written data. The data read is converted into machine language and is either recorded on magnetic or paper tape, or trans-

CIRCLE NO. 54 ON INQUIRY CARD

Portable data terminals

Under $60 per pound

Today's most advanced portable remote data terminal comes from Omnitec . . . and it comes for less than $1500. If you're thinking in OEM quantities, the cost gets lower and lower. This full conversational terminal weighs less than 25 lbs., complete with input keyboard, hard copy printer and telephone coupler. Put it in its rugged carrying case and you can take it anywhere; it's o.k. for airline carry-on. No matter where you are, all you need to stay in touch with your computer is an Omnitec data terminal, a telephone and an electric outlet. With full 63 character ASCII keyboard, Omnitec terminals are uniquely suited for remote data entry and information storage/retrieval applications. Also available in 2741 compatible model. Field proven. Off-the-shelf delivery. Try a demonstrator; your installation, our expense.

Now, in less than an hour, you can turn your Teletype® into an acoustic terminal using Omnitec's telephone coupler conversion kit. Costing only $345.00 in quantities of 50, the kit offers the proven advantages of the world's leading acoustic couplers, the Omnitec 700 series, to all users of Teletype® computer terminals.

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mitted directly to the central processing system. Present optical readers fall into three distinct classes: character readers, bar code readers, and mark sense readers.

An ***optical character reader*** (OCR) recognizes the actual character directly by its shape. Optical character readers are classified by their ability to read different styles of mechanical and handwritten characters. There are readers for single-font, multi-font, and handprinted characters. Within these classes, OCR equipment may be further divided by character set capabilities: numerics, alphanumerics, symbols, and special functional notations.

Multi-font OCRs, which range in price from $100,000 to $1,000,000, are a recent development and are becoming widely accepted. Single-font readers range in price from $20,000 to $130,000. Numeric handprinted character readers are now being commercially produced by most major manufacturers. Their usage, however, is still dependent on the quality of text preparation.

Bar code readers "read" a character indirectly by recognizing an associated bar code which is limited to a numeric character set. Bar codes are printed on paper by embossed (usually plastic) cards or by keyboard imprinters. Bar code readers cost less than OCRs and are as reliable. Their main disadvantage is the requirement for embossed cards or special keyboard imprinters.

Mark sense readers do not "read" characters; rather, they choose among given characters by detecting marks in specific locations on the paper. Their advantages are that they are highly reliable and low in cost. (Typically in the $20,000 range.) Their disadvantage is that they are inflexible due to a requirement for preprinted forms and packed formats.

MAGNETIC READERS — read preprinted magnetic marks on hard copy and have been used mainly by the banking industry for recording bank check data. The character set represented by the E-13B type font has been a familiar part of the checks printed in the United States.

Although magnetically-encoded documents require high-quality printing and a highly-specialized font, they are relatively immune to dirt marks and overwriting. Furthermore, magnetic readers offer better protection against forgery than optical systems.

Magnetic readers have not only been used for reading alphanumeric characters, but for reading magnetic binary-coded data. They can read a large amount of such data in a small area, thus reducing document costs. Applications are basically in reading preprinted ticket sales data (e.g., transportation tickets, clothing tickets).

REMOTE SCANNERS — are used to transmit source data from a remote location to a central processor which may be anywhere from a few feet to many hundreds of miles away. Some devices may be used in conjunction with a communications coupler to transmit data over telephone lines, while others must be connected by cable to a nearby control unit which sends data from several devices to the computer.

Most remote scanners can read standard 80-column punched cards. Some only read prepunched cards while others will only read marks made by pencil. Some scanners can read documents of many different sizes up to 8½″ x 11″. Remote scanners, for the most part, read mark sense Hollerith code. Those which will read characters, essentially remote OCR devices, may take anywhere from one card or document up to 500 cards at a time.

PORTABLE DATA RECORDERS — are small, lightweight devices designed for use where it is impossible or impractical to place a more sophisticated data recording device. They are of simple construction and very easy to operate. Their output may be punched cards, paper tape, or magnetic tape. Levers, buttons, and dials are used to enter the data, usually anywhere from 1 to 12 characters per entry. All devices are manually operated. Some are completely mechanical, while others operate on batteries.

DISPLAY TERMINALS — are compact units that display information on the face of a cathode ray tube; data can be entered from a keyboard or received from a computer. Most display terminals handle alphanumeric information only. There are, however, terminals which display graphs and other complex shapes. These more sophisticated display devices are commonly referred to as "line drawing" or "graphic" units.

Display terminals can either be connected directly to a computer I/O channel or remotely connected via an appropriate controller or adapter. They require an auxiliary printer unit in order to provide a permanent (hard copy) record of transmitted data.

TELETYPEWRITERS/TELEPRINTERS — are keyboard entry devices that transmit data over communications lines and also provide hard copy. Originally, these devices were developed to transmit and receive messages via wire or radio communications links; their versatility for message composition has resulted in their use for direct input to computers.

TOUCH-TONE DEVICES — are telephone instruments which utilize multi-frequency tones for both dialing and data transmission. The Touch-Tone system provides the subscriber with upgraded telephone service and, as a by-product, a very good low-speed (2400 bits/second) data transmission capability. Optional equipment is now offered both by AT&T and independent manufacturers.

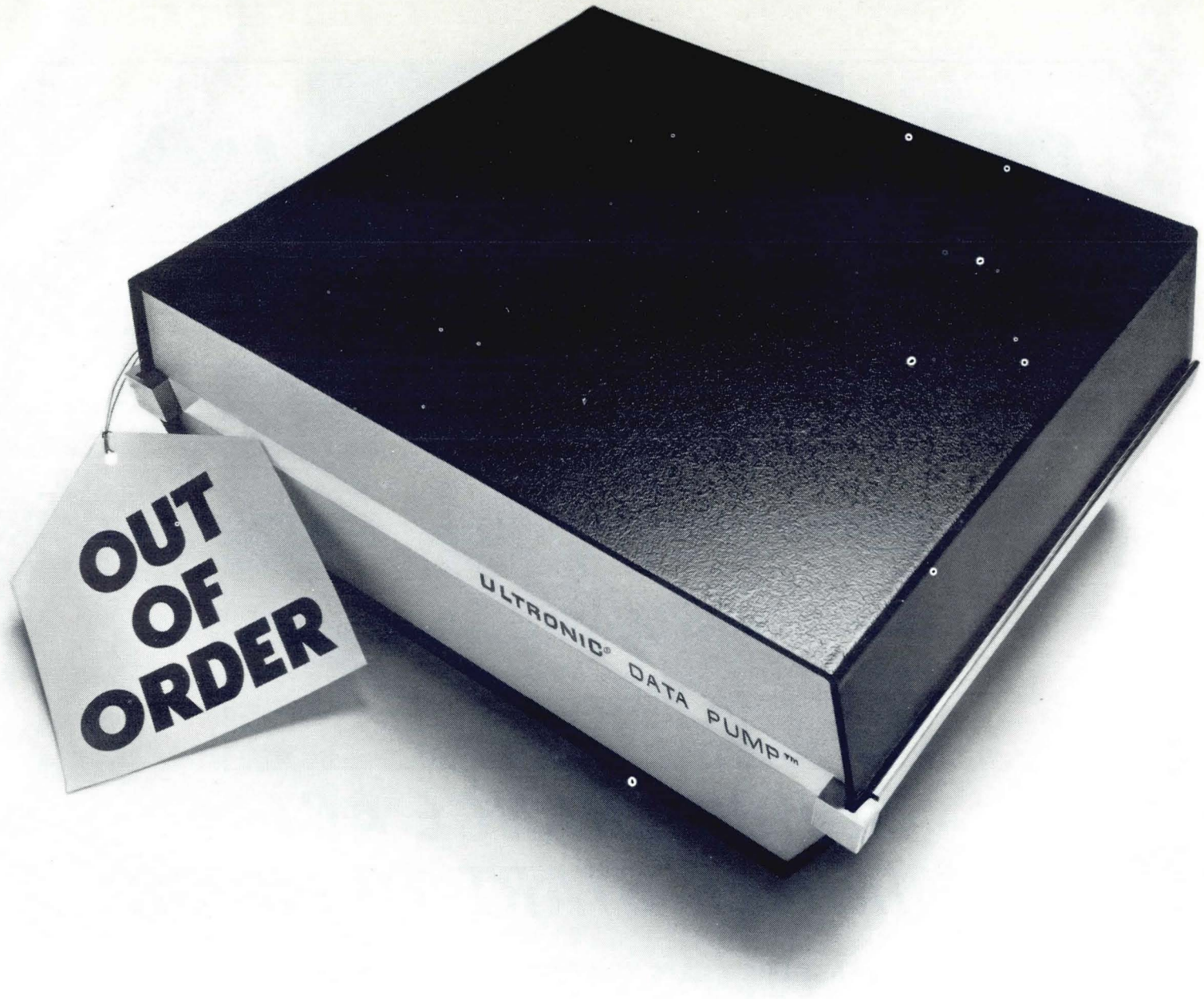
INDUSTRIAL DATA COLLECTION EQUIPMENT — is typically used for employee attendance recording and production and inventory control. There are both transmitting and non-transmitting systems, with the former being more complex and expensive.

A ***transmitting*** data collection system consists of remote input stations transmitting data messages to a control location. A message might consist of an employee number read from a badge, a job number read from a prepunched card, a unit quantity read in via keyboard, and a station number which is automatically entered under program control. ***Non-transmitting data*** collection equipment produces (at each station) a record of the source data on punched cards, paper, or magnetic tape.

CASH REGISTER ADDING MACHINES — record retail sales information, usually in the form of a journal tape, and accumulate totals. Sales inventory data can be processed directly from the tapes.

The Uni-Tote point-of-sale register system is an alternative to the above. In the Uni-Tote system, keyboard-entered transaction data is printed on sales slips and simultaneously transmitted to a central location where it is recorded on magnetic or paper tape. Sales data can be transmitted immediately for processing by the computers, which eliminates the need for tape collection. Furthermore, an optical feature permits an on-line credit centralization check.

In later articles each of these device types will be discussed in more detail. ▲



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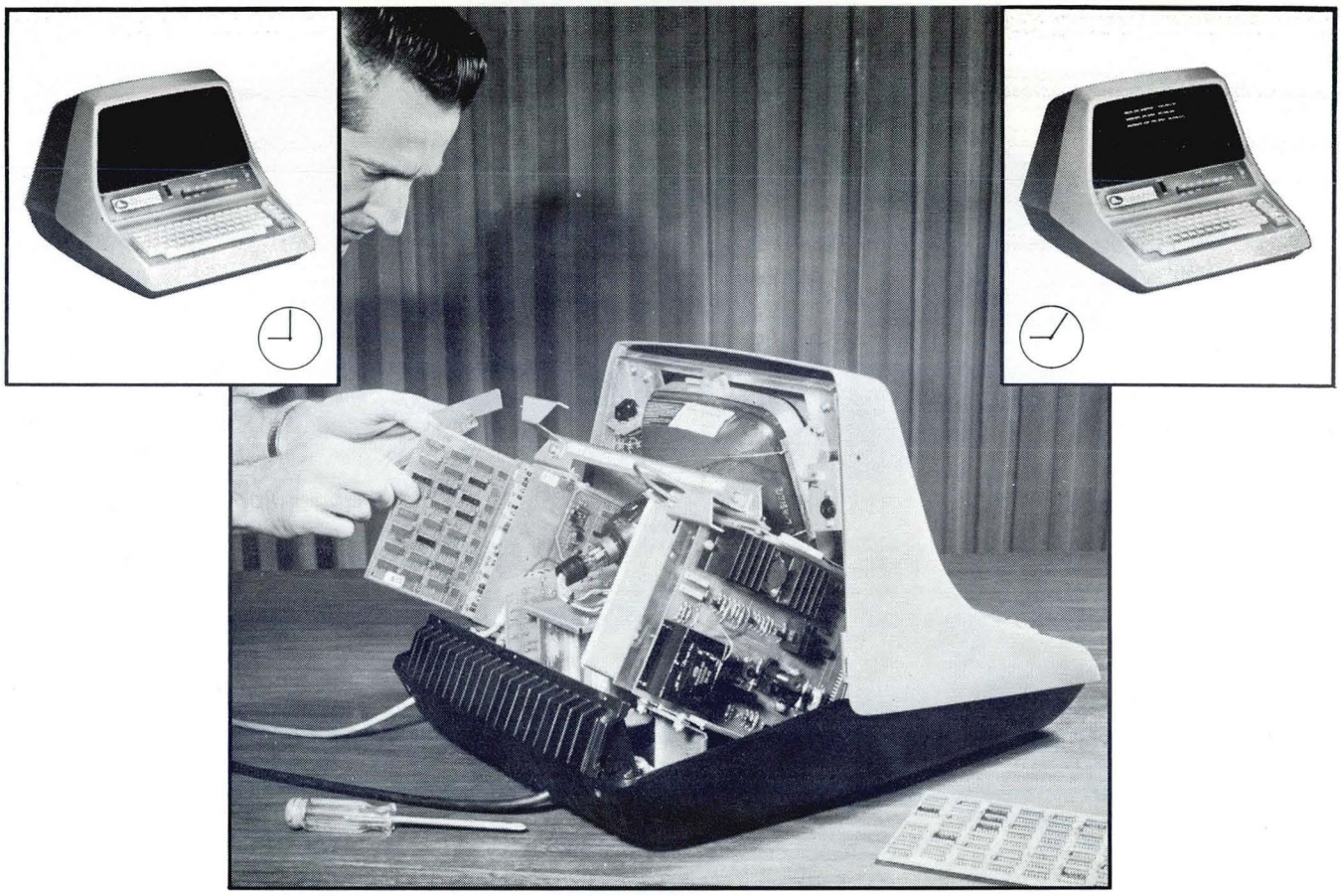

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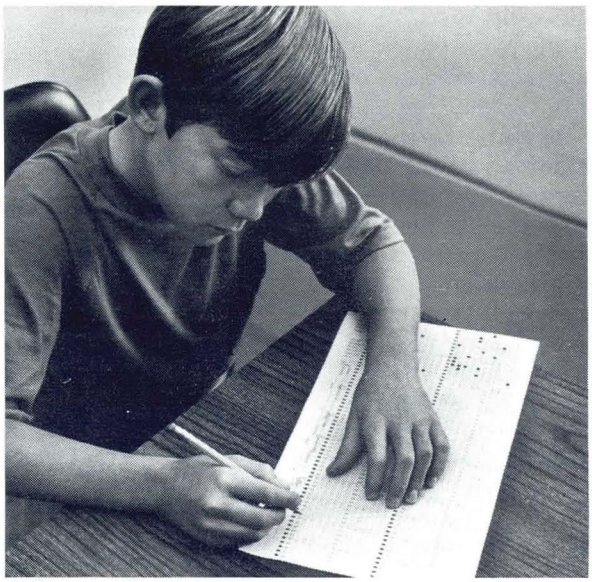

The boy in the picture isn't one of those computer prodigies.

Yet he routinely prepares documents for computer processing. With the simplest data-entry device imaginable: an ordinary, everyday pencil.

A unique machine reads those documents (they're tests) and automatically translates the pencil marks to computer language. The machine also automates attendance record-keeping and report-card preparation.

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Because you wouldn't have the bottleneck and the cost of keypunching. Or any other kind of keyboard data conversion.

With the MDR, anyone who can operate a pencil can prepare computer-usable data as a routine part of his job.

You could have "instant" inventory control. Super-speed order entry. Self-updating quality assurance data. Fully automated payroll accounting.

It sounds blue-sky, of course. But the logic of our approach becomes quite clear when you consider that most of the data you process by computer originates at the end of a pencil.

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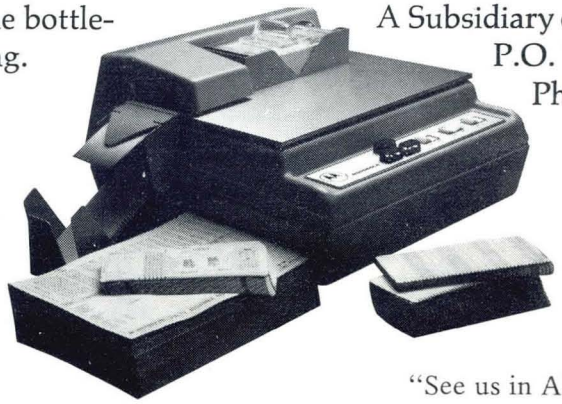

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COMMUNICATIONS CLINIC

An Order Entry Case Study

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. 08034.**

Faithful readers of this column know that one of the flags we constantly wave is that of price-performance analysis on a system basis. While valid on a system basis, the approach may be even more mandatory on some sub-systems. Where a system comprises a CPU and a number of remote terminals, the sub-system of terminals and communication facilities can easily have a cost equal to or greater than that of the CPU. It is this fact which demands a knowledgeable, thorough analysis of the sub-system alone, if design management is to be responsible in doing its job. We recently concluded a consulting assignment wherein these principles were again confirmed. The system was very typical in its function and purpose. Because of this, we feel that a review of the problem, the solution methodology, and the results would be of interest. As an actual case study, it is a report on a real "what and why" of system design. Its significance is that where the company originally anticipated an annual expenditure of some $175,000, the resulting design will cost some $60,000 annually.

The XYZ company maintains 26 stocking warehouses throughout the U.S., and a data processing center in New York City. Customers' orders are received by mail and phone at the warehouses. The content of the customer order form is edited to match XYZ's product codes and quantity-makeups, and a bill of lading is prepared. The goods are shipped and a copy of the B/L is forwarded to New York where invoices are prepared and issued.

XYZ wanted to achieve: centralized control over inventory; more real-time correlation between customer credit information and the shipping decision; and a speed-up of the issuance of invoices. This required order processing at New York rather than in the warehouses. However, they did not want customers to mail orders to New York because it would brunt their "local distribution" image. Also, having the warehouses mail the orders in would introduce unacceptable delays. Hence, a sub-system was required to:

- Input order data at the warehouses;
- Provide data communication between warehouses and CPU;
- Print B/Ls at the warehouses.

The first discussion of the problem was a brainstorming session, at which ideas were tossed out. The only analysis or test at this point was whether the idea had any correlation with the needs. As to terminals, they included Teletype Models 33 & 37, IBM 1050, IBM 2741, Dura, MDS 1183, Facsimile, Novar 5-50, Digitronics Data-Verter, and Motorola mark-sense reader.

In retrospect, there are other terminals we might have included. (From this point on, "we" refers to the consultants and XYZ's data processing and customer service staffs, as the design was a joint and interactive effort.) Names such as Communitype, Datel, Compat, Computer Transceiver, Data Products, G.E., Viatron, etc., came to mind. In defense of not including everything, all problems have to be kept within reasonable bounds. In the course of working on the problem, Univac announced their DCT 500 and 1000, DASA announced their Datakwik, and Teletype announced their mag tape terminal. All of these were then also included in the possibility list. As to communication facilities, they included WATS and POTS (Plain Ordinary Telephone Service). A cursory review of volumes immediately ruled out private line service.

The next step was to define the data volumes and times of transmission. Volumes were based on a month-by-month study of the previous year's activity. The average orders per month were then doubled and this figure was used as the design basis. It was felt that we should design for some growth, and doubling was as good a target as any, allowing also for seasonal peaks over average. The input figures that were developed were 4000 characters per day per warehouse. This, however, was based on complete entry of all order data at the warehouses. Since the B/L was to be prepared and transmitted by New York, this amounted to sending the same data from the warehouse to New York, and from New York back to the warehouse. We decided then to use a descriptive type of entry at the warehouse. In a kind of shorthand, we would only enter minimum data to describe the order content, e.g., a five character numeric descriptor of "customers of record" rather than spelling out name and address; or three digit product codes rather than spelling out product names, etc. This approach reduced the daily volume per warehouse to 1600 characters. An important by-product was the reduction in format complexity in the warehouse entry procedure. The less data entered, and the less complex the format, the lower the operator error rate per order.

Orders were generally received in the morning mail so entry transmission could be in the afternoon of normal shift. If so, the orders could be processed at New York in time to transmit B/L's during the third shift. Thus, the B/L's would be at the warehouse for picking the following morning. Finally, at this point in the design, we calculated the weighted average transmission distance based on actual average orders per warehouse:

Warehouse 1:	10 orders x 600 miles	= 6,000
Warehouse 2:	15 orders x 300 miles	= 4,500
Warehouse 3:		
etc.		
	T orders	E Products

Dividing the sum of the products by total orders gave us the effective distance (for determining toll costs) over which every order would be sent.

ANALYSIS

At this point we had enough information to make comparisons of various sub-systems and their costs. This was done generally for all of the originally conceived approaches, including those added during the information gathering stage. Subsequently, two review sessions were held at which original ideas were weeded out as being obviously less desirable than others being considered. Reasons may have been deterministic such as cost, or subjective such as insufficient field service coverage, or insufficient delivery record to show conclusive field reliability. By the second review session, we had narrowed down to the sub-sys-items as listed in Table 1.

TABLE 1
SUB-SYSTEMS COSTS CONSIDERATIONS

System	Equipment	Communication	Total
Facsimile input Model 35 TTY output	4,572	13,409	17,981
Teletypewriter input and output			
Model 35 Teletype	3,933	2,240	6,173
Model 33 Teletype	2,047	2,240	4,287
Motorola mark-sense input, Teletype RO output	5,847	2,240	8,087
Teletypewriter input and output via Teletype's MTT	6,286	933	7,219
IBM 1050	6,998	1,631	8,629
MDS 1183	9,720	810	10,530

The first sub-system considered was that of facsimile input and teletypewriter output. Facsimile was tested because it would eliminate all keying operations at the warehouse, these operations being centrally performed, supervised, and controlled in New York. Thus, the low error rates of centralized input could be obtained, and a very low skill level would be required at the warehouse. The transmission time for the volume involved WATS lines for least communication cost. Notwithstanding the use of WATS, and even though total equipment costs were comparable to other approaches, the communication costs made the facsimile approach too expensive for its benefits.

The second approach considered was that of teletypewriter input and output. Such an approach was included on intuitive grounds that the prevalency of such an approach requires its consideration. Priced first for Model 35 equipment, we then recognized that the daily volumes were commensurate with the capability of the light duty Model 33, and priced for this model.

The third approach was that of input via a Motorola mark-sense card reader, and output on a Teletype page printer. The reason for including the mark-sense approach was that it also reduced the skill level required at input. The incremental additional cost over other possibilities was felt to be too great for the benefits realized in this application.

A fourth approach was to consider the use of the Teletype magnetic tape terminal (MTT). As might be expected this increased equipment costs and reduced communications costs. This was too expensive by comparison and had questionable delivery and pricing.

Finally, we considered the IBM 1050 to test for cost of EDC on low speed transmission; and the MDS 1183, to test for EDC on medium speed transmission. Note in the table that the 1050's 14.8 cps speed brings about cheaper communications than for Teletype, and the Mohawk gear at 1200 bps is even cheaper in communications. The Mohawk gear was not dramatically effective in reducing communication costs, however, because the average warehouse was transmitting within three minutes even at teletypewriter speed. Even if we increased this speed, we still had to pay a three minute minimum on the call. The primary impact of both the Mohawk and the Teletype MTT was on B/L transmissions. Here we had greater volume — 4000 characters per warehouse — and we were to transmit on third shift when the new one minute minimum applies.

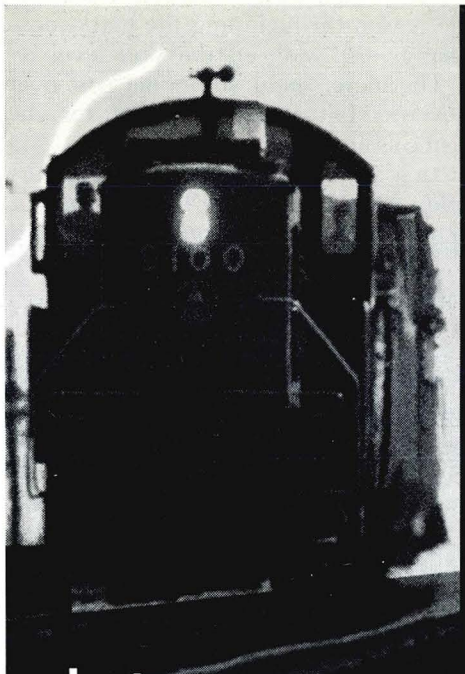
As far as EDC was concerned, then, if we were to have it, it would be with the 1050. Management, however, wanted a justification for the necessity of the EDC incremental cost. For this we conducted a test as follows. Each day for a two-week period, a test transmission was made from two warehouses, each located in a section of the country historically poor for data transmission. Each transmission, made several times morning and afternoon, consisted of 1600 characters, the average warehouse entry. The test results were:

Order error rate	0.362%
Bit error rate	less than 1 in 10^6

With the use of parity for error detection, we felt we would achieve another order of magnitude improvement in undetected error rate. On this basis we concluded that automatic retransmission was unjustified. (Please don't jump to conclusions or view this as a general truism. This was a value **judgment** for **this** situation, for **this** system, based on **this** set of data.)

With all reports in, the study indicated the subsystem should comprise Data Phone Teletypewriter, with input during first shift, and unattended output during third shift. In addition to low cost, other advantages accrued. The Model 33 is very easy to operate, thus alleviating the concern over high skill level operators in the warehouses. Also, the Model 33 is still available for Data Phone service from the operating telephone companies. This means 30-day termination on equipment if system needs change, and a generally higher probability of competent field service.

The total study effort was on the order of 20 to 30 man-days, including XYZ personnel. As such, we can't present here all of the analyses we went through. Nevertheless, we hope this presentation gives a good map of sub-system design criteria and procedures. ▲



data bits from Teletype

8 million pounds of food moved daily!

When you handle 14,000 food-filled freight cars annually, deal with more than 160 truck carriers to service the daily needs of over 500 retail chain and independent outlets, the need to know takes on staggering proportions.

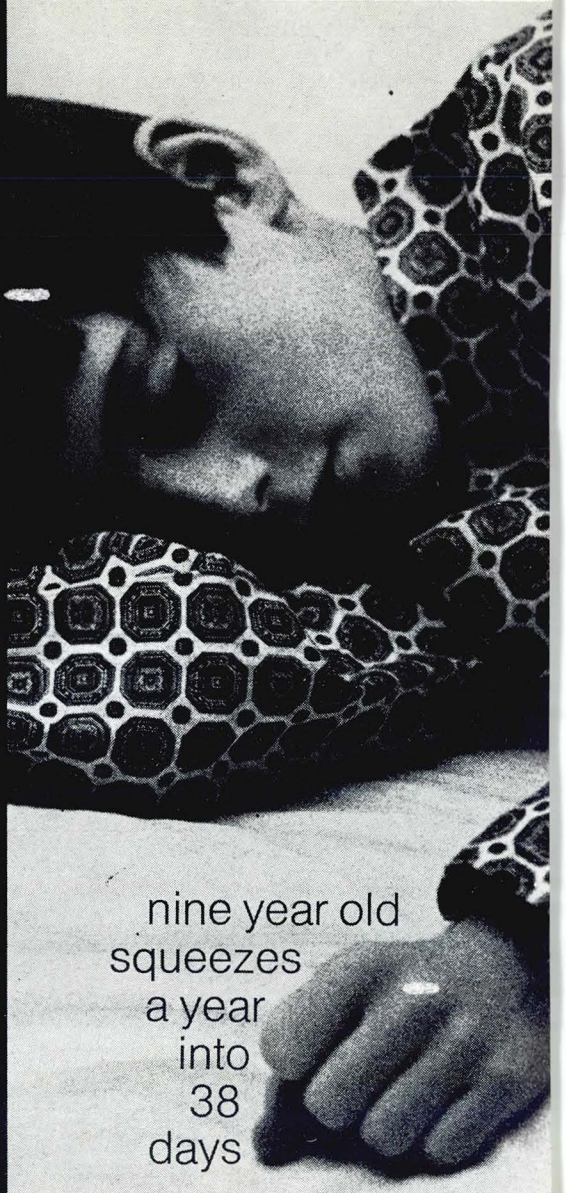
The warehouse that copes with this logistical problem has linked its customers with a computer using Teletype® terminals. Shipping data from processors and food packers is fed into the computer on a daily basis. Retail buyers use Teletype equipment to obtain up-to-the-minute inventory status reports, to place orders and receive concise shipping data. This enables the warehouse to keep track of, and move some 8 million pounds of food every day. Fast, accurate data communications has also helped cut processor billing time down from over a week to twenty-four hours.

time-sharing money saver

There are probably more Teletype 33 sets being used in time-sharing applications than any other data terminal. Because, on a price/performance basis, it is one of the most reliable and economical terminals available.

The model 33 has everything required for preparing programs, getting them into the computer and retrieving information. It communicates in ASCII and operates at 100 words per minute. Its design simplicity makes computer dialog easier for the operator. But, what's really nice, is the price: It's amazingly low for all of its capabilities.

The model 33 line includes options and accessories needed for a variety of time-sharing needs. If you would like to know more about this low-priced terminal line, write for the model 33 brochure.



nine year old squeezes a year into 38 days

A young boy became so fascinated with a Teletype 33 terminal that he completed a whole year's arithmetic program in 38 days. His school is involved in a computer assisted educational program using a remote university computer. The simplicity of the terminal enables the youngest of students to master its operation in a short period of time.

Some subjects included in the program are reading, science and arithmetic. Students receive individual drill and instruction geared to their own level of comprehension. The slower student gets much needed practice at a level which he can achieve. The average student reinforces his grasp of the subject with drill and practice at the terminal. The bright are offered programs that challenge and are limited only by their own abilities. Computer assisted education also enables teachers to find more time for individual student needs.

erasing errors on-line

Teletype has an interesting solid-state device called the Stuntronic™ parity error detector which helps locate and eliminate parity errors. It can be used with Teletype 33, 35, 37, Telespeed™ and Inktronic® terminals.

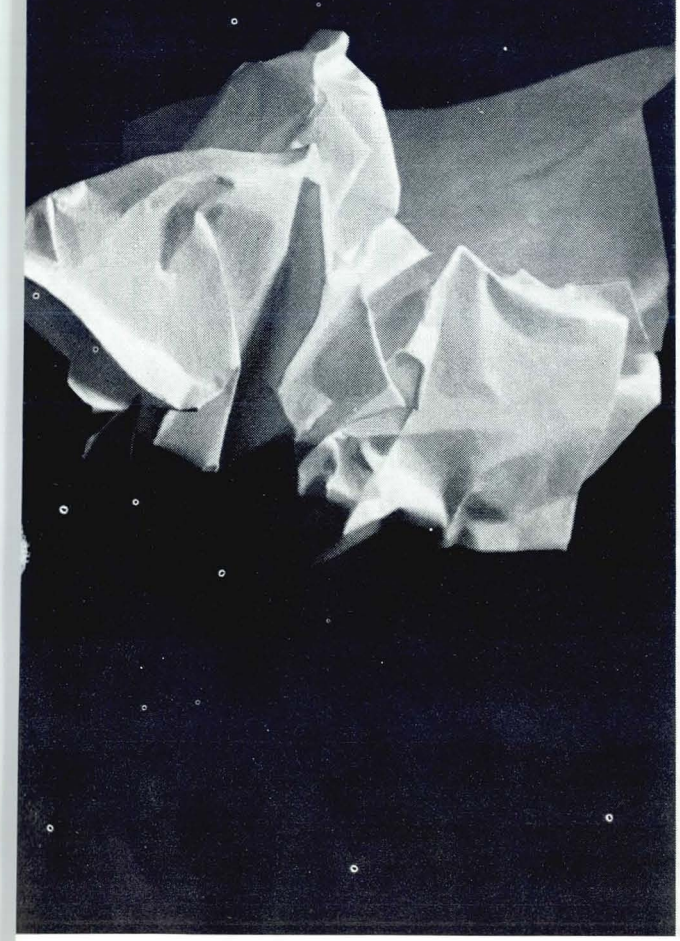
This accessory will accept a signal with up to 45% distortion and regenerate the signal with less than 5% distortion before passing it on to the terminal. Minimizing erroneous print-outs due to distorted signals.

It will also locate individual vertical parity errors and alert the station operator so that corrective action can be taken.

```
HERE IS AN EASY WAY TO SPOT AND      432*
CORREC* ERRORS RECEIVED IN TEXT      5678
OR NUMBER TRANSMI*SION.              90*2
```

With the Stuntronic detector, a preprogrammed substitute character can be used to graphically indicate exactly where an error is on the terminal print-out.

Stuntronic accessories can also count errors, light a signal lamp and generate a line break, notifying the sender of any errors.



recommended reading

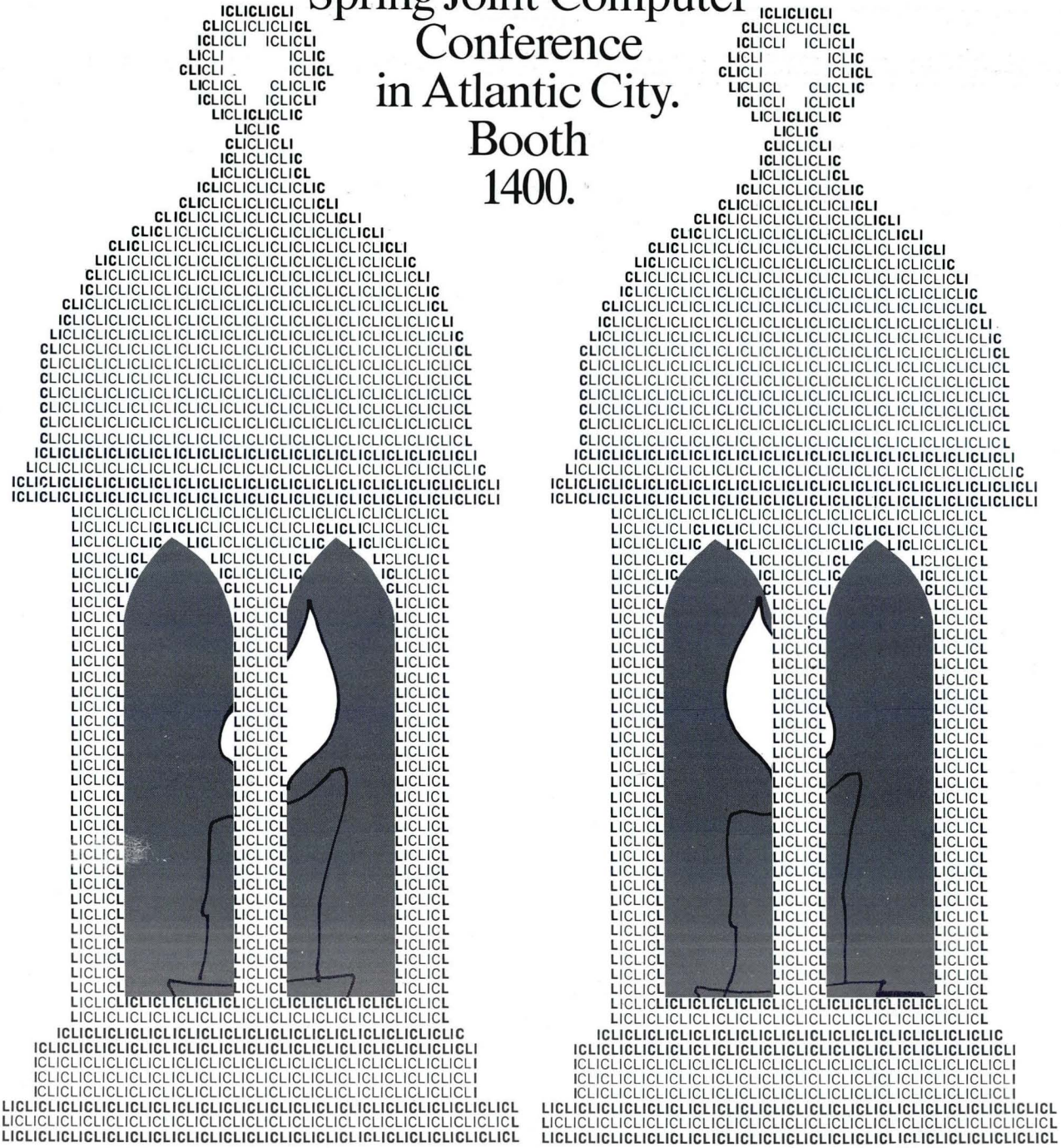
Teletype has a number of bulletins on equipment, applications, and case history data. A short description of what is available is contained in: *"How to get answers to your questions about Teletype equipment." Write for your copy.*

Teletype data communication equipment is available in send-receive capabilities of up to 2400 words per minute. Included are hard-copy, magnetic-tape and paper-tape terminals, error control devices, options and accessory equipment to fit most data communication system requirements. For information, write:

TELETYPE CORPORATION
Dept. 40-12, 5555 Touhy Ave., Skokie, Ill. 60076
machines that make data move
Teletype is a trademark registered in the U.S. Pat. Office

CIRCLE NO. 58 ON INQUIRY CARD

Since we've been unable to locate Mr. Revere, late of Lexington, Massachusetts, to announce our presence, we should like to inform you that International Computers Limited, will be at the Spring Joint Computer Conference in Atlantic City. Booth 1400.



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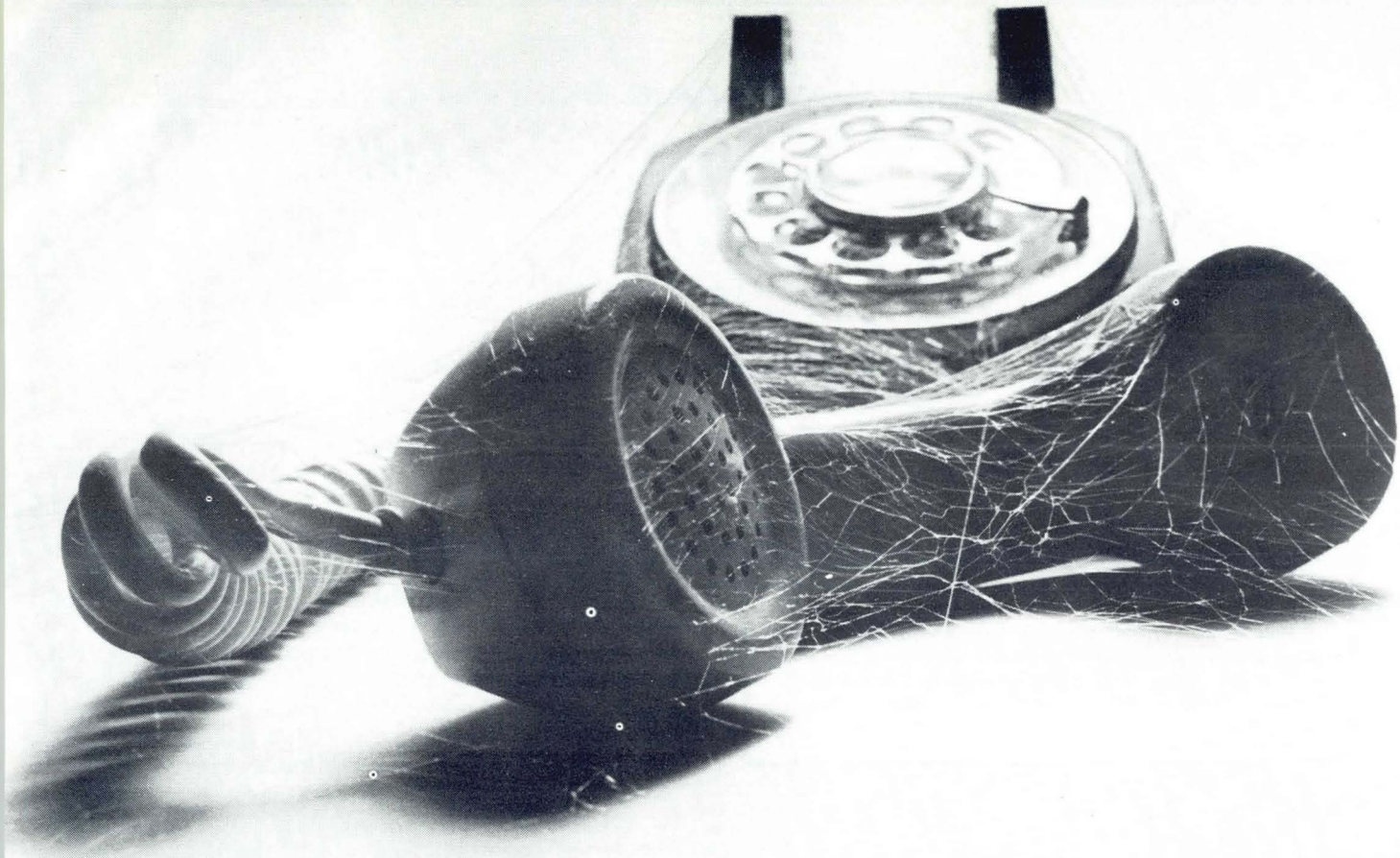

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CIRCLL NO. 60 ON INQUIRY CARD

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

ON-LINE

TERMINAL WITH A TWIST

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**

Too late to make the star-studded terminal show at the '69 FJCC, Corning Glass Co.'s Corning Data Systems is now adding another ingredient to the already rich graphics brew. Their new, as yet unannounced, CDS 904 time-sharing graphic display terminal surfaced during an informal conversation with one of their expanding sales force. Now, after comprehensive field trials, prices are available and deliveries are being scheduled.

The CDS 904 has a number of usually hard-to-come-by features incorporated in its basic design options and support, such as fast hard copy and a slide overlay. It can be attached to any time-sharing computer via switchable voice grade telephone lines at 110, 300, and 1200 baud data rates in full or half duplex modes. It can handle asynchronous ASCII data and, at 110 baud, is compatible with Teletype systems.

Although the concept is not new, the CDS 904 uses a rarely applied photochromic glass storage tube; in this case, a Corning proprietary development. Photochromic glass darkens when exposed to ultra-violet light and becomes transparent again when exposed to infrared light. The resulting display has remarkably good contrast and is relatively immune to difficult ambient light conditions. The tube image is projected onto an 8½" x 11" screen fixed at a near vertical position for user viewing and also used to produce excellent high contrast hard copy.

The slide overlay feature allows correlating fixed stored data with newly computed results simply and easily. Displaying stored data on top of already displayed new information can create display management problems quickly if the tube is to present both displays simultaneously. A slide overlay gets around this nicely and has other neat applications as well. It can be used for menu displays and selection as well as for forms and grids. When coupled with the hard copy output, it becomes a versatile tool for producing business and engineering data on fixed report formats. Sixty-four 72 character lines are standard for vertical page orientation. A 90° rotation mode orients the page horizontally and results in formats that are 94 characters wide. A double size character mode is also available.

Using either 2 or 4 ASCII characters, the CDS 904 produces vectors up to 2.73 inches long at speeds of 7.5, 20 and 82 inches per second at 110, 300, and 1200 baud, respectively. When 4 characters are used, the vectors may be visible or invisible. Analog graphical input is either by a joystick or mouse option. A tablet is in the works, and presumably will be available soon. A 58-key main keyboard and control panel with a full set of ASCII characters, a 14 key data entry island with associated cursor, hardcopy, overlay, vector, character size, and erase buttons round out the 700-pound terminal configuration.

There is also software — a refreshing departure. The package contains 39 primary and advanced Fortran IV subroutines; furnished without charge to users. Primary subroutines perform a group of basic functions such as drawing vectors from current cursor positions to specified locations. Advanced subroutines make use of the primaries to display data with minimum user involvement. Routines accomplish windowing; plot data in Cartesian, semi-log, log-log and polar coordinates; scale displays; draw curves, circles, and arcs; and fit polynomials.

The $19K basic price range, which includes hard copy and film overlay, puts the CDS 904 in the carriage trade class so far as non-refresher tube terminals go. But the 904 looks as if it has the Moxie to belong there. ▲

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Now if you don't like our specs, you can always tell us what to do with them.

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CIRCLE NO. 61 ON INQUIRY CARD

THE SYSTEMS SCENE

DATA BASE SYSTEMS

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**

How should a data base be organized? The answer proposed by the Conference on Data Systems Languages' (CODASYL) Data Base Task Group is "How **shouldn't** a data base be organized?" Anything goes, including ring structures, tree structures, multidimensional bidirectional chains, etc.

It's very nice to be able to operate on a data base in a conceptual manner as:

MOVE (SCHWARZ AND ASSOCIATES OF SCHWARZ) TO SIBERIA or PURGE (MENSHEVIKS AND REVISIONISTS).

But it is distressing when such an operation involves passing the whole data base sequentially. The unfortunate fact is that the way a data base must be organized is a function of the device on which it is resident. (This was our guiding concept in laying out the file structure of CALL/360 and we believe that the system handles its files as efficiently as anything now running.)

What the Data Base Task Group has proposed is really a number of different ways a programmer can **pretend** his data base is organized. At least two manufacturers are now building systems to **simulate** the structure suggested in the CODASYL report. The manufacturers, of course, have everything to gain.

It is interesting to note that most of the features proposed in the report are variations of the same thing: they give the programmer the power to treat his data base as though it were resident in an associative memory. The most important result of the efforts of Mr. Metaxides and the Task Group will probably be in the area of hardware and system architecture. Machines will be built to run efficiently with the data base organization they have proposed.

To make a head-per-track disk into an associative peripheral does not seem like an impossible problem. Heads would always be in the read mode, transferring data into shift registers. (One register per head.) Shift registers would be continually matched against the contents of a character string specified by the CPU as part of the fetch operation. Whenever a match occurred, the rest of the record would be transmitted to the CPU. The head would then be turned off until the next fetch. Matches at other heads would be ignored during transmission and picked up on subsequent revolutions. A full turn of the unit without any further match would indicate end of transmission.

Such a device could make the running of a fully organized data base much more efficient. It would virtually eliminate the task of routine re-organization.

Most headaches come, not in running a data base, or programming for it, but in the data collection and reduction. Forms design is a particular stumbling block. (This is the data processing world's version of the Pregnant Girlfriend Dilemma: solutions are either bad or terrible.) When the forms are questionnaires to be filled out by respondents, the problem is even worse. There is almost no possibility of passing the work directly to keypunch without an editing phase.

Some special cases can be handled effectively with sense mark forms or by making use of the increased flexibility of OCR or key-to-tape. The more general case, involving variable length and alpha data, ends up being edited and mailed off to someplace like Korea or Barbados or Newark for reduction.

Most data bases cost one cent per character or more to build. The best deal is a data base that is a by-product of some other operation. With the advent of computer typesetting, some interesting things could fall out nearly for free. If law books were set via computer, for instance, it might be possible to put together a law research system using the text tapes to build the data base. When dictionaries are set by computer, translation data bases can be built cheaply. Someday. ▲

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CalComp's new offline 1670 COM system is the finest Computer Output Microfilm plotter you can buy.

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Features a programmable raster of 16,384 by 16,384 positions. The finest resolution available.

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And take your choice of cameras. 16 or 35mm. Sprocketed or unsprocketed. Even a 105mm microfiche option.

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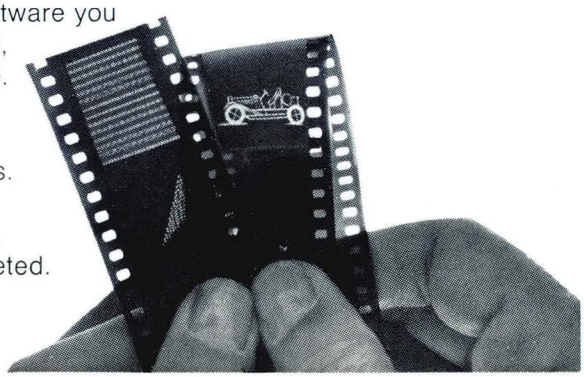

CIRCLE NO. 62 ON INQUIRY CARD

FOR MORE INFORMATION ON THE PRODUCTS ADVERTISED ON THE FOLLOWING PAGES CIRCLE NO. 63 ON INQUIRY CARD

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SOFTWARE FORUM

NEW COMMON DATA BASE SYSTEM

Software Forum is a regular monthly column written by Ken Falor and the staff of **Cullinane Corporation** exclusively for MODERN DATA. Questions from readers on any aspect of software will be answered, as space permits, in this column. Address all questions to: **Software Forum, MODERN DATA, 3 Lockland Avenue, Framingham, Mass. 01701**

Information Management System/360 is a new common data base and data interface system being developed by IBM. Data Language/1 is the data interface language used to access the data base without concern to the (changing) details of its structure.

IMS/360 is designed to become part of OS under multiprogramming with MFT-II or MVT. It also involves powerful teleprocessing as well as batch capabilities, simultaneously. Besides DL/1, IMS includes modules for communications control, applications scheduling, and checkpoint and restart.

IMS allows considerable flexibility in the addition of records to the data base to accommodate new applications without affecting existing programs. Therein lies one attraction. In addition, it is a Type I system, fully supported by IBM for present and future operating systems, and therein lies another attraction.

WHEN SHOULD YOU CENTRALIZE?

A centralized data base system of the type IMS offers is valuable when a number of programs share much of the same data. The degree of sharing determines the economic feasibility or even necessity of going to a common data base system. Of course, the alternative is staying with the traditional independent programs and their files, and just re-entering the fresh data required for more than one file or, in some cases, performing routine file conversions for subsystems.

When this traditional method results in hairy tangles of programs, files, and updates, you should look into a common data base system like IMS.

HOW DOES IT WORK?

The IMS data base is set up in a hierarchical fashion in multiple levels, as shown in Fig. 1. Four-character mnemonics or codes are established for each record segment at each level. The application programs use these mnemonics without regard for the location of the records they reference – this is the concern of IMS. Thus, new records may be added for use by other programs without affecting existing programs.

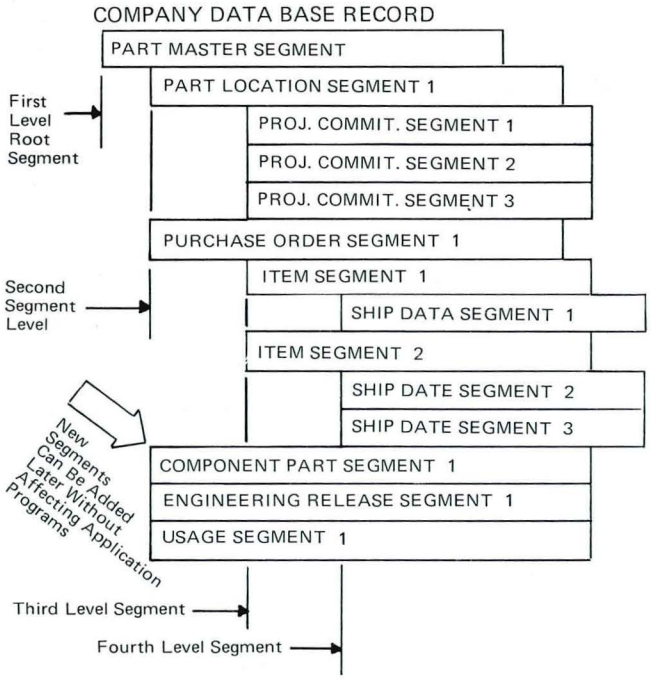

Fig. 1 Company IMS data base record segment level structure—engineering data added. (From IBM IMS/360 Application Description Manual H 20-0524-1.)

A portion of the total data base that constitutes the data file for a particular application program is established in a table. Each of these files is then accessed by means of these communication tables. The address of the pertinent communication table is given in order to access the required data. IMS locates a particular lower-level record by referencing the last record of the next-higher-level record preceding it (the "parent" record).

Any application program using DL/1 is essentially a subroutine to IMS. These application programs may be written in Cobol, PL/1, or Assembly language. Some powerful report generators have also been interfaced with DL/1 to reduce the amount of programming necessary to produce reports from the data base. One of these is Cullinane Corp.'s CULPRIT report generator.

When the application program gets control from IMS, it also gets, as arguments, the addresses of the Program Communication Blocks. These "PCBs" are used as communication regions between the application program and the data files they access. There is one PCB for each data file.

Thus, the first statements in the Cobol procedure division of a typical application program are ENTER LINKAGE, then ENTRY 'DLITCBL' USING pcbname-1, . . . pcbname-n, then ENTER COBOL. Later data file calls are accomplished by CALL 'CBLTDL' USING function-code, pcbname, segment I/O area, ssa (segment search argument) . . . Spe-

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cial provisions are made for other operations with records and fields in the procedure division, and for definitions in the data division.

STATUS OF IMS

IMS has completed its preliminary "alpha" field test for feasibility of design, and is in its final "beta" field tests for actual operational implementation. It is rumored that something on the order of 50 companies are already implementing it, with 250 or more having committed themselves or expressed serious interest.

The system appears to be fairly well along. Most of the problems appear to be in devising new data base and other design approaches to cut down access time and overhead (maintenance) cost, the traditional problems incurred by large data bases. However, the system does work and should prove valuable to those who are determined to go this direction, and want to go it with IBM.

CONSIDERATIONS

As yet, we have no indication how IMS will be priced; but whatever its cost, it is bound to be insignificant compared to the costs of implementation and maintenance.

The costs of implementation start **first** in nailing down inter-company, inter-subsidiary, inter-divisional, and inter-departmental requirements. Inevitably, as flexible as the IMS data structure is, some will feel forced into a mold and want something difficult.

Second, the sheer task of defining in detail a large data base requires considerable investment. And there is no out here – every header, record, and field must be defined, reviewed, reworked, approved, fully documented, and distributed with directions for use.

Third, the collection and entry of all the required data is a task that can be appreciated by anyone who has been involved in the implementation of even a relatively modest "mono-application" program.

Finally, there is the large cost of maintaining the data base once it is established. This has killed many large common data base systems.

To achieve any degree of success with such a system, the people in charge would be well advised to be sure that every datum entered is a datum needed. Until the industry comes up with a method of economically maintaining marginal data along with the hot stuff, users should proceed cautiously and use all the experienced personnel they can get to advise them in this phase of the project. The **design** of the data base is a very crucial factor and cannot be overemphasized. It is an art in itself.

IMS is an interesting and advanced system, and implements an important step in the much-needed data interface concept. It should greatly assist those committed to implementing a common data base who might have had to go a much more hazardous and less generalized and supported route. ▲

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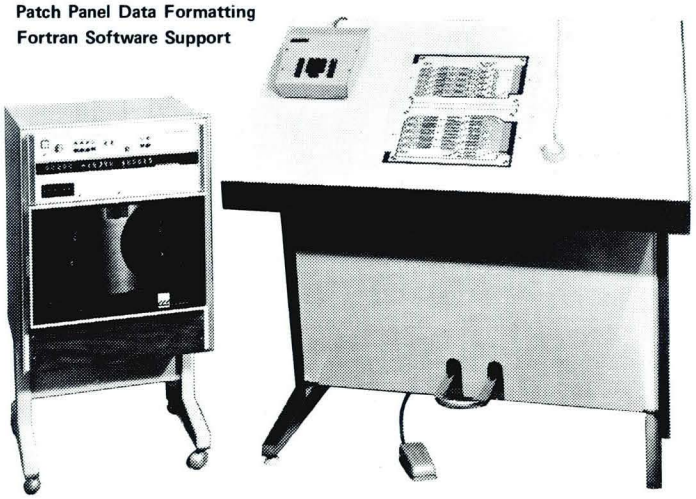

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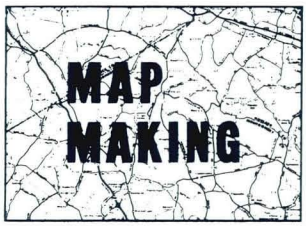

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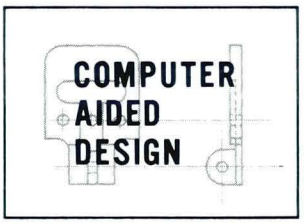

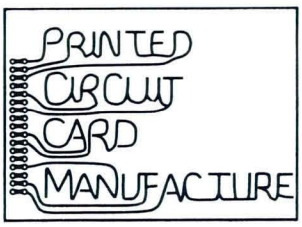

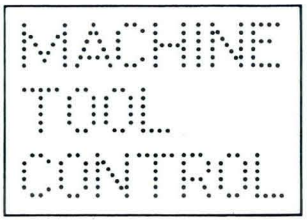

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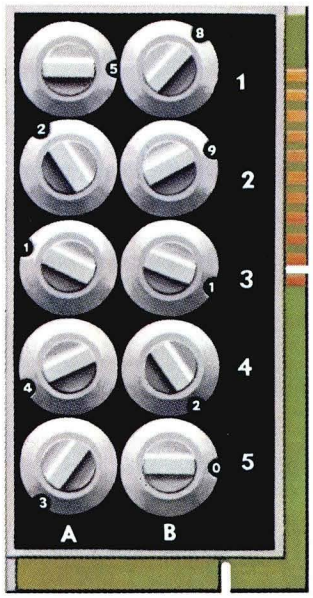

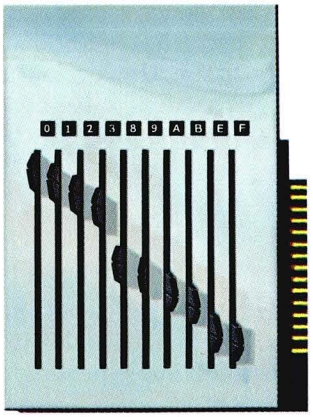

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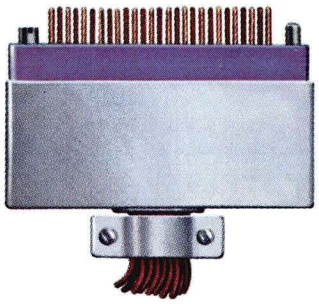

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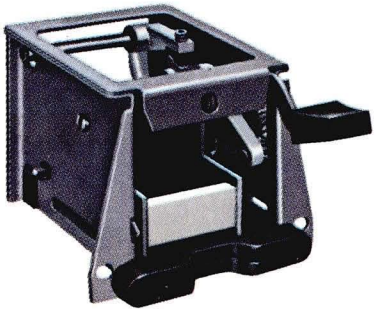

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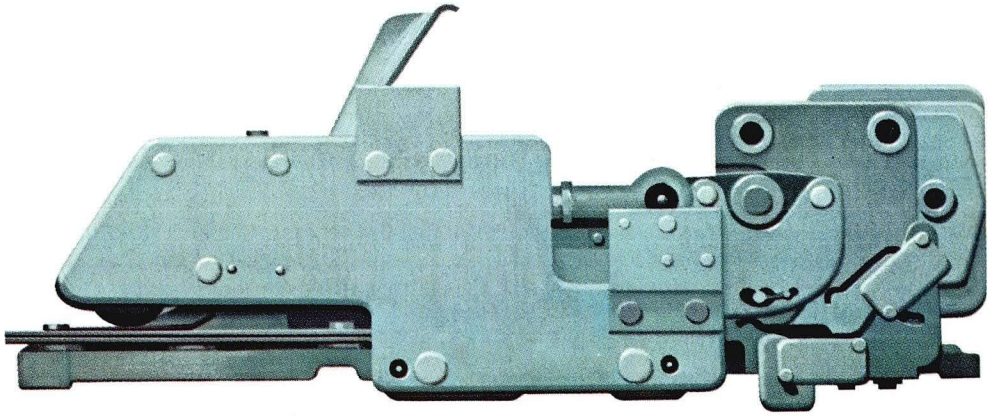

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Submitted by:
James W. Hayden
Norwalk, Iowa

DUE TO MY WHAT?

Last month I received my bank charge card statement. Printed at the bottom was the following computer-generated message: "Due to your excellent payment record, we have raised your credit limit from $300.00 to $500.00." Printed at the top was another computer-printed message: "Our records show your account $20 past due. Would you please take care of this immediately."

Submitted by:
Robert L. Sparling,
EDP Mgr.
Ren Plastics, Inc.
Lansing, Mich.

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ONE SMALL BUG

A large midwestern manufacturing company received an IBM 360 and began converting its payroll systems from the IBM 1401 it had been using. The programmer doing the conversion was being pressed as the deadline was nearing. Testing and debugging. Testing and debugging. Finally the program was ready and the checks were sent out. The programmer was promised a raise for his efforts. The next day he received his check and discovered the only bug in the entire program. His check read: PAY EXACTLY $.00.

Submitted by:
James A. Ritschel
St. Paul, Minn.

THANKS FOR THE MEMORY

In the middle of 1967, I received, unrequested, two copies of an inter-bank credit card from my bank. I cut them up and threw them away. About two months later I received two more copies, also unrequested. I cut them up and threw them away also. In July 1969, I received a statement from the bank, showing an account number, statement date, credit limit, unused credit, date payment due, and number of entries. This information was followed by all zero entries for previous balance, payments, credits, two separate finance charges and their total, late charge, amounts advanced, new balance, balance subject to finance charge, and annual percentage rate. Fortunately, all these entries were correctly entered as zeros, and I was happy to be remembered for two years by the computer — except that my last name was printed as Johnson instead of Jones, and the street name was misspelled.

Submitted by:
Ronald A. Jones
Information Systems Engineering
McDonnell Douglas Astronautics Co.
Huntington Beach, Cal.

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SAFEGUARD—A Forum of Opinion

The January issue of MODERN DATA contained an editorial on the Safeguard-ABM controversy which invited our readers to reply to the question: **Is the ABM system capable of being practically implemented, or is it beyond our current state-of-the-art?** The editorial stressed that while a considerable amount of literature has been generated concerning the moral and political aspects of the Safeguard-ABM system, comparatively little has been addressed to the technical issues raised in connection with Safeguard's computer system by "individuals with actual computer experience."

Included with the editorial as the first contributions to this "forum of opinion" were letters solicited from two such experienced individuals with opposing points of view. The first letter, from Dr. John S. Foster, Jr., Director of the Dept. of Defense, Office of Defense Research and Engineering, answered a MODERN DATA request for a reply to "the number of questions raised in connection with the Safeguard-ABM computer system." The second letter was forwarded to MODERN DATA by Daniel D. McCracken, a well-known software authority and chairman of "Computer Professionals Against ABM." The editorial concluded "in the hope that those of our readers who are qualified to shed some additional light on this important issue will do so by sending us their comments."

We are pleased that many of our readers found the time to respond to this request, and the following letters are some of the replies we have received so far. In subsequent issues of MODERN DATA we shall continue this "experiment to help us determine not only whether we can accept Safeguard as a viable program, but whether you, the professional, care enough to think about it."

Alan R. Kaplan
Editor

To the Editor:

In response to your call for opinions on the ABM issue, I would like to add a few specifics to the general statement of Computer Professionals Against ABM, of which I am a signer.

I am not familiar with Mr. Foster's background, but I have to assume from his letter that he has little or no computer experience. His poor analogies are clearly refuted by the CPAABM statement, and if he had any experience with large systems he would know that input simulation is an acknowledged inadequate technique for testing programs. First of all, we know we can not prove that a large system works. The most that can be said for any program is that it has worked for a great variety of inputs for a long time; and simulated inputs are not sufficient. Their completeness is the same function of programmer's understanding the requirements, as was the original programming job. Therefore, there is a strong tendency to design tests the system will be able to pass. If the program has ignored a particular attack strategy completely, it is not likely that the test inputs will include that strategy. Worse yet, if the programmers have failed to imagine the possibility of some accident, they are hardly likely to test for it, except by accident.

Then there is the matter of "point of diminishing returns." At some point in the de-bugging process of a very large, complex program, it becomes reasonable to assume that even known errors should not be corrected due to the high probability that worse faults will be introduced by the change. Virtually every operating system, compiler, and assembler has such known bugs. The Electronic Switching System of Bell Laboratories is just such a program. I worked on that system for ten years, and can attest to the fact that it has been in use since 1965 with known bugs, some of which have been changed by a slow evolutionary process involving real world data and a feedback mechanism that will not be possible with the ABM system. The telephone system's large program is judged "good enough," and is never expected to be perfect. But "good enough" is not good enough for a system that can unleash nuclear weapons.

Also, there is the matter of changes. Assume, optimistically, that we manage to develop a harmless system. Clearly the program will require continual revision to keep up with improved offensive techniques. We can be quite confident that at some stage of its continued metamorphosis, our poorly tested, but apparently harmless system, will become frighteningly dangerous.

If the military industrial complex feels the need to build an ABM system, it won't be stopped by letters to **MODERN DATA,** but I couldn't let Mr. Foster's statement go unanswered.

Justin L. Kodner
RCA-David Sarnoff Research Center
Princeton, N.J.

To the Editor:

This letter is prompted by your editorial in the January issue of **MODERN DATA** concerning the ABM Safeguard system. As a computer professional I believe that this system will perform in a satisfactory manner including the hardware and software subsystems.

The letter from Mr. McCracken and the Computer Professionals Against ABM shows a lack of confidence in the ability of engineers to design a reliable complex system. This ABM system will be developed by engineers that routinely must succeed in difficult tasks; tasks that many times are not even well defined when final commitment must be made on them. For instance the large and very successful Apollo moon program is a good example of the accomplishments of engineers.

The software engineering problems that will be encountered in the ABM system are indeed staggering but I have every confidence that these engineering problems will be satisfactorily overcome and the computer subsystem will perform up to standards. The large amount of software engineering development that will be accumulated during this effort will be an important byproduct.

Also as a professional nuclear engineer, I do not feel the apprehension over the testing or destruction procedures that the CPAABM present in their letter. The simulation testing of the ABM system is again an engineering problem and can be handled without the use of nuclear warheads. On the other hand, high-altitude nuclear explosions have occurred before and the accidental occurrence of another would not be desirable but neither would it be catastrophic.

In summary, the ABM system developed by superior engineering talent will be a successful operating system.

J. O. Mingle,
Prof. of Nucl. Engrg., and
Dir., Inst. for Computational Res. in Engrg.,
Kansas State University,
Manhattan, Kansas

To the Editor:

I would like to take advantage of your invitation to comment and hopefully shed a small additional ray of light on the ABM issue. In my opinion, the hope of success of the system is high enough to justify our attempting it. Admittedly, the system is not without risk, but what new system ever has been? In the following paragraphs, I would like to present some of my reasoning in arriving at my position.

I do not feel particularly qualified to analyze the requirement or the threat, yet some weight must be placed on the consequences of deciding to continue or to cancel an ABM program. The effectiveness of any ABM system lies somewhere between useless if it does not work at all, to strategically decisive if it is completely effective. In the latter case, the possessor of such a system could use his offensive weapons with impunity in the full realization that he is immune to retaliation. Clearly, the system we are considering here lies somewhere between these two extremes (if I am right that it will work after a fashion). To continue a situation of no defense at all without so much as trying to improve our position is to insure that we shall never have a ballistic missile defense. This is an intolerable situation.

I would like to avoid the vitriolic rebuttals which are occasionally seen in technical journals, but it seems desirable to examine in further detail the arguments presented by Computer Professionals Against ABM in the January 1970 issue of **"MODERN DATA."** The air traffic control system analogy is a good one, but it does not seem to take into consideration some of the things that can be done to avoid the pitfalls described. Undoubtedly, a great deal of effort must go into the development of simulators. In the initial stages, complete simulation would be required. As the system is developed, only inputs to detection sites would be simulated. The outputs of these sites would then be compared against results which are expected for actual ICBM detections under the circumstances which are simulated. Once a series of simulations has been developed and validated by a technique such as that described above, the next step is to introduce these results into the ABM control system and analyze the output against that expected. Finally, when the response from the ABM control system has been validated, simulated firings should be made, and finally live firings (with dummy warheads) should demonstrate that the system performs properly. This simulation, if carefully planned and executed, should eliminate the lion's share of the risk.

The election-result-predicting computer does not seem to be a particularly cogent analogy. The program errors mentioned in the previous letter could certainly have been detected by relatively simple simulation, hence I conclude such testing must not have been done.

Evolutionary development has certainly been shown to be the proper approach to system growth, but a system must start somewhere and evolve from that point. ABM can hardly start as less than a few closely related sites, which, if successful, would grow into a nationwide ballistic missile defense.

The hardware reliability problem which was mentioned is easily reduced, although not eliminated, by use of redundancy and automatic switchover — a luxury frequently not available to data processing systems. Certainly the election-predicting processor did not have these features, presumably for economic reasons. I have personal knowledge of several large processing systems where down time averages a few minutes or less per month, and techniques exist which, I believe, could reduce recovery time to the millisecond range.

Turning now to the four specifics of the earlier letter, it is true that the computing task is extremely complex. On the other hand, the mathematics of ballistic flight, either powered or not, are well known, and the equations lend themselves to explicit solution.

There are only a limited number of countermeasures which an attacker might use. The number may be large, but it is finite. Furthermore, many of his options may be "don't cares" so far as we are concerned. For example, if he sabotages a radar site or merely jams all its available frequencies, from our point of view it is a single alternative. In any event, his alternative can be listed and our courses of action matched to them.

Testing is possible, but admittedly not with live warheads. However, the problem is to put the ABM in a specific volume of space at a predetermined time. This can be tested. Firing mechanisms, safety mechanisms, destruct-mechanisms, etc. can all be checked out by actual test. Only the kill radius cannot be actively tested, and I feel certain adequate data to determine this parameter is already available.

Evolutionary development, as mentioned above, would occur on the basis of test data, both live and simulated. It would begin with the early simulations and continue through deployment of the first ABM until the ultimate ABM system is deployed nationwide. Harking back to the election-predicting computer, surely its evolutionary development does not occur in quanta every four years. In all likelihood, bugs are eliminated and improvements implemented continuously during the whole period between elections. In like manner, the ABM control system will not need to wait on firings-in-anger.

Tactical warning may be short indeed. However, the decision to fire need not be left to the processor if we keep ABM reaction time short and thus preserve those precious minutes for human decision. Certainly, priority should be high enough that the slightest indication of attack is relayed directly to the President and the Chairman of the Joint Chiefs of Staff for immediate evaluation. However, it must be realized that installation of the Safeguard system will not decrease warning time and, today, in those few minutes of tactical warning, a decision must be made to release or to hold the retaliatory force. A bad decision concerning the defensive system if installed would not have as far-reaching effects as a wrong decision to launch the retaliatory force.

As a practical matter, there are many intelligence indicators which would give far greater warning than a few minutes or even hours. With the occurrence of some of these indicators, the system (including the people who make decisions) could move to more and more ready conditions such that good decisions can be made in a short time. Furthermore, the system can be designed such that it could not, under any circumstances, cause a launch unless human intervention has entered a "guns free" command.

What damage can be caused by an inadvertent or erroneous launch? It is true that the ABM will have a nuclear warhead, however, safety devices would normally be provided to prevent the warhead from arming below a predetermined altitude, or to disarm it should it descend again. A destruct mechanism controlled from the ground would cause the missile to be destroyed in a non-nuclear detonation which would also cause disarming of the nuclear head to prevent detonation upon impact. Thus, the only danger in an erroneous launch would be that of a low-order, non-nuclear detonation upon impact of the ABM. Such an event would be deplorable, of course, but, even in the unlikely event that it should occur in a metropolitan area, it would not be a national calamity.

The probability of an ABM launched in error, assuming by chance a trajectory which would appear hostile to another nation, is quite remote. In addition, as soon as it is discovered that we are not under attack and that our ABMs have been launched, we would immediately take steps to destroy them and to advise any potential hostile nation. Their detection systems will already have detected the launch, the trajectories, and finally the destruct.

From a technical point of view, the intercept problem is not a new one. It has been solved for both manned aircraft and for missile intercepts. There may be a number of different conditions under which intercepts may have to be made and the program will have to be able to recognize which set of conditions exists at any particular time. This, too, represents nothing that has not been done before. There may be conditions under which intercept must be made which have not been defined as yet, but these conditions exist only in finite numbers and can be defined.

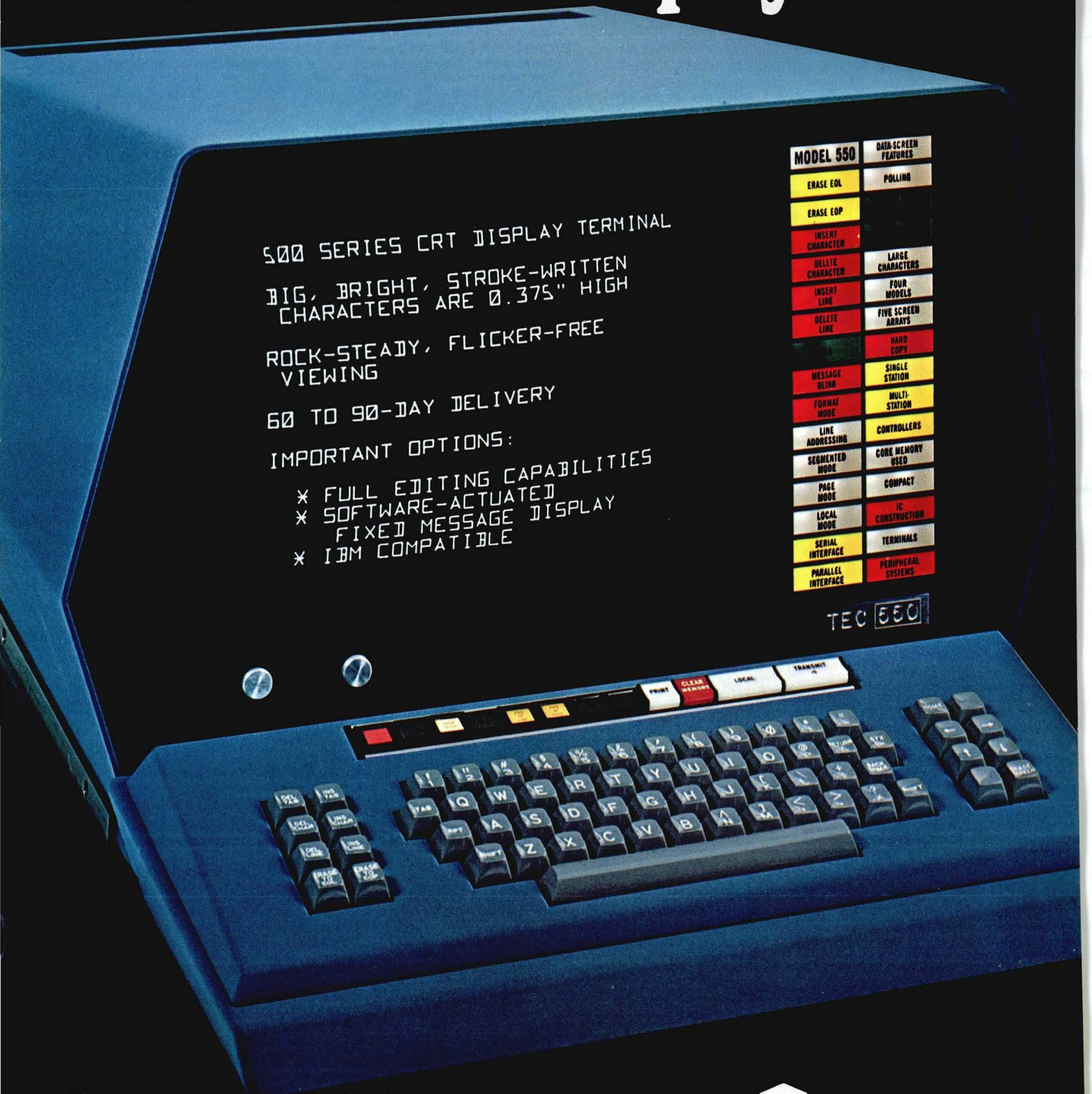
There are many analogies to the proposed Safeguard processing system. All of the achievements of the space program can be cited. Specifically, the Mariner projects are worthy of mention as are all the manned space flights culminating in Apollo and successful landing upon the moon. There was little evolutionary development in those programs. In each case, there had been simulation, but each launching was a one-of-a-kind. Each had to work the first time and, strangely enough, all of them did.

The moon landings had been simulated on earth, but there was far less realism there, it seems to me, than is possible in the Safeguard program. In the case of the two landings, a number of complex and untested things had to work properly the first time. Certainly, the success enjoyed by that program shows the sort of reliability and accuracy that can be achieved with a very minimum of trial and error type testing.

In conclusion, for reasons stated above, I consider the Safeguard ABM system to be technically feasible. In addition, the dangers of the system appear to have been greatly overstated while little has been said to support the fact that a workable ABM system confers a tremendous advantage upon the nation which first develops it, even though it not be perfect. In the absence of some better system, I urge that we proceed with the Safeguard ABM system.

R. G. Bounds, Group Head
Collins Radio Company, Computer Systems Div. 1B
Dallas, Texas

You're looking at the most readable CRT Display made.



TEC stands alone . . . with the most readable, most flexible CRT Display Terminal. Priced from $3783 in 100 quantities. TEC, Incorporated, 6700 So. Washington Avenue, Eden Prairie, Minnesota 55343.

TEC® INCORPORATED

See TEC's DATA-SCREEN™ Terminals at SJCC Booth #4704-06.

1970 SPRING JOINT COMPUTER CONFERENCE

May 5, 6, 7, 1970 • Convention Hall • Atlantic City, N. J.

The American Federation of Information Processing Societies brings the SJCC back to Atlantic City to discuss "The Computer: Gathering Force of the Seventies."

This year's SJCC theme reflects the growing impact computers will have on business and society in this decade. Certainly it gets the decade off to a running start. The 36th JCC sponsored by AFIPS, this spring's Atlantic City conference, is expected to draw more than 40,000 spectators, exhibitors, and attendees — making it the largest computer conference ever held in the U.S.

KEYNOTE ADDRESS

The conference will be opened Tuesday morning, May 5, with a keynote address by Sam Wyly, chairman of the board of University Computing Corp. As the founder and directors of a company that in seven years has grown into a multi-million dollar, multi-national computer utility with subsidiary corporations in computer leasing, manufacturing, and communications, Mr. Wyly is certainly qualified to discuss future prospects.

THE MAN RESPONSIBLE

General chairman of the conference will be Harry L. Cooke, manager of information services and technical relations for RCA's David Sarnoff Research Center in Princeton, N.J. Mr. Cooke has served previously as chairman of local arrangements for the 1968 SJCC, and is widely respected for his original work in circuit and display technologies.

SPECIAL ACTIVITIES

To supplement the 33 technical sessions (4 more than were given at Las Vegas last fall), the SJCC program committee has scheduled several unusual special activities:

A Pre-university Technical Program developed by none other than the R.E.S.I.S.T.O.R.S. of Hopewell, N.J. You'll have the opportunity to meet this interesting and percocious group of youngsters on Tuesday evening.

A Venture Capital Panel on Wednesday evening will discuss venture capital as it applies to companies in the computer industry.

Two Computer Science Theatres off the main exhibit floor will operate concurrently Tuesday afternoon and all day Wednesday and Thursday.

EXHIBITS

Although Atlantic City will host slightly fewer exhibitors than were at last year's FJCC, AFIPS expects more than a 60% increase in exhibitors over the 174 companies that were represented at last spring's Boston conference. The exhibit areas in Convention Hall will open Tuesday through Thursday at 10:00 A.M. and remain open until 6:00, 9:00 and 5:00 P.M., respectively.

A WORD OF ADVICE

The Atlantic City Convention Bureau claims that there are "32,000 rooms in hundreds of hotels and motels within a short distance of each other and the Convention Hall." Maybe so. But only if you count those for which bed-board and "room" is interpreted loosely. Don't plan on finding satisfactory accommodations **after** you arrive. Get your reservations in now!

SJCC TRANSPORTATION

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

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

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

By bus – 18 express busses daily from New York and Philadelphia, regular service from Washington and Baltimore, and charter service.

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

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

a microfilm recorder for less than $40,000*

You can pay many times the price of the SEACO 401 COM Recorder ...you bet and get many extras and frills that you probably don't want or need. The SEACO engineering team, with years of know-how in CRT technology, has applied their experience toward producing **a better COM** recorder for less money. SEACO has it

The SEACO 401 has an impressive list of credits that make it the industry's most stable and reliable COM Recorder: ■ unequalled stability, practically eliminating realignment ■ a unique interface circuit that easily accepts any input without reformating ■ a wide choice of options..including an inexpensive and simple forms flash assembly.

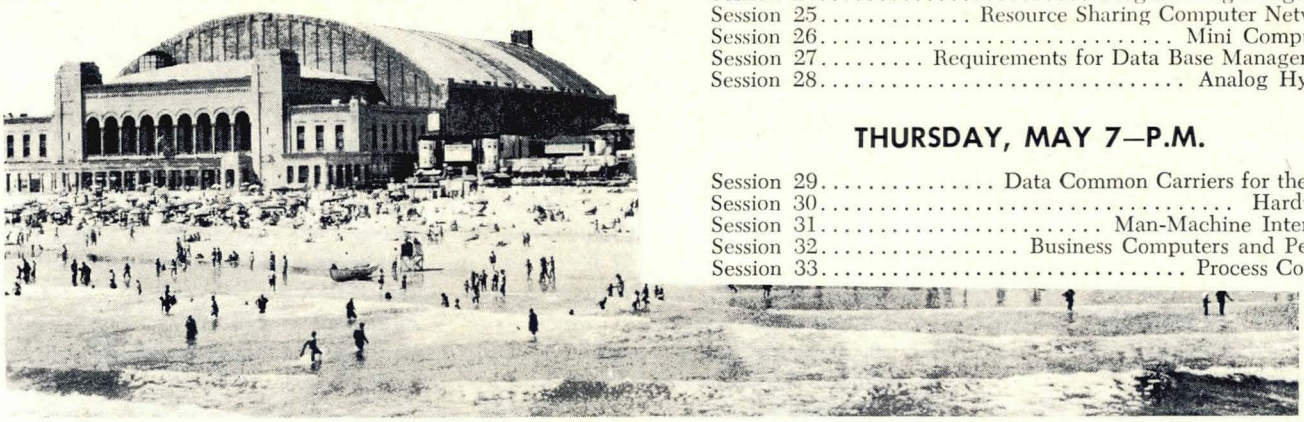
Contact our Marketing Division **now** for a complete demonstration. Or...send for microfilm sample of SEACO's exclusive high-quality characters...the most legible in the industry.

* Price includes a 7 or 9 track tape transport.

SEACO
Computer-Display Incorporated
2714 National Circle / Garland, Texas 75040 / (214) 271-2521

TUESDAY, MAY 5—A.M.

Session 1 ..... Graphics
Session 2 ..... Patents and Copyrights
Session 3 ..... Multiprocessors for Military Systems
Session 4 .... The Information Utility and Social Choice
Session 5 ..... Simulation in Education
Session 6 ..... Program Transferability
Session 7 ..... Computing in State Government
Session 8 ..... Microprograming
Session 9 ..... Automata Theory



WEDNESDAY, MAY 6—A.M.

Session 10 ..... Operating Systems
Session 11 ..... Information Management Systems
Session 12 ..... Lessons of the Sixties
Session 13 ..... Artificial Intelligence
Session 14 ..... Computers in Education

WEDNESDAY, MAY 6—P.M.

Session 15 ..... Proprietary Software in the 1970s
Session 16 ..... Humanities
Session 17 ..... Digital Simulation Applications
Session 18 ..... System Architecture
Session 19 ..... Numerical Analysis
Session 20 ..... Separate Pricing Revisited
Session 21 ..... Social Implications
Session 22 ..... Computer Systems Modeling and Analysis
Session 23 ..... Medical-Dental Applications

THURSDAY, MAY 7—A.M.

Session 24 ..... Programming Languages
Session 25 ..... Resource Sharing Computer Network
Session 26 ..... Mini Computers
Session 27 ..... Requirements for Data Base Management
Session 28 ..... Analog Hybrid

THURSDAY, MAY 7—P.M.

Session 29 ..... Data Common Carriers for the 70s
Session 30 ..... Hardware
Session 31 ..... Man-Machine Interface
Session 32 ..... Business Computers and People
Session 33 ..... Process Control

REGISTRATION FEES

AFIPS MEMBERS $20 (incl. proceedings)

NON-MEMBERS $40 (incl. proceedings)

BANQUET (May 6 . . . 7:00 P.M. Grand Ballroom of the Shelburne Hotel; preceded by cocktail hour) $10

COCKTAIL RECEPTION (May 5 . . . 6:00 to 8:00 PM, Grenada Room of the Howard Johnson Motor Lodge) $ 7

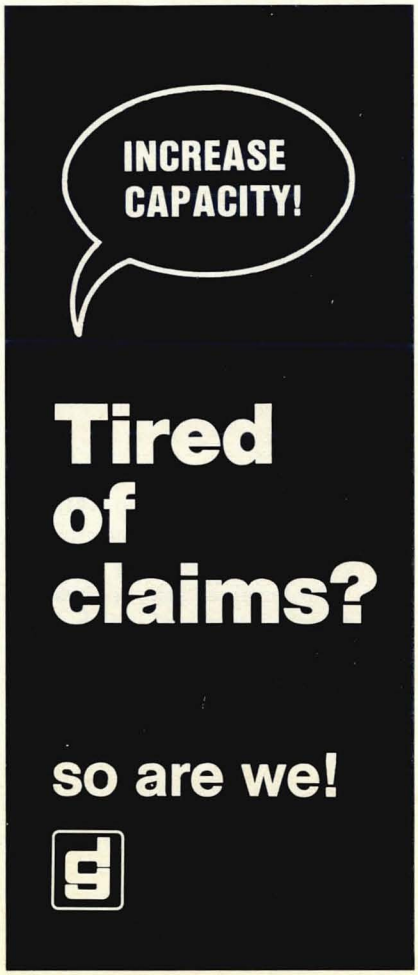
PRE-REGISTRATIONS, including banquet and cocktail reception reservations, will be accepted by mail until April 15. Checks must be made payable to "1970 SJCC" and mailed to:

1970 SJCC Registration
c/o AFIPS
210 Summit Avenue
Montvale, New Jersey 07645

Members must list the AFIPS organization(s) to which they belong.

CONFERENCE REGISTRATION will be accepted at the following sites and times:

SITE	May 4 Monday	May 5 Tuesday	May 6 Wednesday	May 7 Thursday
Convention Hall	4pm-10pm	8am- 6pm	8am-9pm	8am-5pm
Shelburne Hotel	4pm-10pm	7am-12am	none	none
Holiday Inn	4pm-10pm	7am-12am	none	none
Dennis Hotel	4pm-10pm	7am-12am	none	none
Deauville South Hotel	4pm-10pm	7am-12am	none	none
Traymore Hotel	4pm-10pm	7am-12am	none	none



1970 SJCC EXHIBIT PREVIEW

This preview does not include every exhibitor — only those who responded to our request for information in time to meet our press deadline.

ADVANCED SPACE AGE PRODUCTS, INC.

Booth No. 35003 — This subsidiary of Telegraph Equipment Corp. will announce the latest in its line of Mylar/paper tape punches. The P-150 punches Mylar and paper at speeds up to 150 cps. DTL and TTL compatible, the unit sells for approximately $2250.

ALLEN-BABCOCK COMPUTING, INC.

Booth Nos. 46022-23 — This company will demonstrate its time-sharing capabilities, which now include FORE (for File Operation in the Rush mode), a proprietary file maintenance/management package for updating and entering records in both conversational and background modes.

ALLIED COMPUTER SYSTEMS, INC.

Booth Nos. 10002-03 — The ReaDoc Mark 2, a multi-station optical reader system for accounts receivable applications, will be shown. The system includes a 4K central processor, disk and tape units, and up to 12 document readers with keyboards.

AMP INC.

Booth No. 5000 — The AMP Syscom, a remote input terminal for punched badge cards, will be on display. The terminal also accepts variable data via a series of switches.

AMPEX CORP.

Booth No. 3800 — The TMC cassette tape drive, a 9.6KC drive to be used with minicomputers and remote terminals, will be introduced. A new family of low-cost core memories will also be shown.

ANDERSON, JACOBSON, INC.

Booth Nos. 33001-02 — Anderson Jacobson will exhibit ASR and KSR terminals with built-in couplers; acoustic shields for teletypewriters; a 1200 baud half-duplex Bell 202C compatible combination coupler and modem; and a new series of couplers, modems, and combination coupler modems. The new 240 series terminals is said to be of an advanced design that economically satisfies various requirements of time-sharing equipment users. The user is able to select a model that includes only those inputs and outputs required.

APPLIED DIGITAL DATA SYSTEMS, INC.

Booth Nos. 11011-12-13 — ADDS will exhibit its SRD-100 static raster display, the MRD series of CRT displays, and Portavision portable CRT terminal. Also planned for exhibit is the COM-100 series of low-speed modems.

APPLIED DYNAMICS INC.

Booth No. 27000 — Shown will be a series of analog/hybrid and dynamics terminals for analog/hybrid time-sharing.

APPLIED LOGIC CORP.

Booth Nos. 114-15 — This time-sharing company will demonstrate its interactive and high-speed terminals, and new chemical engineering, civil engineering, and MIS software.

APPLIED PERIPHERAL SYSTEMS, INC.

Booth No. 1441 — The DG-4, a remote numeric data entry terminal, transmits information to a DG-5 tape unit at speeds up to 6,000 char./minute. Data entered on the DG-4 keyboard is stored on tape and then transmitted to the DG-5 tape unit, where it is checked for accuracy and formatted on 7- or 9-track tape at densities of 556 or 800 bpi.

ASTROCOM CORP.

Booth No. 49006 — Astrocom Corp. will announce several additions to its line of data communication systems. The new equipment includes the Astroset 120 series, equivalent to the Bell 202; and the Astroset 701 series, automatic answer adapter for use with the manual DAA. In addition, the Astroset 708 series provides a replacement for the Bell 801 automatic calling unit with multi-line capability. The compatibility of this equipment will be demonstrated by on-line operation.

ASTRODATA, INC.

Booth No. 3400 — Astrodata's electronic data sorter will be demonstrated together with analog/hybrid interfaces and various data collection systems.

AUERBACH INFO, INC.

Booth No. 1601 — This publisher of computer reference services will introduce two new product lines. *AUERBACH Software Reports*, comprising business, scientific, and engineering software will be available on a bi-monthly subscription basis. Also being introduced is a line of hard-cover industry directories, price/performance digests, and state-of-the-art reports.

AURICORD DIV. OF SCOVILL CO.

Booth No. 50002 — This manufacturer of tape and cassette equipment will exhibit a new series of low-cost metal cassettes said to eliminate static charge problems.

AUTO-TROL CORP.

Booth Nos. 34005-06-07-08 — Auto-trol is introducing a new version of its Model 6030 digital plotter featuring a combination of two plotting surfaces in one machine, both flat bed and drum style. The unit is said to be the first drum on the market capable of drawing straight lines at any angle at a resolution of 0.0005″ with end-point X & Y co-ordinate values as the input command.

AXICOM SYSTEMS, INC.

Booth Nos. 4605-06 — Axicom will demonstrate an interactive plotting system and several other remote terminals used with its various time-sharing services.

BETA INSTRUMENT CORP.

Booth Nos. 120-21 — A 105mm microfiche camera option for the Beta COM 600 computer output microfilmer will be introduced. The option includes formatting and indexing software.

BRIDGE DATA PRODUCTS, INC.

Booth No. 50011 — The Model 8096 card reader, which reads the new IBM System/3 card as well as 51-column and 80-column cards, will be introduced.

BUCODE INC.

Booth No. 303 — Bucode will introduce its Model 20290 tape transport, a completely automatic loading high-speed tape drive which operates at speeds from 100 to 200 ips and at packing densities to 1600 bpi. Available with read/write electronics for 800 bpi NRZI, 1600 bpi phase-encoded, and dual (800/1600 bpi) density recording, the 20290 offers transfer rates to 320KC. Bucode will also announce the availability of 1600 bpi read/write electronics for its Models 2010, 2015, and 2017 low-cost, low-speed tape transports.

CALIFORNIA COMPUTER PRODUCTS, INC.

Booth No. 5200 — CalComp will introduce the CD12/14, an IBM 2314-compatible disk storage system. Also to be demonstrated live are digital plotters, a microfilm output system, and keypunch equipment.

CAMBRIDGE MEMORIES, INC.

Booth No. 25008 — Magnetic core, thin film, and semiconductor memory systems will be on display.

CENTURY DATA SYSTEMS, INC.

Booth Nos. 2002-03 and -09 — This affiliate of California Computer Products will display an IBM 2314-compatible disk drive system. Utilizing a Model 1014 controller and from one to nine Model 114 disk drives, the new system is said to be 100% program-compatible and fully interchangeable with the IBM 2314.

CINCINNATI MILLING MACHINE CO.

Booth No. 12008 — This company will exhibit its recently-announced microprogrammable minicomputers, the CIP/2000 and CIP/2100.

CIPHER DATA PRODUCTS

Booth No. 26001 — Cipher Data Products will introduce a new line of continuous mag tape transports with limited electronics. The Series 0700, a portion of the new line, will be on display.

CODEX CORP.

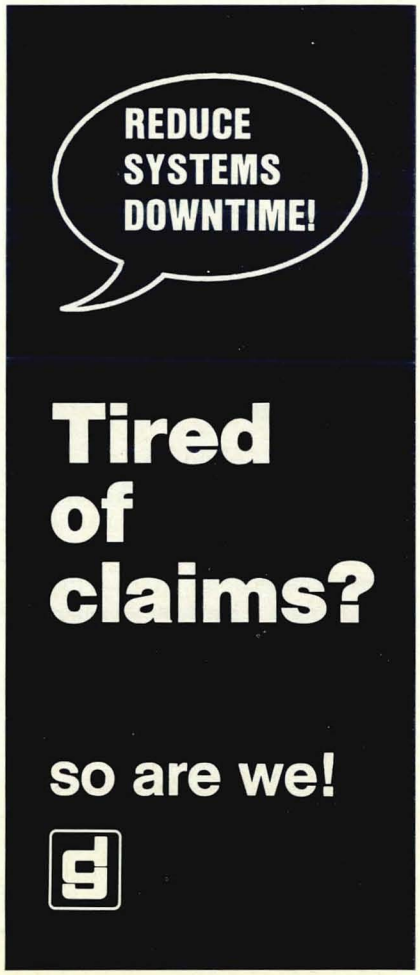
Booth No. 15000 — Codex will display the TM-8, a time-division multiplexer that simultaneously handles up to 8 terminals at intermixed speeds. The multiplexer operates with the Codex AE-96 modem at speeds from 1200 to 4800 bps.

COGAR CORP.

Booth Nos. 2005-06 — A display of high-performance bipolar memory systems, which operate in the 40ns range, will be shown in both read/write and read only configurations. Also on display will be models of Cogar's medium-performance memory systems which operate in the 120ns/150ns range.

COMMUNITY COMPUTER CORP.

Booth Nos. 49015-16 — The Model 1010 Disk/Controller provides up to 51 megabytes of mass storage capability for a 16-bit computer by allowing two 16-bit processors to access up to eight disk drives. The Model 1010, a self-contained plug-in package, was designed around the Hewlett-Packard 2116B, 2115A, and 2114B computers and the IBM 2311 disk drive, but will interface most other 16-bit word length processors with any other compatible disk storage units.



COMPAT CORP.

Booth Nos. 13003-04-05 — Compat will introduce its 88-33, a remote batch terminal with a central processor, a printer, and four random access mag tape magazines. Other remote terminals will also be shown.

COMPILER SYSTEMS INC.

Booth Nos. 25009-10 — Three compilers—Algol, Basic, and Fortran IV—will be run on a 16-bit and a 24-bit word computer.

COMPUTEK, INC.

Booth No. 19001 — The Computek Series 400 CRT display system, a curve graphic, vector graphic, and alphanumeric interactive terminal will be shown together with the new Model GT/50 graphic tablet, and the Model 100 microprogrammable alphanumeric CRT display.

COMPUTER DIGITAL SYSTEMS

Booth No. 50013 — On display will be the Model 9606 card reader, which reads the new 96-character IBM System/3 cards at 1000 cpm.

COMPUTER DISPLAYS INC.

Booth Nos. 25003-04-05 — The ARDS 100A, an alphanumeric/graphic CRT terminal, operates at 1200 baud (remote) and 50,000 baud (direct connection). A cassette tape recorder and a hard-copy camera are designed for use with the terminal.

COMPUTER-LINK CORP.

Booth Nos. 43008-09 — Computer-Link will announce dual-density magnetic tape evaluator-cleaner. Also to be announced is a line of disk pack testing equipment for 6- or 11-disk IBM-compatible disk packs.

COMPUTER MICRO-IMAGE SYSTEMS, INC.

Booth Nos. 35004-05 — On display will be the CMS-7000 Computer Output Microform System, which accepts alphanumeric data on-line or off-line from magnetic devices at data rates up to 300,000 chars/sec. and prints on any microform at 120,000 chars/sec. Page printing rate is up to 900 pages/minute. Any character code is acceptable.

COMPUTER PERIPHERALS CORP.

Booth Nos. 4611-12 — The Fastrack Model 8100, a fixed-head disk storage system, stores up to 96 megabits and transfers data at speeds up to 6 megabits/second. The system's error rate is said to be one bit per 10 billion bits transferred.

COMPUTER SCIENCES CORP.

Booth No. 2200 — INFONET, CSC's new time-sharing information network service, will demonstrate its three services: Basic, conversational remote job, and remote job entry.

COMPUTER SIGNAL PROCESSORS, INC.

Booth Nos. 201-02 — The CSP-30 high-speed signal processor will be shown for the first time. The CSP-30 is a fast (100 nsec. basic cycle time) dedicated processor featuring both core and IC memories, and complete utility and functional software.

COMPUTER TRANSCEIVER SYSTEMS, INC.

Booth Nos. 203-04-05 — The Execuport 220TV, is a scan converter for displaying the input/output of CTSI's Execuport 300 thermal page-printing data transceiver on any conventional TV set. Another scan converter, the Execuport 220TVT, is for teletypewriter users. Both units display 800 characters.

COMPUTERVISION CORP.

Booth Nos. 13015-16 — The INTERACTgraphicI, an interactive CRT display terminal and digital plotter, will be demonstrated live. The Compucircuit 100, a daylight-loading and operating photoplotter, will also be demonstrated on-line.

COURIER TERMINAL SYSTEMS, INC.

Booth Nos. 16500-1 — The Executerm 60, a stand-alone CRT terminal, will be demonstrated on-line to an IBM 360 computer.

DAEDALUS COMPUTER PRODUCTS, INC.

Booth Nos. 25006-07 — Daedalus will have its first public display of the IBM-compatible Model 119 magnetic tape controller. The 9-track, 800 bpi controller is the first announced peripheral option to the Daedalus 711 programmable data terminal, the recently-introduced remote batch terminal which features a built-in modem, memory, universal I/O, and 30 cps printer. The magnetic tape controller has been designed to serve as a mass data storage device and to interchange data with the terminal on-line or off-line.

DASA CORP.

Booth Nos. 24010-11-12-13 — Two tape-cartridge storage and transmission terminals will be shown: the Datakwik, with a capacity of 6000 characters; and the Datacall, which stores 80,000 alphanumeric characters. Both units operate with standard modems over voice-grade telephone lines.

DATA CARD CORP.

Booth Nos. 1508-09 — Data Card will exhibit a device for embossing and encoding credit cards. Data input is from computer-compatible magnetic tape input.

DATA COMPUTER SYSTEMS, INC.

Booth Nos. 45010-11-12-13 — The System CP-4, a high-speed remote batch terminal, will be demonstrated. Features include S/360 compatibility and full- or half-duplex operation.

DATA COMPUTING, INC.

Booth No. 1506 — Three models of this company's Cardliner remote communication terminal for reading cards at 10, 15, and 30 cps speeds will be shown. Also displayed will be the Typeliner, a 100 lpm communication printer with 80- or 132-column capacity.

DATACRAFT CORP.

Booth No. 24007 — Datacraft will exhibit its new 24-bit/word computer designed for real-time applications. The DC 6024/3 offers a full-cycle time of 1.0 usecs; five g-p registers, of which three may be used for indexing; an 8K memory, expandable to 65K; and four levels of priority interrupt.

DATA DISC, INC.

Booth Nos. 111-12-13 — The 6500 Series of alphanumeric/graphic display systems, compatible with IBM, Honeywell, and Hewlett-Packard minicomputers and the DEC PDP-9, will be displayed. Plug-compatible disk memory systems for Hewlett-Packard and Varian minicomputers will also be shown.

DATAFLO BUSINESS MACHINES CORP.

Booth Nos. 10014-15-16 — The new Dataflo-I, a magnetic tape-to-printer media adapter for high-speed off-line printing with IBM peripherals, will be in operation. Dataflo makes it possible to relieve the computer of time-consuming printing chores without the expense and complexity of additional computers or multiprogramming.

DATA GENERAL CORP.

Booth No. 2600 — Data General will announce what it claims is the single largest package of software in minicomputer history. The new software for the Nova and Supernova computers will include a disk operating system, Fortran IV, and a comprehensive Algol system.

DATA PRINTER CORP.

Booth Nos. 46013-14 — The V-132, a 600 lpm printer, will be introduced. The new printer accommodates form widths from 3-½ to 19-½ inches, and includes an 8-channel vertical format unit.

DATA PRODUCTS CORP.

Booth No. 1000 — The Model 2410 (132-column) line printer, designed for use with small/medium-size computers and data communications terminals, will be shown for the first time. The printer features an exclusive print hammer design which provides speeds of 245 to 1110 lpm for all 64 characters.

DATARAM CORP.

Booth Nos. 51001-02-03 — Dataram will introduce its Model 101 automatic plane and stack tester, the first in a new line of memory testers. The Model 101 is a universal system that will test any 2D, 2½D, or 3D memory core array, or larger stacks by sections.

DATATERM, INC.

Booth No. 45007 — The HS-300 reads punched tape photoelectrically at rates up to 300 cps, and has only one moving part — a stepping motor. Wear, dust, and noise associated with capstan and pinch-roll designs are eliminated. The photoelectric sensing system is said to insure reliable reading of all commercially-available tapes, whether opaque or translucent. The HS-300 will operate with reeled tapes or fan-folded tapes, as well as loops or strips. Modular design permits rapid rearrangements to satisfy different requirements.

DATATROL CORP.

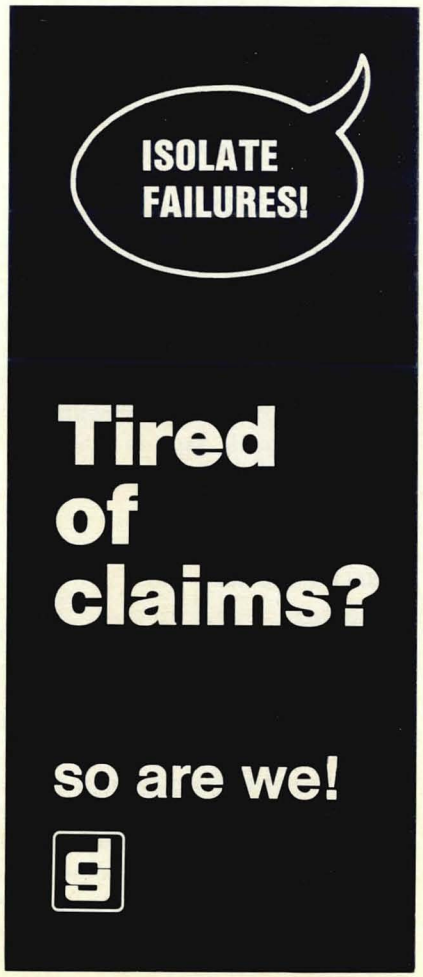
Booth No. 45002 — The Model DCS-2 and the new Model 60 simulators are used to design and evaluate process control systems and to train personnel.

DATRAN CORP.

Booth Nos. 6109-10 — Datran will introduce its Model 8551/8552. This IBM-compatible magnetic tape drive features triple-density operation with logical or manual selection, a 24KC maximum transfer rate, and 1KC incremental operation at any density.

DELTA DATA SYSTEMS CORP.

Booth Nos. 1702-03-04 — The TelTerm series of CRT display terminals, featuring edit, format, and blink capabilities, will be introduced. The Delta 1 display terminal, with color unit and auxiliary peripherals, will also be exhibited.



DIGITAL INFORMATION DEVICES, INC.

Booth No. 47007 — DID will display its V-Series of OEM magnetic tape transports. which are available in modular subcomponents ranging from basic rack-mounted decks to complete free-standing units. The V-Series drives feature dual vacuum capstans and computer-compatible tape cartridges. Floor and table-top models handle ½-inch tape at speeds up to 30KC, and are designed for small computer systems and remote terminal applications.

DIGITAL SCIENTIFIC CORP.

Booth Nos. 45004-05 — The Meta 4, with a 90-nanosecond ROM cycle time and a 900-nanosecond main memory cycle time, operates as a stand-alone computer or communication line controller, or can be used in a variety of high-speed interface arrangements. Capacity of the 18-bits-per-word memory is expandable to 65K.

DIGITRONICS CORP.

Booth No. 5100 — A new Data-Verter central magnetic tape terminal for gathering information sent over the telephone network from source recorders will be announced. The Model 5237 communicates with acoustical or unattended transmitters and records on IBM-compatible 9-channel magnetic tape in ASCII or EBCDIC code.

DYNELEC SYSTEMS INC.

Booth DD — The DyneMaCC 90 multiple-access communications controller is a universal front-end control system employing techniques of direct-line connection, multiplexing, and store-and-forward switching. The system can be structured to take over a few or all of the communications functions of the central processor, and is adaptable to the I/O channels of all major computers, emulating standard peripheral devices.

EASTMAN KODAK CO.

Booth No. 5400 — Kodak will introduce the Recordak Model MPG Motormatic Reader which accommodates microfilm reels, microfiche, and the Recordak Thread-Easy Magazine. Other new products on display will include a microfilm processor and a COM cartridge, both for daylight loading.

EDWIN INDUSTRIES CORP.

Booth No. 35008 — Edwin Industries will demonstrate the Model PF-40DM-8 graphic coordinate digitizer, a system which features built-in grid recognition and incremental modes as a part of the standard package. Also standard: a 16-key keyboard for inserting data, other than coordinate data, on magnetic tape, paper tape, punch card, or typewriter.

ELECTRONIC ARRAYS, INC.

Booth Nos. 11014 and 49017 — Electronic Arrays will announce four new products: 1) A low-cost keyboard terminal for use in digital data acquisition and management networks; 2) A 512-word, 4 bit/word random access read/write memory with 0.8 usec. max. read access time (MOSTAK I); 3) A 1024-word, 8 bit/word memory with a full-cycle time of 1 usec. (MOSTAK II); 4) An ROM simulator.

ELECTRONIC ASSOCIATES, INC.

Booth No. 1800 — Conference attendees will have the opportunity to design and race their own dragsters at the EAI exhibit. The EAI Model 590 hybrid computer will be programmed as a non-optimally-designed dragster which runs a quarter mile. Members of the audience can beat the dragster by selecting the correct dragster design parameters such as wheelbase, engine, and tire radius. Also demonstrated will be the new Model 430/200 Dataplotter.

ENGINEERED DATA PERIPHERALS CORP.

Booth No. 35010 — E.D.P. Corp. will display two fixed-head disk memory systems. The MDS-2000 stores 6 million bits and has a maximum transfer rate of 3 megabits/sec. The MDS-3000 has one-half the transfer rate.

FERROXCUBE CORP.

Booth Nos. 5801-02-03-04 — The FI-4 core memory system, with a 1.0 usec. cycle time and capacities up to 4K by 40 bits, will be shown.

FOTO-MEM, INC.

Booth No. 50008 — Exhibited will be the Foto-Vision CRT display terminal, the Foto-Print Model 30 data printing terminal, and the Centaur "memory computer."

GENERAL AUTOMATION

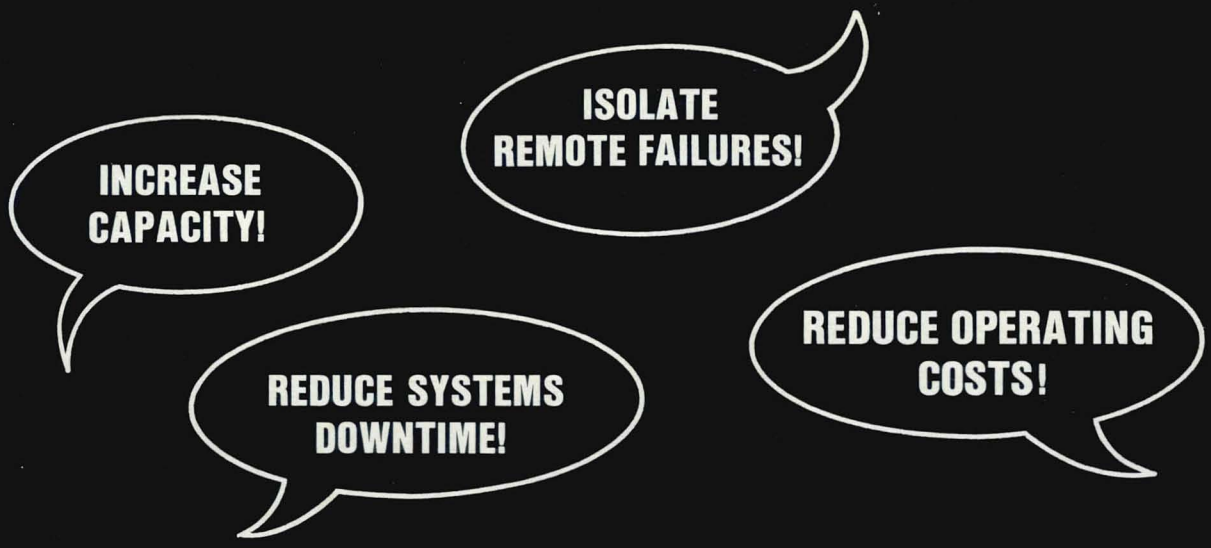
Booth Nos. 4101-02-03-04 — The SPC-16, a computer designed for industrial automation, has a 16-bit word length and a 960-nanosecond cycle time. Core memory is expandable to 32K, read-only memory to 2048 words.

GENERAL COMPUTERS, INC.

Booth No. 1701 — GCI will display its third generation of programmable, general-purpose diode function generators. The Model 300 provides the capability of programming an analog function directly from a digital computer.

GERBER SCIENTIFIC INST. CO.

Booth Nos. 4008-09-10-11 — Gerber Scientific will introduce its new computer-automated drafting system. The Draft Aid system permits non-programming draftsmen to translate rough sketches directly into camera-ready drawings. The system is built for simple real-time operation.



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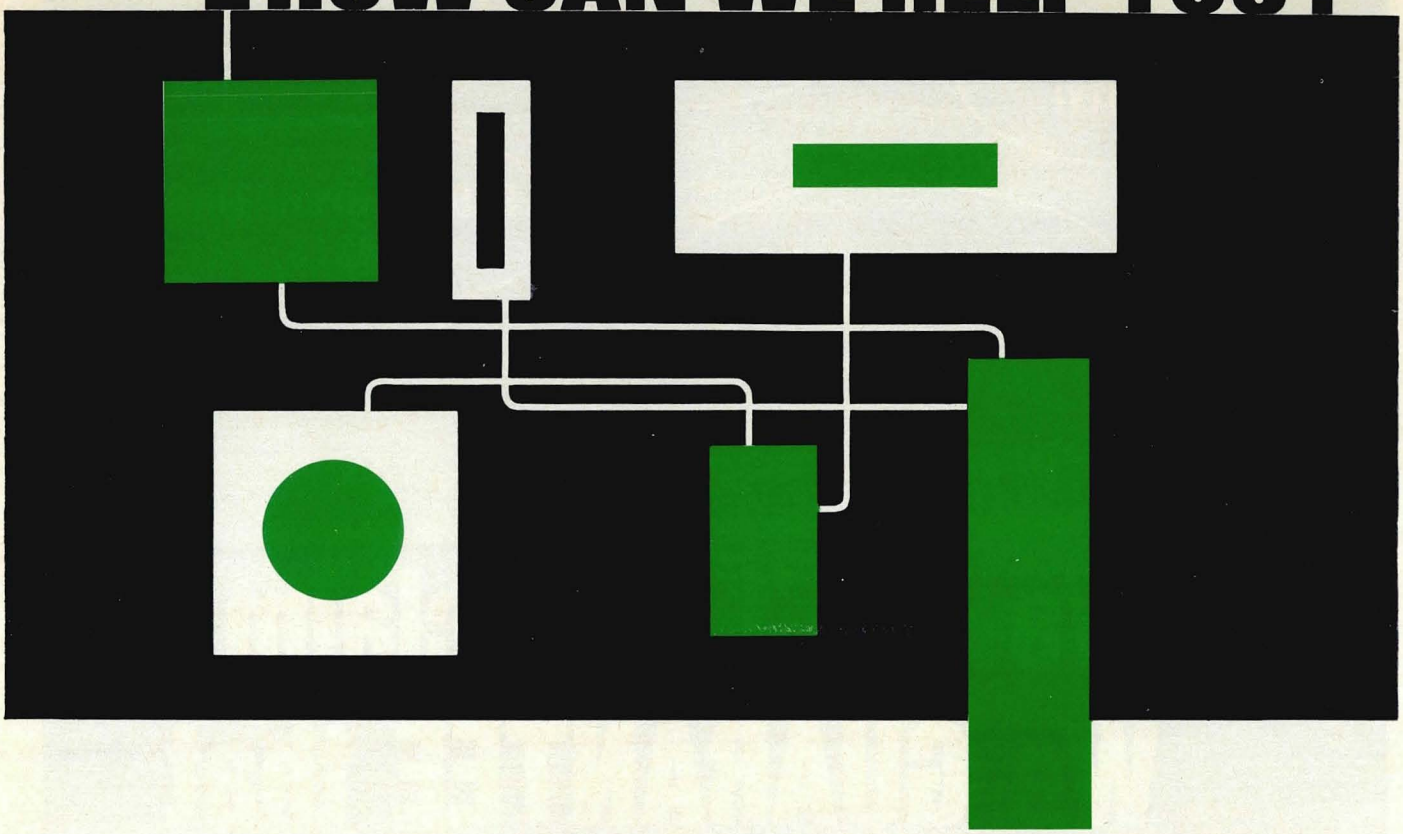

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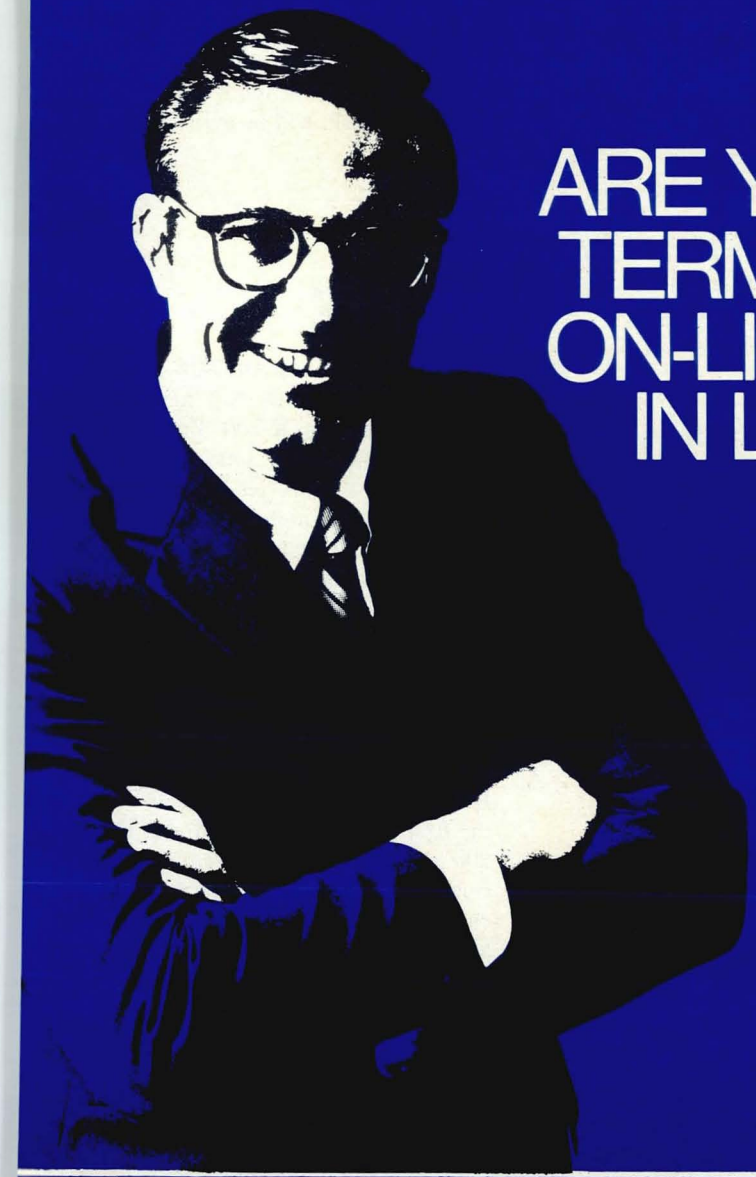

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With our TM-8 mux and AE-96 modem package, you can serialize and transmit up to eight channels of digital data (from 1200 to 4800 bps) over voice grade circuits at 9600 bps.

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GRI COMPUTER CORP.

Booth Nos. 46001-02-03-04 — A dual-purpose byte pack/byte swap option for the GRI-909 computer will be exhibited. Byte pack combines two 8-bit bytes into a 16-bit word; byte swap splits up the word for processing on byte-oriented equipment.

HAZELTINE CORP.

Booth No. 49012 — Hazeltine will demonstrate its new Model 1760 keyboard CRT display terminal, which provides 1760 character capacity, split-screen capability, and includes a full range of editing and tabulating features.

HEWLETT-PACKARD

Booth No. 2400—The HP 2000B, a 32-terminal Basic time-shared computer system, will be introduced. Utilizing a 1.6-microsecond, 16K-by-16 central processor (HP's 2116B), the system includes business software. HP will also display a minicomputer, a communication coupler/controller, and a variety of peripherals.

HONEYWELL COMPUTER CONTROL DIV.

Booth No. 3700 — Honeywell's Computer Control Div. will exhibit both operating and non-operating Model 316s with a wide line of peripherals. and an H-632 computer. and six Teletype terminals connected to a remote H-1648 time-sharing system. The exhibit will also include I/C modules, core memories, A/D converters, and the H-112 controller/computer.

I E R CORP.

Booth No. 103 — The new B Series of magnetic drum memory systems will be featured. The model to be displayed has a 9 megabit storage capacity and a transfer rate of 1.8 megabits/second.

IMLAC CORP.

Booth Nos. 5711-12 — The PDS-2 is a graphic/alphanumeric CRT terminal with an integrated 16-bit word computer.

INDUSTRIAL COMPUTER SYSTEMS, INC.

Booth No. 49001 — APL, a simplified general-purpose compiler for time-sharing users, will be featured.

INFOREX, INC.

Booth No. 5300 — This company will demonstrate its eight-station Intelligent Key Entry System.

INFORMATION DATA SYSTEMS

Booth Nos. 33003-04 — The 5000 Series of disk controllers connect IDS disk systems to minicomputers. Series 7000 and 8100 fixed-disk systems store up to 2.4 megabits.

INFOTON INC.

Booth Nos. 52008-09-10 — This company's new OCR data terminal, a hand-fed document scanner with a speed of 12 lines/second, reads hand-printing, mark sense, standard elite and pica fonts, OCR-A and OCR-B. A CRT permits operator correction of errors. The terminal can be programmed to accept a variety of document formats.

INTERNATIONAL COMPUTER PRODUCTS

Booth Nos. 1605-06 — The Model 60 DigiDeck, a miniature cassette tape transport for minicomputers and remote terminals, will be introduced.

INTERNATIONAL DATA SCIENCES, INC.

Booth Nos. 43001-02 — A new key-to-tape source data entry system of modular design will be demonstrated. Transmission line testing equipment will also be shown.

IOMEC, INC.

Booth Nos. 4004-05-06 — The IODISC 2012, a 44 million bit capacity disk drive with one fixed and one removable disk, will be exhibited.

KEYMATIC DATA SYSTEMS CORP.

Booth Nos. 47005-06 — Keymatic will announce two new products: the Series K-100 Encoder, a keyboard-to-cassette data entry device; and the Series K-200 Pooler/Converter, which converts the K-100 cassettes to computer-compatible 7-and 9-track magnetic tape.

KYBE CORP.

Booth Nos. 5805-06 — Shown for the first time will be the Model TMS-200 end-user-oriented magnetic tape certifier, a complete tester/evaluator capable of locating and stopping on a signal dropout; and the Model TMS-70 fully-automatic table-model magnetic tape tester/evaluator. Also shown will be the Model DP-20, said to be the first automatic disk pack cleaning machine compatible with 1316- and 2316-type packs.

LITTON INDUSTRIES

Booth Nos. 4701-02-03 — Litton's Datalog Division will introduce two cassette-loading, non-impact alphanumeric printers: the 65 char./sec. MC 1000 strip printer and the MC 3000 page printer.

MADATRON CORP.

Booth No. 49002 — Madatron's new Source Data Collection Device features English-language data entry, a CRT display monitor, and on- or off-line operation. Also to be shown is an annunciator and an alphanumeric display that stores up to 128 ten-letter words.

MANAGEMENT ASSISTANCE INC.

Booth Nos. 2008-09 — MAI will introduce the 7700, an off-line formatting printer. The printer has a Fortran software package and a variety of justification options.

MARSHALL DATA SYSTEMS

Booth Nos. 44001-02-03 — This division of Marshall Industries will introduce the M2800, an IBM 2314-compatible disk storage system. The maximum system stores 29 million bytes on 9 spindles and has a transfer rate of 312,000 bytes/second. The M2500 disk drive will also be shown.

MECHANICAL ENTERPRISES, INC.

Booth No. 49007—ME's Mercutronic Division will display a series of interchangeable-key keyboards to be custom-built for the OEM user.

MICRO SWITCH DIV. OF HONEYWELL INC.

Booth No. 46500 — Micro Switch will announce several new features and design improvements for its product line of solid-state MOS-encoded keyboards.

MILGO ELECTRONIC CORP.

Booth No. 5900 — International Communications Corp., a subsidiary of Milgo, will hold an on-line demonstration of its new Modem 3300/36. This 3600-bps data set will link a high-speed terminal in the ICC booth with a computer in New York City. Other data sets to be displayed operate at speeds from 1200 bps to 1,000,000 bps.

MONITOR DISPLAYS

Booth Nos. 5725-26 — The Model 8100, an alphanumeric/graphic keyboard display terminal will be exhibited. The terminal includes vector and circle generators, light pen, and software.

MOTOROLA INSTRU. & CONTROL, INC.

Booth No. BB — A line of low-cost office data processing and communication terminals will be exhibited, including Motorola's new MTP Series of desk-top electostatic teleprinters. The 4000-wpm printers are designed for large-volume processing as well as communications.

NATIONAL CASH REGISTER

Booths 52013-14-15-16-17 — NCR will demonstrate heat-activated thermal printers; a new buffered line printer; disk units; and microfiche and microform systems.

NORTEC COMPUTER DEVICES, INC.

Booth Nos. 26002-03 — The Nortec 200 is a 200-lpm, compact line printer that prints 132 columns on forms up to 14⅞ inches wide. The printer employs a moving print font chain and produces up to six copies.

OMEGA-T SYSTEMS, INC.

Booth No. 10010 — Omega-T will introduce an on-line/off-line analog plotter with complete software packages. The Fastplot features one part per thousand resolution, plotting speeds up to 10 ips, and a plotting ages. The Fastplot features one part bed that can be tilted up to 80°. Unit accepts paper tape or teletypewriter input, and permits teletypewriter output.

PENRIL DATA COMMUNICATIONS, INC.

Booth No. 24014 — The PDC 4800B, a 4800 bps synchronous modem, will be introduced.

PENTA COMPUTER ASSOCIATES, INC.

Booth Nos. 19004-05-06 — The KeyLogic multiple-station data entry system, featuring fully-programmed automatic validation, will be shown. In the KeyLogic system, errors are detected, identified, and corrected as data flows through the CPU to disk storage. Validated data from the disk is read back onto a master tape which can be processed by the main frame.

PERIPHERAL EQUIPMENT CORP.

Booth Nos. 1711-12 — PEC will introduce two data formatters for 7- and 9-track 800 bpi NRZI format, and 9-track 1600 bpi phase-encoded ASCII and IBM-compatible formats.

PERIPHERALS GENERAL

Booth Nos. 10012-13 — The Model 816/716 disk storage system and the Model 700 disk drive exerciser will be introduced. The 816/716 system has a maximum capacity of 116 million bits and consists of a controller (Model 816) and one or two disk drives (Model 716) which are plug-for-plug compatible with the IBM Model 2311. The Model 700 exerciser, also for use with 2311-compatible drives, is designed for field service and production engineering applications.

POTTER INSTRUMENT CO., INC.

Booth No. 600 — The TC5803, an S/360-compatible tape controller for Potter magnetic tape drives, will be introduced. Automatic-threading tape units, a remote terminal, and a low-speed line printer will also be demonstrated.

PRINCETON ELECTRONIC PRODUCTS, INC.

Booth Nos. 47003-04—PEP will exhibit its PEP-400 Video/Graphics Storage Terminal, a silicon-tube scan converter for the OEM user.

QUANTUM SCIENCE CORP.

Booth No. 50009 — This information service company will discuss its detailed analyses of the computer industry, which consist of standard programs as well as special studies. Recent Quantum studies cover network information services, dedicated information systems, federal information systems, and computer memory markets and technology.

RFL INDUSTRIES, INC.

Booth No. 5713 — The Model 13AO/TTY, a hardwire/accoustical asynchronous modem compatible with Bell 103A data sets, will be on display. The Model 3952, a Bell 2018-compatible 2400 bps synchronous modem, will also be exhibited.

REDCOR CORP.

Booth No. 37000 — The PAFT II, a programmable automatic function tester for MOS/LSI devices, and the MMT, an MOS/LSI memory tester, will be displayed.

RIXON ELECTRONICS, INC.

Booth Nos. 2103-04—Rixon Electronics will introduce a new line of modems for operation at speeds up to 1800 bps. Said to represent a significantly new concept for the OEM market, the FM-3 and FM-18B modems may be ordered with as many or as few commonly-used modem functions as the customer actually requires. They are designed to operate over dial or private networks. Also to be displayed is a new time division multiplexer. The TDX-2 handles up to 88 channels, and can intermix multiple rates from 110 to 300 bps.

SCAN-OPTICS, INC.

Booth No. 49010 — The Scan-Optics 20/20, said to be the first and only OCR capable of handling both pages and documents off-line, will be introduced. The 20/20 reads pages at speeds up to 2000 chars/sec. and documents at speeds up to 500 dpm. The basic system — approximately $100,000 — includes page and document handler, scanner, control computer, 7- or 9-track magnetic tape transport, and I/O typewriter. Also available is a comprehensive systems software package for a broad range of applications.

SONEX

Booth No. 5007 — Sonex will display its I/Onex Model 30, an acoustic coupler that operates with standard telephones at speeds up to 300 baud. The coupler is compatible with Bell 103 data sets and the Bell DAA, in both half- and full-duplex modes.

SPIRAS SYSTEMS, INC.

Booth Nos. 118-19 — Spiras will demonstrate a new upper- and lowercase model of their IRAscope display terminal. Also shown will be the Spiras-65 minicomputer.

STANDARD MEMORIES, INC.

Booth No. 50016 — The new low-cost ECOM Series B, C, and D memories will be on display. OEM Series B features a 900-nanosecond cycle time. Series C is an OEM modular package, 4K by 16 bits. Capacities of Series D 8-bit memories are 1K, 2K, and 4K.

STORAGE TECHNOLOGY CORP.

Booth No. 10009 — A series of IBM-compatible magnetic tape systems for operation at speeds up to 200 ips feature cartridge loading and automatic threading.

SYSTEMATICS/MAGNE-HEAD

Booth Nos. 26004-05-06 — The new DiskStor 505 head-per-track removable disk memory system will be shown. Also displayed will be drum memories, magnetic tape heads, and a tape-to-card converter.

SYNER DATA

Booth Nos. 901-03 — Model Alpha, an 80-column, 300 lpm line printer, and the Model 300, a photoelectric paper tape reader that operates at speeds up to 500 char./second, will be on display.

TDK ELECTRONICS CORP.

Booth No. 50012 — TDK Electronics Corp. will introduce a patented endless loop cassette, said to be compatible with any cassette machine, in which the tape is fed from and taken up by the same hub. TDK's endless loop cassette will be available in 3-, 6-, and 12-minute packages.

TALLY CORP.

Booth Nos. 107A-B-C — The R-5000, a new bidirectional photoelectric punched tape reader, reads paper, paper-mylar, or mylar tapes at speeds up to 500 chars./second.

ATTENTION SJCC ATTENDEES

YOU CAN NOW VIEW THE MAJOR PRODUCTS ON EXHIBIT AT THE SJCC WITHOUT MOVING A MUSCLE.

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Reduce as you copy. With the 1714's four lenses. For same-size copies. 20%, 30% (optional) or 50% smaller copies.

So you can standardize paperwork. Cut filing space. Get more data on a sheet. Combine related documents. Even duplicate two originals simultaneously to get two copies for less than the price of one.

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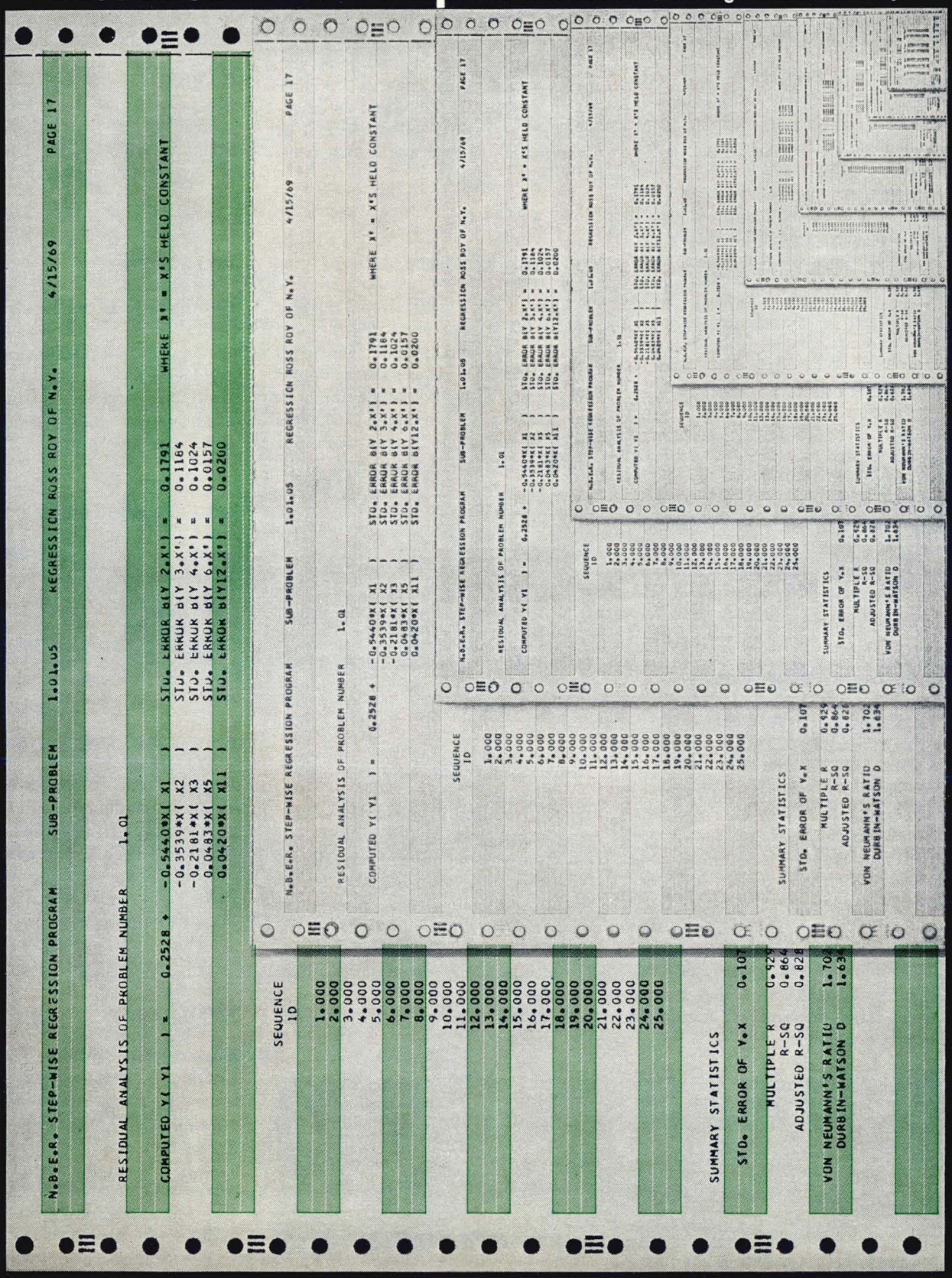


TEC, INC.

Booth Nos. 4704-05-06 — TEC will hold a live demonstration of its 520-40, a remote job entry terminal that includes a 400-cpm card reader and a 300-lpm printer.

TELE-SIGNAL CORP.

Booth No. 1301 — This subsidiary of the Singer Company will exhibit a complete line of data modems for use on the dial telephone network, including a 2400 bps vestigial sideband modem as well as Bell 103A- and 202C-compatible units. All modems are compatible with the AT&T Data Access Arrangement. Also displayed will be time and frequency division multiplex equipment, and control and monitor equipment.

TELETYPE CORP.

Booth Nos. 1705-06 — Teletype Corp.'s magnetic tape data terminals store up to 150,000 words on an interchangeable cartridge, and operate with Teletype Models 33, 35, and 37 teletypewriters at speeds up to 2400 words/minute. Also shown will be the Model 37 Inktronic teletypewriter.

TELEX COMPUTER PRODUCTS

Booth No. 1600—The Telex 5314 disk storage drive system will be shown for the first time. The system on display will be made up of the Telex 5328 file control unit and three Telex 5312 disk storage drives. Other products to be shown include the Telex 4862 tape drive, which features the read/write capability to utilize both 800 bpi, NRZI, and 1600 bpi phase encoding on the same plug-in compatible unit; and the Telex Termicorder, an incremental cassette tape memory for terminals and minicomputers.

TEL-TECH CORP.

Booth Nos. 4607-08 — Tel-Tech will feature its new TTC-3000 concentrator, a time-division bit-interleaved multiplexer designed to transmit multiple independent data streams simultaneously over a single voice grade telephone circuit. The special feature of the TTC-3000 is its ability to be used on multi-point circuits, making any channel available at any remote location, and automatically "busying-out" that channel at other cities when a connection is established.

TRIO LABORATORIES, INC.

Booth No. 2012 — Trio/Lab Series 600 power supplies are rated at 100 watts and provide from 3 to 30 volts dc. Of interest to computer and digital systems manufacturers is the ability of these units to allow full-load operation for a minimum of 30 MS after loss of ac input.

TIMEPLEX, INC.

Booth No. 1308 — On display will be the Datadialer, which enables a computer to dial local or long-distance telephone numbers. Remote operation via multiplexer is possible.

UNIVERSITY COMPUTING CO.

Booth No. 1200 — The Data Communication Systems Div. (DCSD) of University Computing Co. will introduce a new plotter interface for its remote terminal systems. Designated the 1151-00 Plotter Interface, the unit operates with DCSD's COPE (from Communication Oriented Processing Equipment) 30 series and with COPE .41 remote batch terminal systems.

ATTENTION SJCC ATTENDEES

See **MODERN DATA's** SJCC **VIDEOGUIDE**

At Booths 2105-2106.

VARIAN DATA MACHINES

Booth Nos. 3004-05-06-07 — The 620/f, a new minicomputer, is upward-compatible with Varian's 620/i. The exhibit will also include several memory systems (including ROMs) and other minicomputers.

VARISYSTEMS CORP.

Booth No. 50015 — Exhibited will be the PAC-16 stored program controller, a byte-oriented minicomputer which meets a wide range of system interfacing requirements.

VERSATEC, INC.

Booth Nos. 116-17 — The Matrix Series, a new line of electrostatic printers for alphanumeric and/or graphic operation, will be on display. Multiplus System, a master-slave printer system will be announced.

VICTOR COMPTOMETER CORP.

Booth Nos. 5719-20-21-22— Demonstrations of on-line data collection inventory control, accounting, and billing systems will utilize the Series 800 line of terminals.

WEISMANTEL ASSOCIATES, INC.

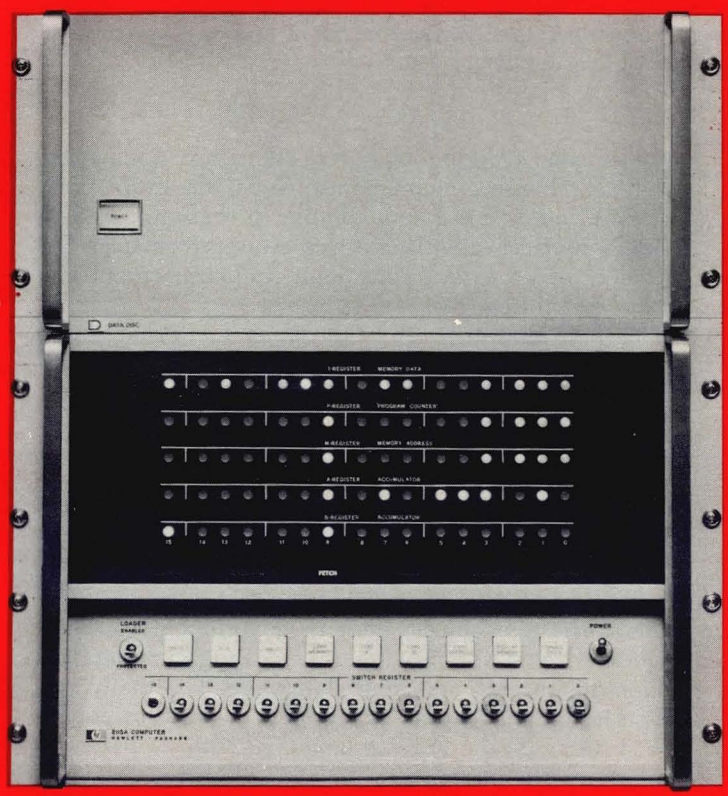
Booth Nos. 12004-05-06-07 — Two new medium-priced 16-bit computers will be introduced. Also unveiled will be a new remote communications concentrator, the WAI/RCC, and two recently-developed main memory subsystems.

XEROX CORP.

Booth No. 2800 — The Copyflo Continuous Printer 1-40 reproduces copy from computer-output microfilm. The Xerox 7000 Reduction Duplicator makes 8-½- by 11-inch copies of computer printouts at 60 copies per minute. The exhibit will also include a label printer system built by Cheshire, a Xerox company.

$7,500

46K Memory



Plug-compatible secondary mass storage is now available in a 46,080-word unit for your Hewlett-Packard 2114B/2115/2116 minicomputer.

It's expandable to 368,640 words and offers transfer rates up to 176,000 16-bit words/second.

At $7,500 the DATA DISC comes complete with installation, 1-year service, and controller — ready to go to work with your existing HP software. Delivery: 30 days.

Circle No. 1 on reply card.

$7,500

32K Memory

Plug-compatible secondary mass storage is now available in a 32,768-word unit for your Varian 620/i minicomputer.

It's expandable to 262,144 words and offers transfer rates up to 120,000 16-bit words/second.

At $7,500 the DATA DISC comes complete with installation, 1-year service, and controller — ready to go to work with your existing Varian software. Delivery: 30 days.

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THE CHALLENGE OF UNBUNDLING

A summary of the dangers and opportunities which face both the computer user and the IBM competitor as a result of the unbundling announcement.

THE new unbundled world of computers has forced maturity on some computer users and spurred them to a position of greater independence from the computer vendors. As a result, many will achieve a level of more effective use of their computer information system. For other users, unbundling could prove bankrupting or otherwise disastrous.

For all users it means higher prices for their computer and all its support services. IBM lowered its hardware costs by three percent, but now charges additional fees for education and training, certain field engineering (including some hardware and software maintenance services), systems engineering services, customer software and consulting support, some basic software (such as language compilers), and applications programming products.

For users who depend on the computer vendor for everything – the "Linus blanket syndrome" – the price increases may run as high as 50%. At the other extreme will be those users who can get or train their own staff to do everything in-house. Their price increase can be as low as 5%. For the average user, the price increases can be held down to the 10% to 20% range by careful planning and intelligent selection of options. These options include buying the repriced services from the vendor, "doing it yourself," or engaging any of a variety of outside firms or consultants. These can include computer education companies, software houses, maintenance firms, or even "lone wolves." Since it is a very complex process to choose a viable alternative with effective cost-performance, the services of an expert consultant, in-house or outside, may be required.

To help find answers to the question "What is the true price of IBM's unbundling?", the full price increase can be calculated for any user company by detailed attention to the various computer unbundling problem areas. Some of these price increases and their effects on user costs are illustrated in Table 1.

PRELUDE TO UNBUNDLING

Our earliest machines, built in government labs and agencies, had no software at all. Programming was done in absolute machine language. Gradually, assembly languages and compilers were developed. IBM provided the Fortran language with its 704 computer by the mid-fifties. In 1957, Control Data introduced the 1604 computer without software at a drastically reduced price. Without software, their market was limited to the most sophisticated scientific users – there simply were not enough programmers to go around. (Sound familiar?) So they were forced to

TABLE 1

PRICE INCREASES RESULTING FROM UNBUNDLING*

IBM SUPPORT SERVICES

Charges prior to 1/1/70	Nothing
Charges after 1/1/70	Field Engrg. = $23/hr. (avg.) (x220 work days = $40,480/yr) Sys. Engrg. = $30/hr (avg.) (= $52,800/yr)

USER INSTALLATION COSTS (annual)	**369/30**	**360/40**	**360/50**	**360/65-67**
Operating personnel (avg)	$110,000	$234,000	$448,000	$904,000
Ratio operating personnel/hardware (avg)	1.0	1.8	1.6	1.8
Add'l costs of retaining IBM S.E.'s	$16,000 (30% part time)	$34,500 (65% part time)	$105,000 (x2)	$211,000 (x4)

*Prices subject to change.

develop and give away a Fortran capability. The computer industry was just not ready for unbundling!

A more recent entry into unbundling was made by Scientific Data Systems (now Xerox Data Systems) in 1966, with separate pricing for their Cobol compiler. They had sold 17 compilers by the spring of 1969.

Some software packages have been developed and sold with a high degree of success. The Autoflow package, developed in 1964, has sold a number of packages in four figures and has just penetrated about 2% of its potential market. Over 100 Mark IV packages have been sold at a price around $30,000 each. A communications software package for the IBM 1130 succeeded financially because IBM had no intention of filling this limited market themselves. The SCERT evaluation and simulation package has succeeded, as has the COMPUMETER package.

But many more attempts to sell software have met with less than success, if not actual disaster. A west coast firm built a "better" compiler for an IBM 7040 in 1964, but the user could get the working (even if un-"better") compiler free from IBM. The user was unwilling to pay a cash outlay for potential or real cost savings in improved running performance. The market was not yet ready for unbundling!

In 1966, a well-heeled major computer network company unsuccessfully tried a software "buy, cleaning, and sell" operation. In 1968, a software house built a "better" SORT package for an IBM 360, compatible with IBM's current SORT program. Then IBM announced a new SORT program, with which the competitor's package was not compatible without major surgery. The company lost on the gamble and was forced into a merger situation.

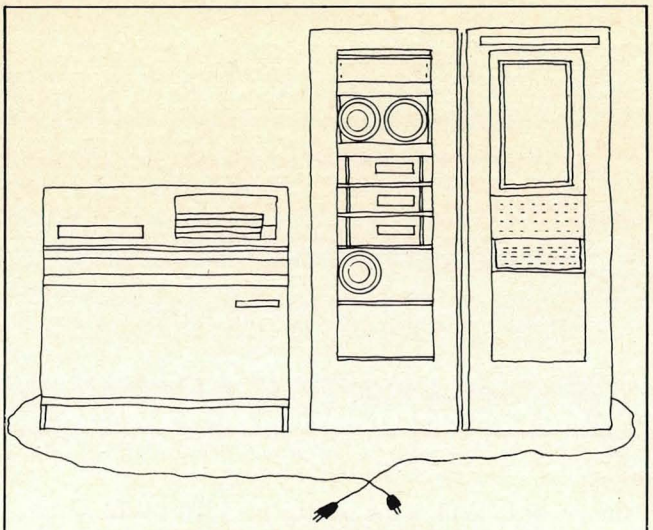
The computer world was not ready for unbundling in the sixties! Will it be ready in 1970? Will it be forced to adjust to the realities of unbundling? I think so. The computer users will have to mature. They will also have to spend more. IBM has cut the umbilical cord; the user **must** become more independent of his vendor somehow. The user's "Linus blanket" has been taken away. He is shaken and confused. He has to face up to the realities of the new, unbundled computer world and its increased costs. He must learn how to reduce his price increases through careful planning, training, and careful selection of alternatives for outside services.

EFFICIENCY THROUGH EDUCATION

At a recent seminar on the status, prices, and effects of computer unbundling, Mr. Don Lees of Computing Efficiency, Inc. related that most users are shocked to learn that they only get about 40% utilization of their computer hardware. One significant way to reduce computer costs and avoid unbundling price increases (even for small users) is to train user operators, programmers, systems people, and managers how to make effective use of multi-programming and other advanced computer techniques.

A company can reduce its computer unbundling "P.R.I.C.E." increases by Programmed Return on Investment through Computer Education, both immediately and in the future. This means "growing your own" people at all levels, to the maximum extent possible. In-house training is the most cost-effective method, but even here outside help may be needed to develop an EDP curriculum, to train the in-house in-

Before forming Oyer Professional Computer Services, Inc. in 1967, **PAUL D. OYER** was director of education with the Computer Usage Education, subsidiary of Computer Usage Corp., in New York City. He also served as time-sharing project manager for IBM, deputy director of research for the Diebold Group, program and systems manager for the Illinois Institute of Technology Research Institute, and manager of advanced data systems for Westinghouse. Mr. Oyer received his B.S. and A.M. degrees in education and mathematics from Indiana University.



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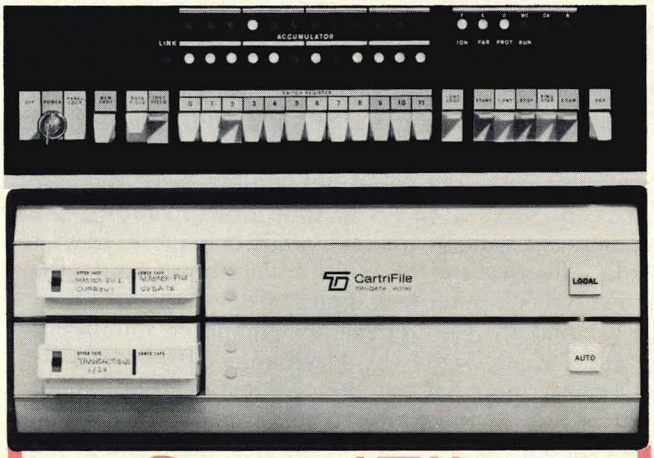

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structors, develop quality educational material, techniques and visual aids, etc.

Fred Withington of Arthur D. Little, Dan Bowers of BCD Computing and of MODERN DATA, and Dr. Daniel Teichroew of the University of Michigan pointed out that unbundling focuses greater urgency on the problem of educating advanced "generalists" for the computer industry — whether we call them systems designers, systems architects, or information analysts. This need presents an opportunity for all users, even small ones, to cooperate in a joint effort to train their own staff to replace vendor SEs. Plans for an intensive advanced training program have been formulated by the New York City Chapter of the Association for Computing Machinery. All user companies, large and small, have been invited to participate in this pilot program to train advanced systems designers and information analysts.

There has been a recent move to design four-year and master's degree (MBA) programs to guide business colleges in educating the well-rounded information systems designer of the future. The National Science Foundation provided the Association for Computing Machinery with a grant to investigate this need and design such a curriculum. This committee, the ACM Curriculum Committee on Computer Education for Management, is chaired by Professor Daniel Teichroew of the University of Michigan.

In addition to the college curricula, the ACM committee has recommended that a six-month intensive course to train information systems designers be developed and offered initially through a pilot school. The first pilot school is planned for the New York area, to be organized and assisted by volunteers from the N.Y.C. chapter of the ACM. Students for this advanced training will be selected from personnel with college degrees who are currently working as systems analysts, software specialists, EDP managers, computer systems managers, programming managers, operations managers, systems designers, etc.

The Association for Computing Machinery developed and published a bachelor's and master's degree curriculum for Computer Sciences as early as 1964. Most universities are using a 1968 revision of that curriculum as a model, although they generally fall short of offering the full curriculum because of a shortage of qualified instructors and over-specialization on the part of the instructors they do have. The curriculum is very good for the scientific side of the computer world, but not for the business or commercial side.

Also, as early as 1964, an MBA degree program in computer methodology was begun at the Bernard Baruch School of Business and Public Administration, CCNY. The instructors, in the early days, were mostly part-timers from the business world. Recently, a midwestern business college contracted with Oyer Professional Computer Services, Inc. to design and to teach a curriculum in Management Information Systems at three of its campuses. This appears to be the first time that a college has contracted with a "for profit" organization to design its curriculum or to teach.

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- ✓ EDUCATION AND TRAINING ..... *"Grow Your Own"*
- ✓ SYSTEMS ENGINEERING AND SUPPORT ..... *"Do It Yourself"*
- ✓ THE COMPUTER & INFORMATION SYSTEMS PROFESSIONAL ..... *"Give Them More Rope"*
- ✓ EDP ORGANIZATION ..... *"Integrate Them Into Your Business"*
- ✓ HARDWARE — LEASING & MAINTENANCE ..... *"Leave It To The Experts"*
- ✓ SOFTWARE, DESIGN, AND ANALYSIS ..... *"Be Selective And Cost Conscious"*
- ✓ COMPUTER EFFICIENCY & COST-EFFECTIVE INFORMATION SYSTEMS ..... *"Through Greater Knowledge"*

THE EFFECTS ON IBM

IBM itself is somewhat confused over unbundling. Systems engineers are sitting on their hands in IBM branch offices with nothing to do because users are not ready, or budgeted, to pay for their expensive services (free before January 1, 1970). Some systems engineers are becoming salesmen, some are leaving, some are transferring, a few are enjoying the vacation and boredom.

IBM does not permit idle hands or heads to remain idle very long (a good business practice). In the next few months we may witness a drastic shakedown period which will restructure IBM's profit centers into 5 major areas:

- Education and Training;
- Software and Consulting;
- Maintenance;
- Leasing, Marketing, and Sales;
- Manufacturing.

These profit centers may subsequently be formed into separate divisions. Finally, as competitors, users, and the Justice Dept. apply pressure, IBM may eventually turn them into separate subsidiaries, with IBM itself becoming little more than a holding company. In any event, however, IBM will be the leader in the computer industry for a long time; they will always remain as a tough, seasoned, imaginative competitor.

OPPORTUNITIES FOR IBM'S COMPETITORS

Unbundling opens great opportunities for independent firms in computer education, software development, programmed packages, maintenance, leasing, systems design and consulting, "peopleware evaluation," and others. Those who are qualified and do a good job of performing and selling will survive. Many will not.

IBM is a great, tough competitor. They have good people and treat them so well they have never unionized. They "do their things" with a thorough systems approach and with sophisticated, dynamic planning. They have tens of thousands of salesmen pounding on doors, holding customer's hands, and trying to keep them satisfied.

Many IBM competitors have already "bit the dust." As a result of unbundling, many new competitors will spring up only to meet the same fate. But some, those with good, qualified people, will survive and prosper. They will need to treat their own people and their customers well. They will need to apply a thorough systems approach both to their business and to their customers' problems. They will need a sizable staff of salesmen, well-trained in EDP, in their products and services, and in sales techniques. (Every successful non-manufacturing competitor of IBM will need at least one salesman for every 2 to 10 other employees, depending on their products or services!)

Thus, those firms who wish to compete successfully with IBM in any sector of the computer world must provide: attention to their own people; systems support; high quality products and/or services; knowledge of their market; good sales and marketing staff and plans; knowledge of their competition; the systems approach to their entire business; constant training of their staff; hard work and long hours (IBM does this); clever strategies; and honest tactical maneuvers.

Many firms and consultants **will** successfully compete with IBM. Many more will try and fail. It should be a lot of fun for all. ▲

UNBUNDLING MANUAL AVAILABLE — A 200-page manual covering the topics of this article in much greater detail is available from ***Oyer Professional Computer Services, Inc., 369 Lexington Ave., New York, N.Y. 10017.*** Price of the manual is $65.00

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

PLANNING A DATA COMMUNICATION SYSTEM

Part I — A Broad Overview and Basic Concepts

This is the first of five articles designed to provide a practical introduction to the technical, cost, and cost/performance aspects of data communications. The articles are directed to data processing managers, systems analysts, and other members of the data processing community who are, or expect to participate, in the planning, installation, or operation of data communications systems. Each article expresses the opinions of its author and is intended to both stand alone and logically complement the other articles in the series.

The general plan of the series is to provide a broad overview in the ***first*** *article, present a broad range of data communications facilities that are available in the* ***second*** *article, examine the cost and characteristics of terminal devices in the* ***third,*** *and critically examine the man-machine interface and its effect on cost and performance in the* ***fourth.*** *The* ***last*** *article will present some cost/performance trade-off techniques and some dollars and sense results.*

DATA COMMUNICATIONS—AN OVERVIEW

Data communications is herein used to describe that part of an overall system which permits one or more users to access a remotely-located computer. (The concepts discussed can be applied to data communications between two terminal devices — a processor not being in the system.) The airline reservation system is a well-known example of a system employing communications. Fig. 1 illustrates the system treated as three major subsystems. The subsystems are the processor subsystem, the communications network, and the terminal subsystem.

The function of the system is to respond within seconds to inquiries of customers in various locations throughout the country. In a typical operation, a customer may ask a ticket agent whether a seat is available on a specified flight. The agent translates this English language request into a format which is acceptable to his terminal device. The terminal device changes the agent's input into a format which is suitable for translation over the communications network. The request reaches the processor via the communications network and terminal device. The agent translates the received reply into English and replies to the customer.

To bring some of the thoughts into focus, consider the following situation. Suppose that a company has two plants located 200 miles apart. Each plant has a data processing center. Further, there is a 300 character per second data communications link between the plants. Assume that due to equipment malfunction it is necessary to transfer a 20-million character reel of magnetic tape from one plant to the other in order to complete a payroll run. The question is — should the tape be transmitted over the data communications network or should it be taken by automobile to the plant? Assuming ideal conditions and 100 percent efficient use of the communications channel, 20 million characters would require approximately 18½ hours to transmit at 300 chars./sec. Assuming that one could achieve an average traveling rate of 40 miles per hour between plants, it would only take 5 hours to deliver the tape by car. Using 10 cents per mile for the car and the station-to-station rate for the data communications channels, using the car would cost $20, the data link $222. Under these conditions, using the automobile would be about 4 times faster and would cost about ⅒ that of the data link. A general point being made here is that normally data communications channels are suitable for sending relatively-low volumes of data per day. A second general idea being suggested is that data communications can be, and usually is, expensive relative to other system cost; therefore, optimize the use of available communications services. The latter consideration is treated in more detail in the next article describing cost and capabilities of available communications facilities.

It may be helpful in gaining some insight into what goes on in data communications to return to the airline reservation system and follow a request through the system. Fig. 2 illustrates the essential components of a single data communications link to the processor.

The link consists of a customer, an airline ticket agent, terminal device, a modem, communications channel, a second modem, and the processor subsystem. In operation, the customer communicates a request to the agent using the English language. The agent, using a combination of typing into a keyboard

and a special precoded card, translates the customer's request into a form that the terminal device can accept. The terminal device translates the agent's input into digital signals. Digital signals are not suitable for transmission in the communications network except at very low speeds because of the communications network bandwidth. Therefore, a modem is interposed between the terminal device and the communications channel. The modem, a contraction for modulator-demodulator, converts the digital signal into a modulated signal. In reverse direction, the modem converts analog signals from the line into digital signals for the terminal device. The number of characters per second that can be transmitted over a given communications channel is highly-dependent upon the signals generated by the modem. For example, on a voice grade line which has a bandwidth of approximately 3 kilohertz, transmission rates varying between 150 and 900 characters per second may be achieved depending upon the way in which the modem translates the digital signal and the signal detection method used. Generally, although not necessarily, a trade-off is made between higher transmission speed and increased error rate when the same communication channel is used. The error rates can have a significant effect on the cost performance achievable with a given communications network. At a telephone switching center, a frequency conversion generally takes place when long distance transmission is involved. At the processor, a second modem converts the modulated analog signal into a digital signal acceptable to the processor. For those interested in examining the operation of the terminals and lines in greater detail, Reference 1 is recommended.

Characters per second, bits per second, and baud rate are frequently used to express the rate at which data can be transmitted. From the users' viewpoint, characters per second are the most meaningful measure of data transmission rate. For a given character transmission rate, the bit rate can vary. For example, 10 characters per second can be 75 or 110 bits per second depending upon the code and type of transmission to be used. Baud is an old telegraph term signifying the maximum modulation rate of a code. It is recommended that this term be dropped as it has little value in modern data transmission.

The cost of data communications is generally high relative to the cost of other system elements. It is, therefore, generally well worth the time and effort to perform careful cost/performance tradeoff studies in the design of the data communications portion of the system. Some of the cost/performance trade-off considerations will be examined in the last of this series of articles. The estimated cost for the system to be considered are presented here to indicate the relative

ABOUT THE AUTHOR . . .

Saul Stimler's background in data communications and data processing includes system design, product planning, cost-performance evaluation, and project management. He is the author of *Real-Time Data Processing Systems* (McGraw-Hill 1969). Mr. Stimler's experience includes eight years at RCA. As Manager of Advanced Systems Analysis in Product Planning, he was responsible for the cost-performance analysis of third- and fourth-generation systems. This position involved both technical management and original technical contributions. Mr. Stimler also managed a time-sharing project which had an annual project expenditure rate of 1.6 million dollars and developed the RCA Corporate Time-Sharing facility on a national basis. In connection with these tasks, he also developed tests and criteria for evaluating time-sharing systems. Mr. Stimler recently founded Stimler Associates, a computer systems consulting firm. The objective of Stimler Associates is to reduce the cost and improve the performance of data processing systems to the user through the application of the engineering discipline to data processing. Specifically, the performance and cost/performance of data processor systems are evaluated by setting up meaningful criteria of performance and than properly combining the preparation of specifications for the system with analysis, hardware and software monitoring, and simulation to validate and optimize the cost/performance of the system.

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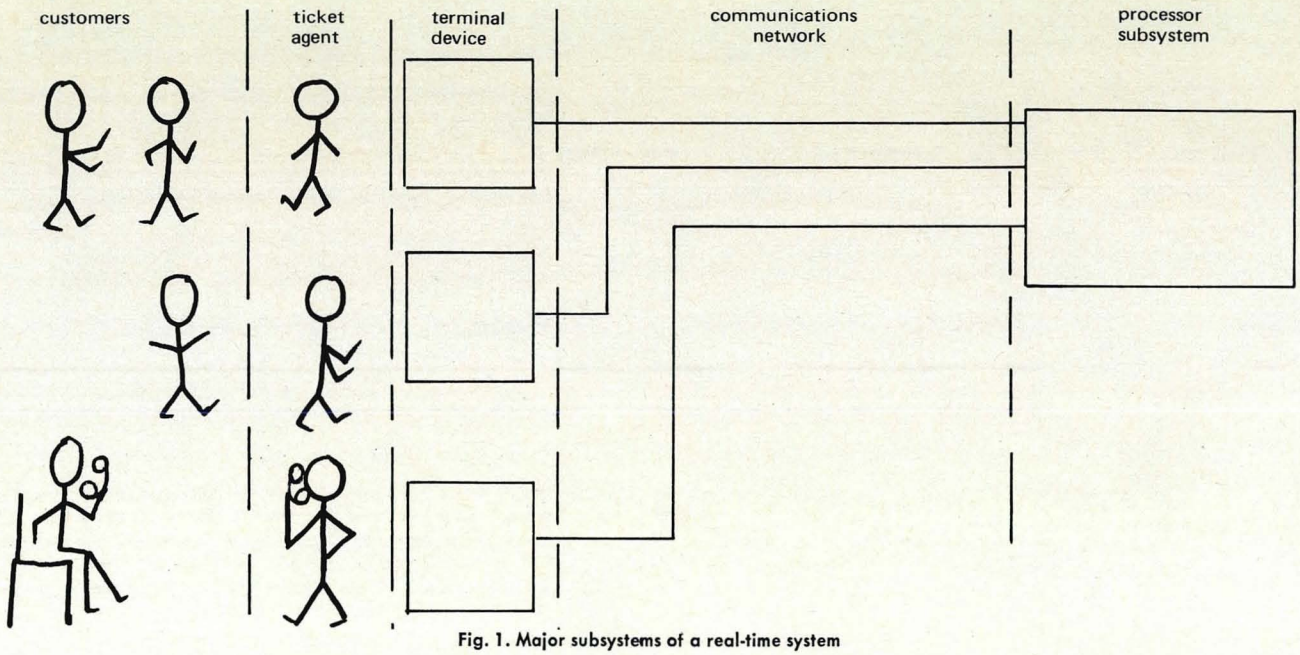

Fig. 1. Major subsystems of a real-time system

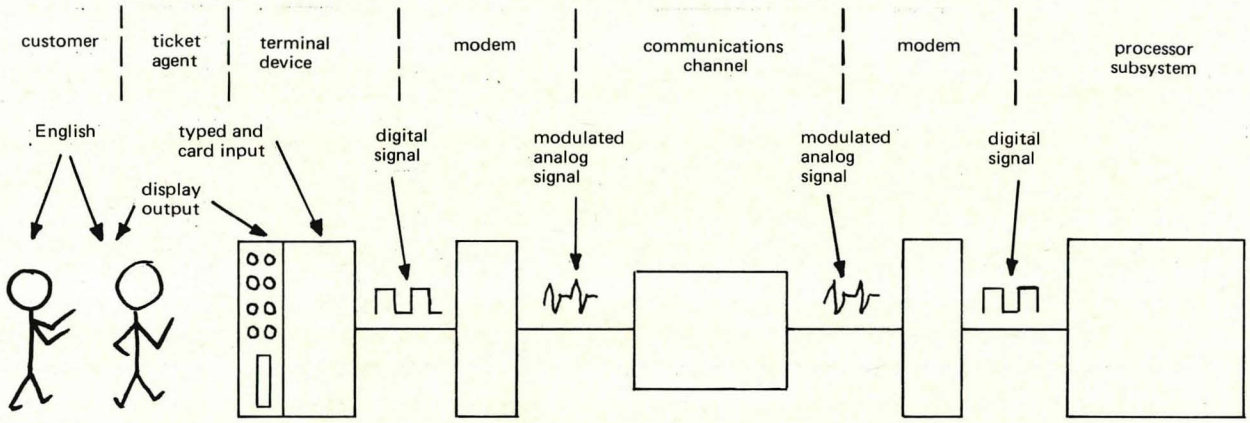

Fig. 2. Essential components of a single data communications link

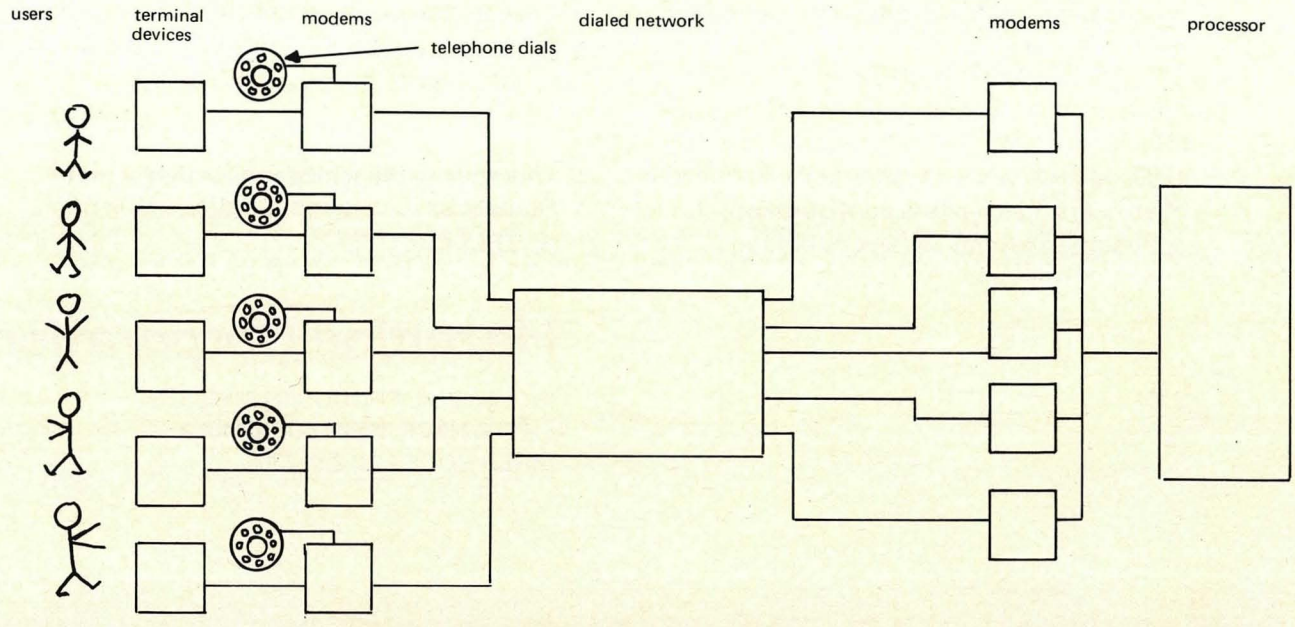

Fig. 3. Data Communications using the dialed network

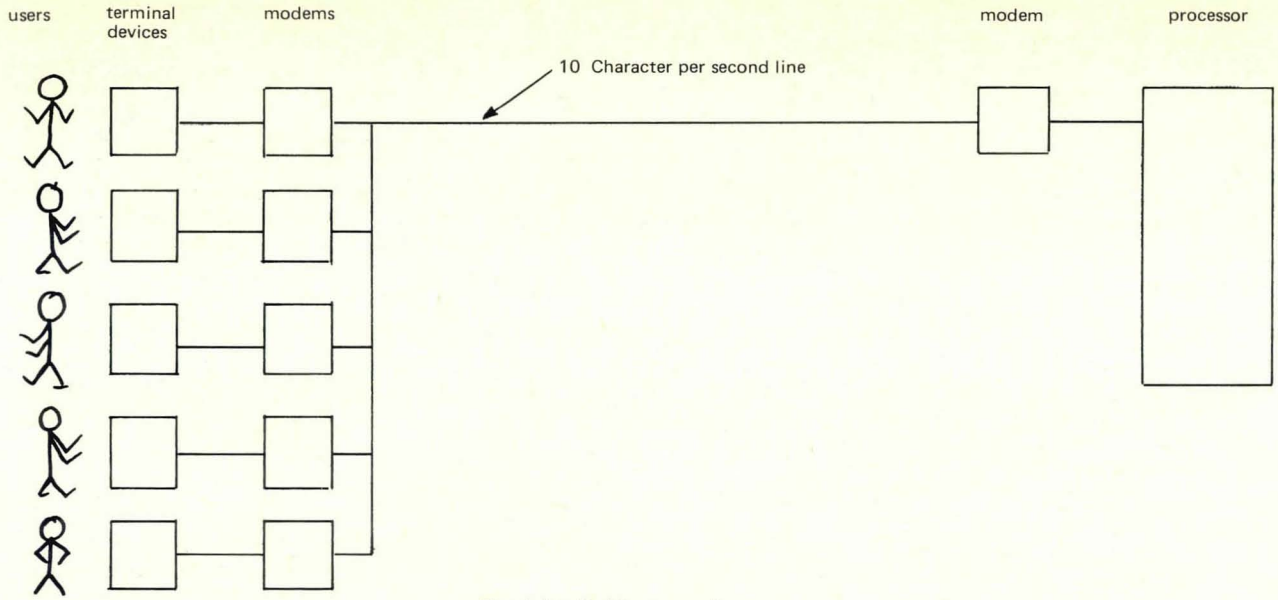

Fig. 4. A polled line network

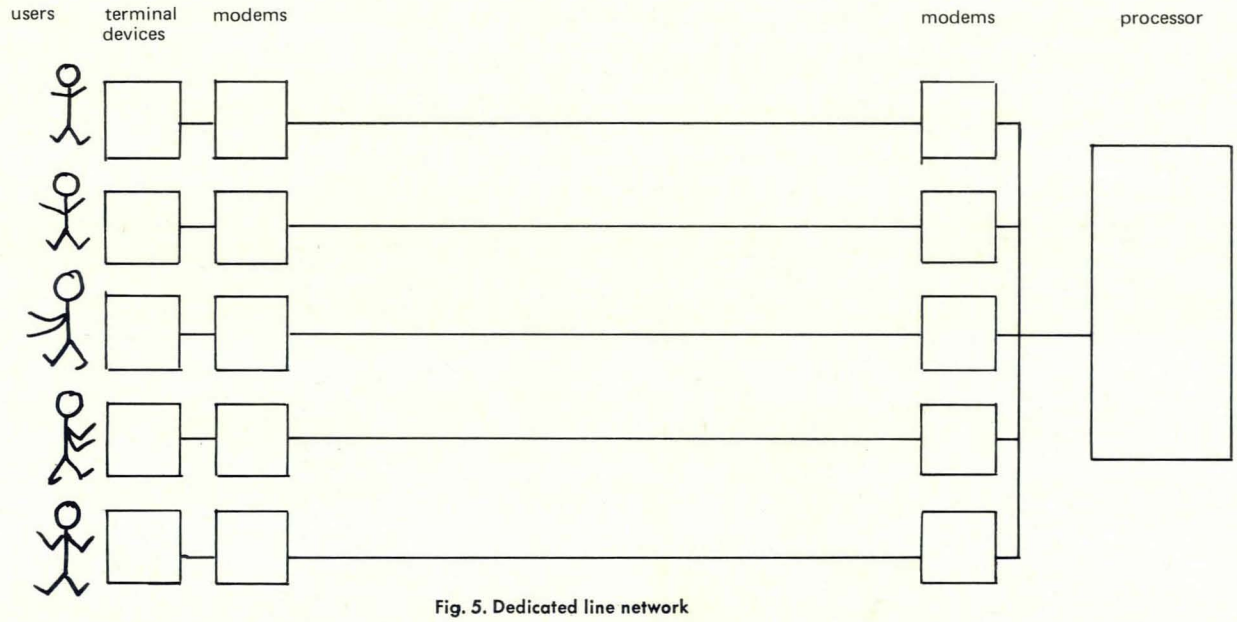

Fig. 5. Dedicated line network

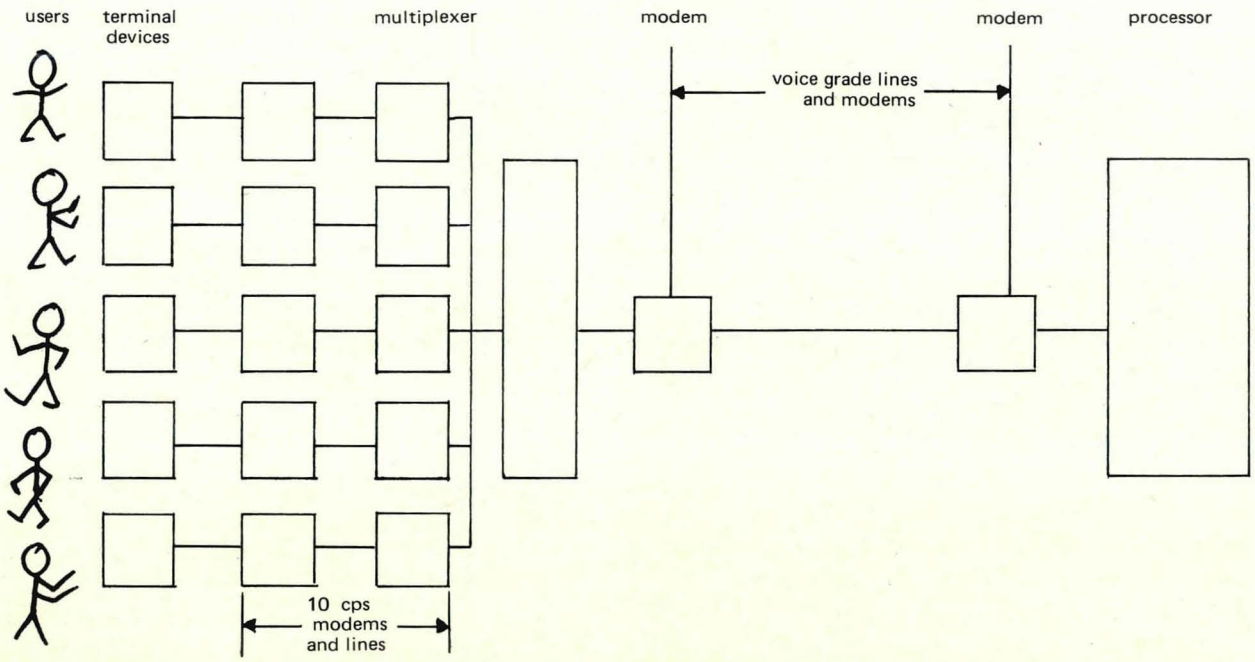

Fig. 6. Multiplexer data communications network

costs. The system is a nationwide, automated stock brokerage system (See Reference 2 for more detailed treatment.
The overall system specifications are:

Number of Offices: 120

Branch Office Locations: New York City, Boston, Philadelphia, Chicago, Los Angeles

Central Processor Location: Philadelphia

Average Traffic: 50,000 messages per day

Average Monthly Costs:

Communications Lines	$22,000
Terminals	$17,000
Modems and Multiplexers	$20,000
Data Communication Monthly Costs:	$59,000
Total System Monthly Cost:	$136,000

The communications network is the most expensive of the subsystems. Data communications hardware requires $59,000 per month of the total $136,000 per month, or 43% of the total cost.

DATA COMMUNICATIONS CONCEPTS

One of the basic requirements in data communications is to provide a data connection between two points. There are three basic connections – **Simplex, Half Duplex,** and **Full Duplex.**

A **Simplex** connection can be made to permit transmission in one direction only. If the connection is made to permit data to be sent from a remote terminal to a processor, that is the only way data can be transmitted. Simplex connections are not commonly used in data communications.

A **Half Duplex** connection permits transmitting data in either direction. However, transmission can be in only one direction at a time.

A **Full Duplex** connection permits simultaneous transmission in both directions. The common telephone uses a full duplex connection. As a rule of thumb, full duplex is approximately 10% more expensive than half duplex.

Having connected two points, the next question is how to transmit data most economically from more than one device in a geographical area to one or more devices in another area. As an illustration, assume that in a system, five 10 character per second terminal devices in Chicago are to send and receive data from a processor in Philadelphia. One connection method is to use the dialed network in a manner similar to using a telephone. Fig. 3 illustrates such a system. In operation, a user dials the telephone number of the modem (also called a data set) at the computer. After the connection is made, data transmission may proceed. The cost is the same as that for telephone service. Time-sharing services use the dialed network for data communications.

Assuming that the traffic between the five terminal devices and the processor is sufficiently low that a single 10 character per second data transmission channel can service all five devices, then a polled line, illustrated in Fig. 4, may be used. In operation, a user enters his message into the terminal device and depresses a send key. The message is stored in a local buffer at the terminal device. Typically, this buffer may be punched paper tape, a magnetic drum, or a small core memory. The processor contains a program which "polls" each device in a pre-specified order. The "poll" is an inquiry as to whether that terminal device has a message ready. If a message is ready, the device is connected to the line by the processor and transmission initiated. If the device did not have a message, the processor may connect the device to the line and send a message to the device or may poll the next device. When a half duplex polled line is used, only one message may be transmitted at any instant. The message may be either from the terminal device to the processor or from the processor to the terminal device. When a full duplex polled line is used, one message may be sent in each direction at the same time. The message may be from and to the same or different terminal devices.

Fig. 5 illustrates the system when the traffic is sufficiently heavy or when other considerations require that each terminal device be connected through its own 10 character per second line.

Fig. 6 illustrates another way of connecting five devices to a processor, each having the equivalent of a 10 character per second connection to the processor. The multiplexer, also called a concentrator, accepts data from a number of low speed lines and transmits the data over a single higher speed line.

The approximate monthly line costs for the three dedicated systems is tabulated below.

POLLED LINE: Rental approximately $690/month
(*To this at least the dollar value of processor time to accomplish polling should be added.*)

FIVE DEDICATED 10 CHAR/SEC LINES: $3450/month

ONE VOICE GRADE LINE: $890/month
(*To this at least the rental of multiplexer should be added.*)

Comparing the five dedicated lines to the multiplexer dedicated line configuration about $2560 per month for the multiplexer is the breakeven between the two configurations. In many applications, the use of multiplexers can save substantial line costs.

REFERENCES

1. **"Telecommunications and the Computer", Martin, James,** *Prentice Hall,* **1969.**

2. **"Real-Time Data Processing Systems", Stimler, Saul,** *McGraw-Hill,* **1969.**

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Up to seven devices at a time can be interfaced through the 2570A to a central computer or time-sharing terminal. Plug-in cards for the 2570A mate with measuring instruments like digital voltmeters and counters; with stimuli like voltage sources and frequency synthesizers; and with logging devices like teletypewriters, high-speed tape punches and graphic plotters.

Because the 2570A communicates in ASCII, it can be used with most computers and commercial time-sharing services. Plug-in program cards take care of instrument housekeeping, simplifying your computer program.

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DATA ACQUISITION SYSTEMS

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THE GREAT SHORTAGE

Editor's Note: The demand for data processing personnel is enormous and an ever increasing shortage seems inevitable. A growing variety of specialized services are becoming available, which could make it more practical and economical to use outside specialists or services than doing the whole job within the organization.

We are constantly reminded of the urgent need for more programmers. Numerous articles have been written about how to interview and evaluate a programmer; large amounts are spent to keep programmers happy within their company environment; and we witness daily the battle to attract programmers in the classified advertisements. If the present looks pretty bleak, what can we expect for the future?

Let us look at some statements and statistics related to electronic data processing:

• In 1968, there were approximately 70,000 computer installations. This figure is expected to increase to 210,000 by 1975, and to 350,000 by 1980.

• The ratio of programmings costs to equipment costs is expected to change from the 50/50 mix of 1968 to 60/40 in 1970, and to 80/20 by 1975.

We can draw some very interesting conclusions on the number of people that will be required to keep the computers of 1975 humming. Suppose 200,000 persons were employed full time in programming support at the beginning of 1969 with a real need for at least another 50,000. With more than three times as many computers in use and four times more software support required per computer, the theoretical need for programmers in 1975 would be 3 x 4 x 250,000 = 3,000,000. It took more than ten years to train the first 200,000 programmers. New programmers leave schools in greater numbers now, but the demand still far outpaces the supply.

With the **quantitative** demand on the increase, the demand for more **qualified** people will similarly increase. Programmer qualifications should go beyond present requirements and include the ability to digest and stay ahead of new developments. Because of rapid changes in technology and the need for many specialists, corporate executives as well will be required to increase their knowledge of automation.

SYSTEMS PEOPLE

How does this need for more and better programming personnel affect the individual at the systems level? A survey conducted a few years ago disclosed that the average lifetime of a computer program is 18 months, this being interpreted as the time a program is in full production before requiring any major changes. When a program's life expires because the system it was designed for was not flexible enough to allow for natural growth, it is usually the systems man who was at fault. Yet the need for systems people is so great that programmers are often promoted to systems-level positions where they are capable of making these expensive mistakes barely after completing their programming education. We know of one case where an "analyst" at a large corporate installation generated seven slightly different daily reports by using seven different programs, each of which processed all the company's tapes – an immense file which averaged only 1% daily activity!

A major task, therefore, is to improve the quality of systems analysis and design. Unfortunately, schools and institutions providing systems courses cannot create experienced systems people. A trainee can speed up the learning process by diligently reading professional literature and by exchanging ideas with systems people in other companies – but there is no substitute for on-the-job training. It is conceivable, however, that a concentrated effort on the part of the entire systems profession could increase the average lifetime of a program from 18 to 27 months by 1975. This would mean a theoretical reduction of 1,000,000 required programmers by 1975!

OUTSIDE SYSTEMS RESOURCES

In most instances only the larger companies can afford an adequate systems staff. Not all not-so-large companies have realized this yet, but it is nevertheless true. What is available to medium-sized and smaller companies?

A number of highly-qualified systems people, aware of the great lack of systems experience in industry, have started their own organizations. Many management consultants and even some accountants now

provide their customers with some systems talent. Yet we still frequently hear the argument that "it takes years to learn how our company operates." Perhaps so. But a systems service should not be engaged for a three-week job or any other short term. It should be contracted to provide a lasting association on a retainer or on-call basis. The service organization will outlive all systems people employed by companies and, aside from providing systems design and analysis, can be very helpful in improving internal programs.

The continuing shortage of qualified personnel and resultant rapid turnover of programmers has made many a company desperate and generated much disappointment. The loss to industry caused by job-hopping personnel is tremendous. This is another reason why some companies turn to outside services.

We have come a long way since the initial services in data processing became available. Some companies have had poor experience with outside help, but the reaction of most is favorable. The growing number of systems firms certainly is a strong argument that they provide a wanted service; today there are more than a few data processing services discussing the possibility of taking over the entire day-to-day operation of data processing departments on a fee basis. The following aids, typical of those now being provided, should be thoroughly evaluated where they could be of benefit to a company.

SOFTWARE DEVELOPMENT ASSISTANCE

To have programming done by an outsider five years ago was fairly uncommon, although the government has long made extensive and efficient use of outside software services for important programs like the development of the Polaris submarine and the Apollo project. Today, however, the situation is quite different. More companies are calling in assistance for software development nowadays, not only during peak periods or emergencies, but also on a continuing basis. A time saving was initially the reason; in some instances it proved to be an actual cost saving as well.

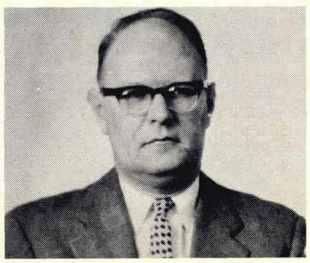
Some software development companies provide assistance for scientific applications only; others concentrate on business applications. A number of specialty companies exist within each group, e.g., production/inventory control in the business area; linear programming in the scientific area. Still, most software houses will accept business as well as scientific projects, and the larger houses have specialists with exceptional skills in a variety of applications.

PROGRAM PACKAGES

Canned packages with options for a range of uses have not yet gained the popularity they deserve. Most data processing managers and supervisors still prefer to solve all their problems within the company. But they will typically accept as a matter of course a manufacturer-supplied sort or merge program. When such subjects as pre-programmed inventory controls or sales analyses are brought up, a mountain of objections are voiced, presumably originating from management requirements. Yet management is often more willing to spend a reasonable amount of money to have control over 90% of the required data on short notice than to wait two years to get 95% of the same data. This is sound reasoning, since complicated packages like the ones mentioned often take a substantial effort to develop and, by the time they are ready for production, the original requirements may have changed to such extent that not all of the data produced is still needed.

Before "unbundling," most computer manufacturers supplied free program packages with their equipment. Enlightened executives now think twice before ordering the latest-generation computer when they discover the cost of making the new equipment productive and compare it with the cost of previous-generation equipment and widely-available software.

A large number of program packages have built-in options to provide for a broad range of common and



Mr. Scheefhals is President of Systematic, Inc., a Connecticut-based company providing consulting services for business automation. He received his formal education in The Netherlands majoring in accounting and business administration. Since coming to this country in 1956, he has continued his studies in business management and the use of automation equipment.

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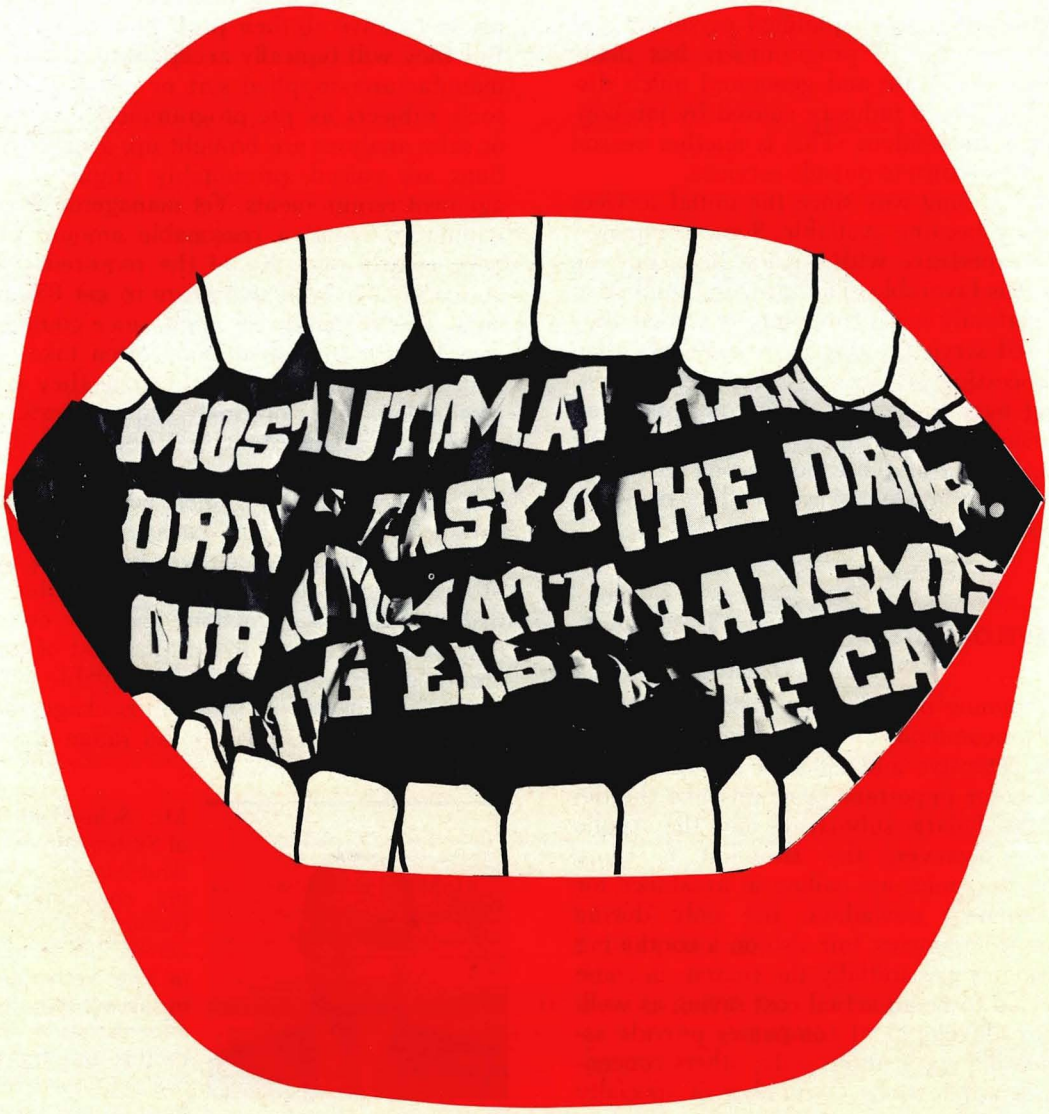


logical requirements. To make effective use of these options sometimes requires great skill; it may also be a yardstick of the value of the package. A reliable house creating program packages may be able to provide a solution for some specialized problem areas on short notice.

DATA PROCESSING CENTERS

Data processing centers are no longer considered to be a haven only for small companies which want their payrolls, simple billing, and accounts receivable procedures automated. Even the larger companies, including many with their own computer installations, have discovered that it may be profitable to contract some of their operations to nearby service centers. Some have even discovered that the computer center around the corner can compete successfully with their entire EDP operation.

Despite the fierce competition between independents, and also within each group, most centers still operate most economically by selling a service package many times over. EDP centers are not paying sufficient attention to providing custom-made services as a long-range objective, a field which could make them considerably more attractive.

On the other hand, although most of the centers' income is still derived from "canned" services like payroll, billing, various accounting functions, and inventory control, some centers are moving in the direction of not-so-common applications. These include hospital administration, educational services, production control, sales analysis, and personnel record-keeping.

Data processing managers may be surprised how well the services of a local data processing center can be incorporated in their EDP operations.

TIME-SHARING SERVICES

Real-time centers with direct-response services constitute the latest variation in data processing assistance. Time-sharing resources are predominantly used in scientific applications, but they are increasingly recognized as powerful management tools.

The design of real-time systems and the development of flexible programs for a variety of customers is a complex task requiring many man years of effort and experience. This explains why most centers offer only a limited number of services. In addition to scientific applications, business services offered range from scheduling and accounting to inventory control and typesetting.

Since on-line service centers are the forerunners of the proposed information utilities, it would be beneficial for data processing managers to investigate now how these user-oriented centers could contribute to their operations.

EXCHANGE OF PROGRAMS

Due to the shortage of qualified personnel, the exchange and sale of programs is becoming more active of late. Several independent companies have prepared rosters of program exchange organizations and catalogs of available application packages, and the U.S. Patent Office recently sponsored a pilot project to classify software by algorithm for the purpose of determining patent guidelines and establishing "prior art." Such rosters and classifications will certainly help to promote a more lively trade in this area. They do not, however, obviate the need to examine critically the standards used and the quality of documentation provided with each of the packages offered.

SUMMARY

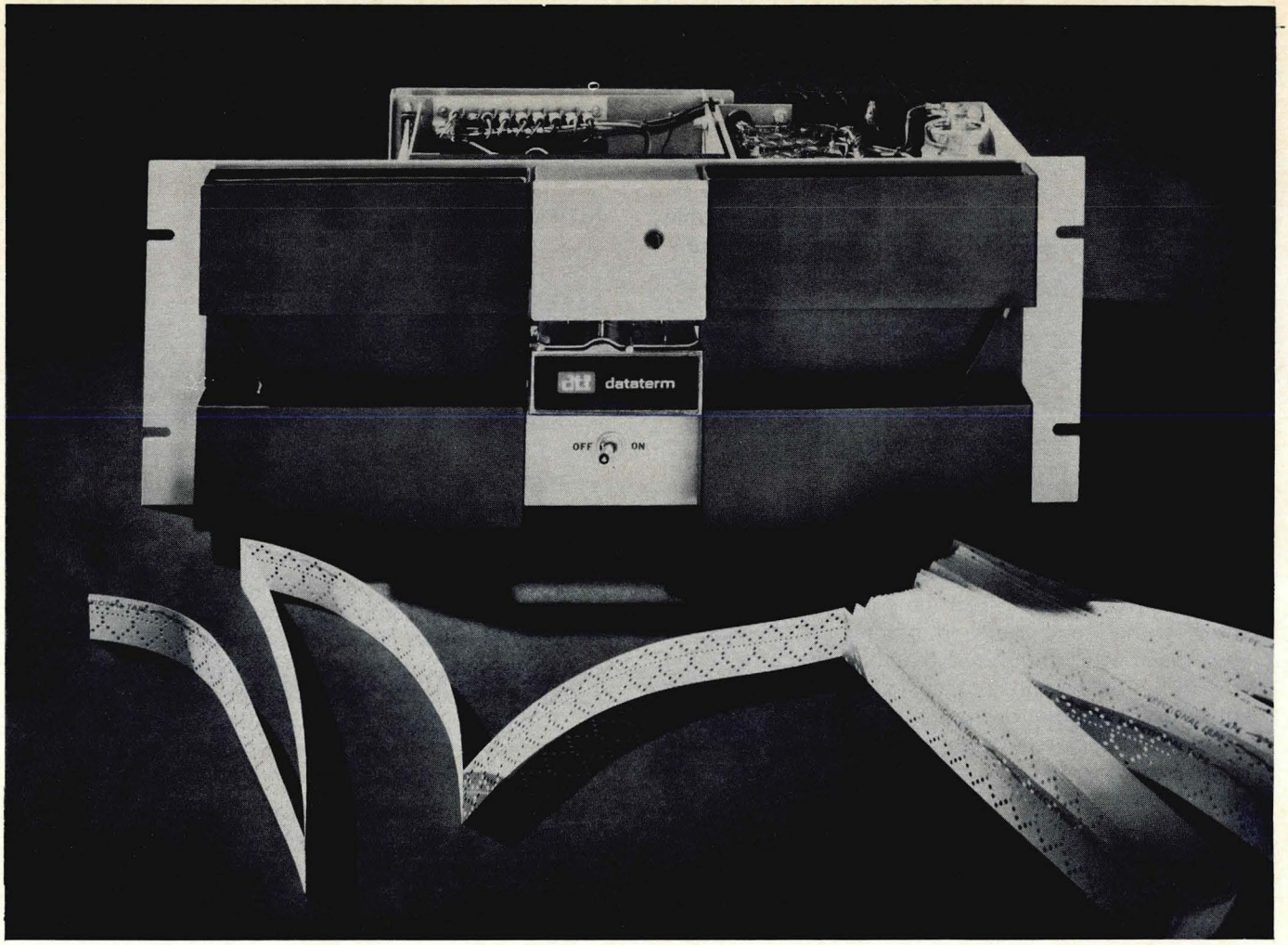
The need for programming and general assistance varies from company to company and from time to time. Managers of others responsible for data processing performance, who find it difficult to meet projected schedules, will do well to consider the aids discussed in this article. Listed in sequence of the dollar volume of business, these aids are:

- Data Processing Centers;
- Software Development Assistance;
- Time-Sharing Services;
- Program Packages;
- Outside Systems Support;
- Exchange of Programs.

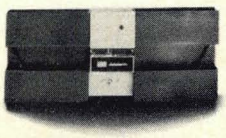
As with any other outside help, the following steps are recommended before definite arrangements are made to use outside services:

1. Check up on the reputation of the service firm and its management;
2. Make sure the individuals working on your projects are capable technicians and thoroughly understand the problem;
3. Start payments on the contract or agreement **after** some visual proof of progress has been received;
4. Guard against costs in excess of original estimate.

Based on current expectations of continued growth, we can look forward to an even wider variety of programming and general EDP services in the future — in fact, we are only beginning to feel the effects of "the great shortage." ▲



One moving part and it moves at 300 cps.



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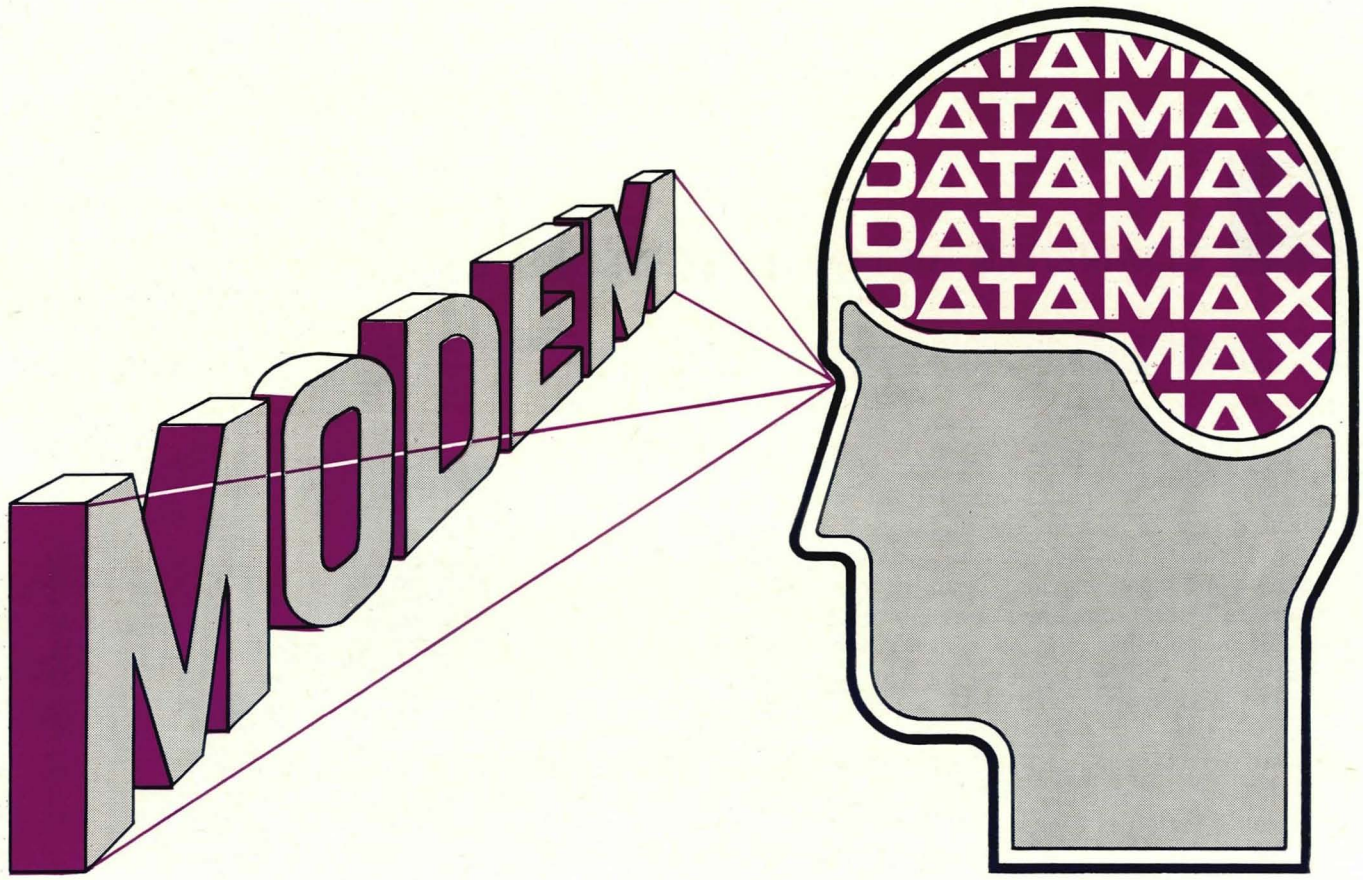

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COMPUTER SIGNAL PROCESSORS' CSP-30 SYSTEM

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COMPUTER Signal Processors, Inc. of Burlington, Mass. is a company dedicated to producing a dedicated type of system: the high-speed signal processor. Founded in 1968 "for the specific purpose of designing and manufacturing digital systems for signal processing," the company's single-mindedness and sense of purpose has paid off well. Within a year of incorporation, CSPI announced its first product, the Compu-Signal System 3 (CSS-3), a fast and flexible "off-the-shelf" signal processing system complete with software for real-time fast Fourier transforms (FFTs), convolutions, correlations, signal averaging and sampling, and a variety of time-series applications.

Fig. 1. The CSP-30, a new high-speed (100 ns full-cycle time) computer for signal processing applications, shown here with magnetic cassettes and KSR-35 I/O.

ACT 1: THE CSS-3 SYSTEM

The CSS-3 was immediately successful. In addition to providing the company with an early source of revenue, it established CSPI's reputation as a company with "know-how" in an extremely complex field. Orders for the CSS-3 were followed by requests for specialized single- or multiple-task signal processors. New personnel were taken on. Office and plant were moved to larger quarters. The company also found the CSS-3 to be an excellent vehicle for developing manufacturing skills and, by following up on its customers, gaining a first-hand picture of the market.

BETWEEN THE ACTS

To Dr. Edmund U. Cohler, President of Computer Signal Processors, Inc., the CSS-3, a custom-configured package of subsystems, was part of an experiment to determine the feasibility of a more sophisticated "total" system he'd been thinking of ever since leaving Sylvania Electric Corp. to found CSPI. While a senior scientist at Sylvania (the highest scientific position within the General Telephone structure), Dr. Cohler had supervised the design and development of basic circuits and memories for military computers. Later, as manager of Sylvania's Advanced Techniques Laboratory, he led groups in the development of digital processors for communications. Dr. Cohler's experience convinced him that: • A special processor was required for the special demands of high-speed signal processing; • It would have to be designed "from the ground up;" • He could design it.

Dr. Cohler's combination of past accomplishments and present ambition was irresistible, and he found many in his team at Sylvania eager to join with him in forming CSPI. Thus, the "total" signal processor concept existed at the time of the company's inception. In fact, even **before** the CSS-3 was available for delivery, CSPI's capabilities brochure hinted of a "second product" which promised to be "more than an order of magnitude faster."

ACT 2: THE CSP-30 SYSTEM

That "second product" is now available as the Compu-Signal Processor-30 (CSP-30), an extremely fast (100 nanosecond basic cycle time), 16-bit, special-purpose computer featuring both core and IC memories (see Table 1). Since speed is unquestionably the most important characteristic of real-time signal processors, one would expect that the "from the ground up" approach taken in the design of the CSP-30 would result in a system considerably faster than the more "general" processors not designed primarily for signal processing applications. We asked Mr. Andrew Emery, CSPI's director of marketing, if he had any benchmark data to justify this assumption. Mr. Emery provided us with Table 2, and assured us that the figures were derived objectively.

TABLE 1 • CSP-30 MEMORY RATES

	IC	CORE
FULL CYCLE TIME (nanosec):	100	900
ACCESS TIME (nanosec):	100	350
HALF-CYCLE TIME (nanosec):	—	600
TRANSFER RATE* (millions of 16-bit words/sec):	10	1
TRANSFER RATE* (millions of 8-bit words/sec):	20	2
BASIC MEMORY CAPACITY (words):	512	4096
EXPANDABLE TO (words):	2048	32,768
IN BLOCKS OF (words):	128	4096

** Direct memory access from or to external devices.*

APPLICATIONS

A curious fact about signal processing systems is that, while they qualify for "special-purpose" billing, they are among the most "general" of "special-purpose" systems. Their range of applications includes:

- Real-time seismic and oceanographic data acquisition;
- High-speed, multi-channel process control;
- Vibration and shock testing;
- Spectrometric and other forms of chemical analysis;
- Signal demodulation and digital filtering for radar and radio communication;
- Optical character recognition;
- Image processing and enhancement;
- Speech studies and acoustic measurements;
- Biomedical monitoring and vital-data analysis.

In short, any application that involves the acquisition and analysis (processing) of raw source data (signals).

The CSP-30, by virtue of its fast data acquisition rate (direct IC memory access from or to external devices allows transferring up to 10 million 16-bit words per second) and processing speed (typically 3 million instructions per second), further extends this range of applications by making it possible to utilize real-time processing techniques that were previously impossible or prohibitively costly. In addition, **multiple** dedicated applications are possible, serially, because the CSP-30 is fast enough to compensate for the price in time usually required by software/functional programming.

HARDWARE/SOFTWARE

The complete (basic) CSP-30, shown in Fig. 1, consists of the CP with 4K 16-bit words of core and 512 words of IC memory (expandable to 32K and 2K words, respectively), two magnetic cassette drives (the system provides for three), rack-mounted control panel (an optional console version has a desk-mounted control panel), power supply, and free-standing KSR-35 teletypewriter. All versions of the system are provided with complete utility and functional software, consisting of a loader, symbolic text editor, debugging aid, stand-alone symbolic assembler, diagnostic and maintenance routines, at least ten FFT programs, and more than a half-dozen miscellaneous programs for averaging, correlation, and digital filtering.

The CSP-30's do-it-yourself instruction set consists of 73 single-word and 55 double-word instructions ar-

TABLE 2

CSP-30 FUNCTIONAL EFFECTIVENESS INDEX

TO PERFORM THE COMPUTATION

$f_k = a \cdot x_k + b \cdot y_k + c \cdot z_k$ where $k = 1$ to N

CSP-30	using fast memory only	5.1 • N microsec.
	using fast memory and core memory:	5.6 • N microsec.
	using core memory with 32-bit sum:	7.7 • N microsec.
DEC PDP-10	integer multiply, with a, b, and c in accumulator:	40.9 • N microsec.
XDS SIGMA 5	half-word multiply, with a, b, and c in accumulator:	26.8 • N microsec.
XDS SIGMA 7	half-word multiply, with a, b, and c in accumulator:	22.3 • N microsec.

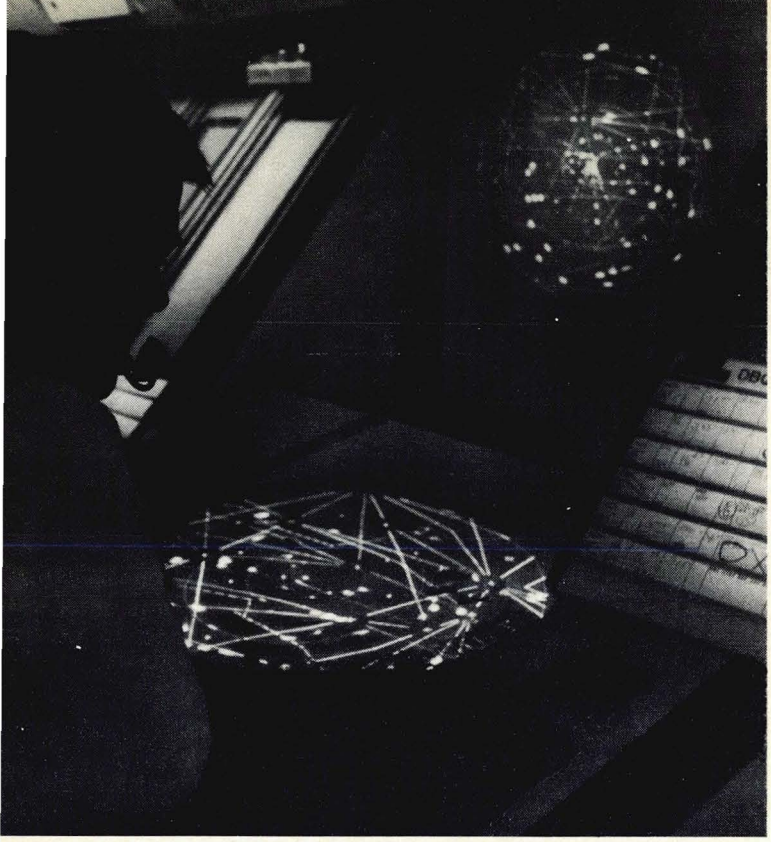
TO PERFORM BASIC LOOPS FROM A 256-COMPLEX FAST FOURIER TRANSFORM:

CDC 3200	60 millisec.
SEL 810B	58 millisec.
IBM 7094 II	53 millisec.
EMR 6130	52.4 millisec.
DEC PDP-10	50 millisec.
XDS SIGMA 7	49 millisec.
EMR 6135	44.4 millisec.
IBM 360/65	22 millisec.
CSP-30	6 millisec.

ranged in seven functional groups: arithmetic instructions specify both the source of operands and the destination of results. Push-down list instructions allow any accumulator to be used as a pointer to a list in memory. (There are 32 ACs, of which 14 are also used as index registers.) The remaining instruction groups are for shifts, skips, jumps (over the full range of IC and core memories), I/O (to 3 parallel, expandable I/O channels for high-speed devices or controller, and one low-speed channel with 8-device party-line controller), move/load/store commands, etc.

Priced at approximately $85K for the basic system, the CSP-30 strikes us as well-worth looking into. **You'll get your chance in Atlantic City at SJCC Booths 201-202, where the CSP-30 will make its debut.**

For more information on Computer Signal Processors, Inc.'s CSP-30 system, Circle No. 122 on Reader Inquiry Card.



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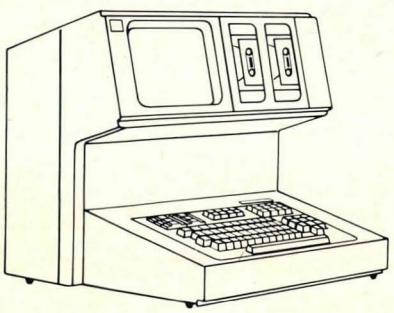

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Off-line you can search a cassette file, insert changes, sort information, or copy records. On-line it will transmit or receive data unattended. With an optional printer, multiple copies are provided.

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This work was conducted under a research grant from the Atomic Energy Commission to Stevens Institute of Technology.

SWAPPING VS. PAGING

Editor's Note: This article compares the nature and characteristics of swapping and paging techniques for time-sharing. Swapping is judged by the author to show greater promise for efficient time-shared operation and to be more subject to improvement.

PROCESSING MULTIPLE PROGRAMS

Swapping and paging are both techniques for optimizing the computer's central processing unit. Often, it is also desirable to furnish the computer to several users, making it appear to each as though he had complete control of the computer. For such applications, the computer is asked to give attention within a short period of time, say one second, to several programs; each may be large or small, short or long.

It is clear we are speaking of a multiprogramming system, in which several programs may reside in memory at the same time. This permits computation and processing to commutate among the programs momentarily. Multiaccess computing enables each of several users to see the computer through a terminal which, during his use, belongs to him. Communication with the terminal may be mediated by an auxiliary computer. This allows infrequent execution for a given user without undue load on the main computer.

Dr. IVAN FLORES
Associate Professor, Department of E.E.
Stevens Institute of Technology, Hoboken, N.J.
and
Contributing Editor, MODERN DATA

The problem that we address is one of efficiency. The multiaccess approach makes the **user** more efficient; multiprogramming makes the **computer** more efficient by permitting it to go to another program when it gets "hung-up" on the one it is presently pursuing.

WHAT MAKES SWITCHING OR PAGING NECESSARY?

If the high-speed memory were infinitely large, it could hold all programs being worked on in their entirety. Switching from one program to any other could then be done instantly. But memory is not infinite; so we must look for some means to improve transition among programs. In the discussion which follows, we make use of the following assumptions, which apply to swapping and paging respectively: • *memory is large enough to hold any single program;* • *memory is large enough to hold significant pieces of all programs being considered.*

PAGING

ADVANTAGES

With paging, pieces of each program are contained in memory with the most recent portion of any given program immediately available when that program is called upon. Thus, when the computer gets stuck it can switch to the program of its choice without expecting any waiting. Certainly this technique favors improving the computer's efficiency – even when I/O is unbalanced. Many programs frequently call upon I/O without further work to be done until the call is completed.

DISADVANTAGES

Dynamic Relocation Capability – One of the qualities of paging techniques is dynamic relocation. Memory is divided into blocks (or multiples thereof) of equal size. The program too is divided automatically into pieces or pages of the same size. The location that any page occupies is undetermined before that page is brought into memory during running. Hence it's location is unknown at compile time and assembly time, and by the linkage editor and loader.

The page is placed in the spot most advantageous to overall computer operation. Thus, although page 7 may be placed in one position today, it may occupy an entirely different position when it is run tomorrow. More importantly, page 7 may be moved around to different positions even while the program is running.

The problems of making any page relocatable "on the run" could be solved, by either software or hardware. In the first case, software must intervene for each and every reference that a program makes. Since this lengthens the running time for every program by a rather large factor, most manufacturers use the hardware approach to paging. But even with the good and comparatively inexpensive solutions now being provided by several manufacturers,[1] special software must still be supplied for augmentation. Some significant fraction of memory references requires multiple memory cycles.

Thus, dynamic relocation, even when facilitating hardware is supplied, increases running time by the additional time required to locate positions on page.

Interpage Reference Frequency – With paging, only one page of a program is brought in at a time. When that program needs another page of data, the page is called for with a separate request. Thus as a program runs, new requests continually arise for new pages of both program and data. Each request is turned over to the paging monitor, which finds an empty spot to place the incoming page.

Generally, however, memory is completely filled with information – there is no spot immediately available for the new page. Hence room must be made by the paging monitor. When a suitable position is found (a complicated task in its own right), the information at that position may have to be saved. The paging monitor checks into this.

The auxiliary memory monitor is responsible for communication and transfer between main and auxiliary memories. It saves the old page when required, and supervises the acquisition of the new page. Processing functions are resumed after the auxiliary memory has initiated the paging request.

To continue processing, a priority monitor chooses the next program to be serviced. Service on the original program is suspended while paging proceeds via the auxiliary memory monitor. The original program won't get another turn until its page is brought in. One difficulty which may arise: some of the pages of the original program may get paged-out while it is waiting for its new page; when it is reinstated, it may find some of its old pages gone, thus facing a new hang-up.

The originally proposed procedure of requesting the single page might require revision to cope with this problem. The present solutions to interpage references do not seem too satisfactory.

That interpage reference is truly a problem was clearly demonstrated in an article by Fine, Jackson, and McIsaac.[2] For this study a computer with a memory of 64K was used. A page consisted of 1K words. There were approximately 48K useful pages available in memory outside of those required for software. The computer's instruction time was 1.6 microseconds exclusive of fetch. The authors found that 10 pages of the program were generally required within 5.6 milliseconds of operation. They also noted that for programs requiring more than 20 pages of memory, at least 20 pages were required within the first 7 milliseconds of operation. While this study did not consider the need for paging-out, it did reveal the high rate of interpaging references for the program. And this without considering the paging requirements of the data!

Paging Time – The actual time required to get information from the auxiliary memory is not negligible. For the smaller disk units we must consider a seek time of 75 milliseconds, latency time of 25 milliseconds, and a transfer time of 25 milliseconds. At 125 milleseconds per page, it is possible to access only 8 pages per second. It is important to note that in some systems the program is completely paged to the disk when communications between the computer and a terminal is complete and the computer is awaiting a new request from the terminal. This means that considerable paging time must be spent simply in reactivating programs, even when a user remains at his terminal.

Of course, this is the least attractive case. Paging time can be effectively reduced by the use of multiple disk modules with seek overlap. Another expedient is the use of high-speed drums. In fact, with drums we can increase our rate up to one hundred pages per second. But we still have the problem of bringing information from the disk to the drum. Present systems require that the disk-to-drum transfer pass information through the main core memory. Such transfers, then, require double access time: disk to memory; memory to drum. This is done before the information is actually required in main memory, which then calls

for another drum-to-memory transfer. This might be improved by hardware means.[3]

Paging Monitor – The paging monitor is most notable for its extensiveness. Here is a brief list of some of it tasks.

- It must frequently do look-ups in the page and signal tables.
- It fabricates and uses the drum monitor queues.
- It fabricates and uses disk monitor queues.
- It contains a disk and drum interrupt monitor.
- It must choose information from interrupts and the page and signal tables.
- It must monitor service for each of the terminals.
- It contains job and task tables together with priorities so that it may choose the next job for the computer.
- It provides a page-out monitor.
- It must manipulate and interchange priorities for user and background tasks.

The paging monitor is extensive not only in the number of tasks that it performs, but in its other qualities: • **Size** – the room in memory for programs to do all these tasks is considerable; • **Length of operation** – for the IBM 360, Model 67, the time required to perform all the functions associated with paging is in the neighborhood of 1 to 2 milliseconds.

SWAPPING

ADVANTAGES

The program under swapping is always completely contained in memory. Hence, during its time slice, it never has to wait for the operating system to obtain more program. Also, it is usually true that all the data to be worked upon by the program is in main memory with the program.

Because of the on-line nature of the system, there is generally very little holdup for input or output activity. Thus, users at terminals are either communicating with an auxiliary computer or with a small real-time monitor, which does not perceptibly impede the main program. Or else the user has made an execution request and is awaiting its completion. In all cases, vast quantities of printed information are not characteristic of this system.

Because of the above characteristics, the time slice allocated to a program is generally totally available without option. New program information or data is not required and hence there are no holdups outside of swapping itself when another program takes over. A program uses up its time slice as a chunk or else terminates its operation within its time slice. Since a time slice is not split-up, there are no intervening programs to slow down the reactivity of the system. This certainly improves the total reaction time during a given run over what it would be under paging.

DISADVANTAGES

Dedication – While a given program is running, only it and the software occupy memory. The entire computer is dedicated to the program which has taken over. Such applications as payroll or other EDP functions which are I/O-bound would meet with intolerable delays with this system. That is, without multiprogramming, unbalanced programs meet with inefficient computer use.

Long Swap Time – When a program completes its time slice or finishes all the tasks assigned to it, a swap is required. If a user needs a portion of a large program for a few simple operations, this is unknown to the system. Regardless of the predicted use of a program, the entire program becomes resident in memory and the computer becomes dedicated during this period. Thus, a complete swap requiring fractions of a second is necessary for even a few microseconds of computing time.

User Limitation – Because of the long swap time required regardless of running time, the number of users of a swap system becomes limited. If we were to permit a large number of terminals, queue length would become long and response time would deteriorate.

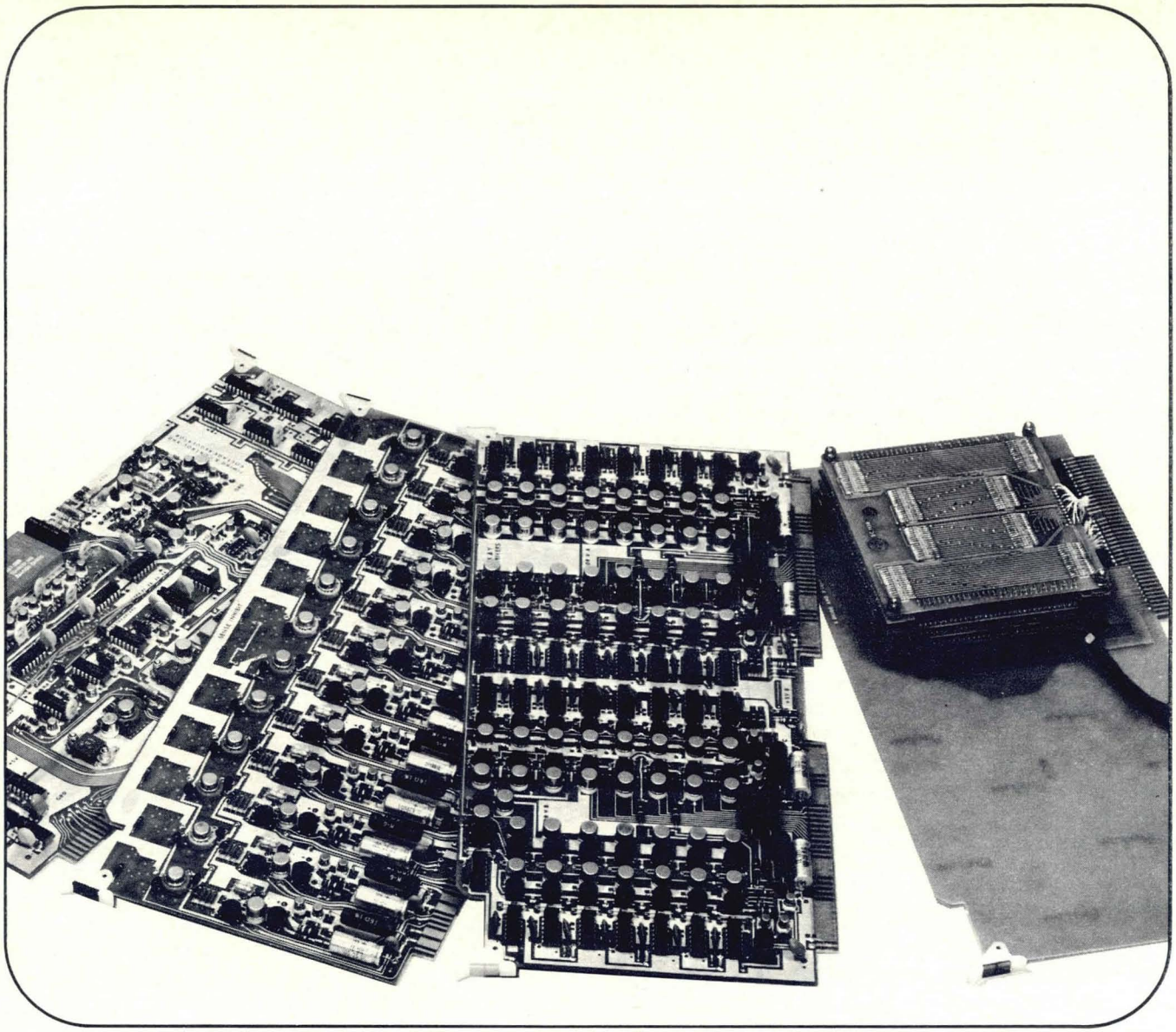
Swap Time Unmasked – Because multiprogramming in its true sense is not available in this system, no useful work is being done while swapping occurs. If this were possible, the high swapping time would not be intolerable.

MULTIPROGRAM SWAPPING

A problem arises with the swapping technique on programs which are I/O-bound. That is, when a program gets stuck during input or output operations, that program no longer makes effective use of the central processor. It can't swap out the program while I/O for it is going on. Nor is there anything else for the central processor to do. Hence, for the time slice assigned to this program, the central processor becomes idle.

Why not several programs in the computer memory at once? Then when we get stuck with one program because of I/O assignments, we can work on another program. The simple objection to this solution is that often it is impossible to get more than one program and the software into memory at once. If we break up the program into chunks, we are faced with the same problem that paging attempts to overcome.

Fragmentation Problem – Suppose programs are small enough so that several can fit into memory at once. This causes a serious problem when one or more of the small programs terminates. The completed program leaves a hole in memory. This is fine if there is



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another program of exactly the same size to fill up this hole. If the waiting program is smaller than the hole, we can fit it in, but we have left a smaller hole. If the program awaiting service is larger than the hole, we have to wait for a hole that size to develop. If another hole develops, such that the total area is enough to house the waiting program, we either have to break it up into two smaller pieces, or wait for a continuous hole of the right size to develop.

Finally, we have the case where several small and large programs are mixed. This really creates a difficulty.

IMPROVING PAGING

There are two main difficulties which arise in paging techniques.

1. Frequently a program is faced with a missing page which causes it to turn control over to the page monitor.
2. The page monitor requires a lot of space and takes up much needed computer running time to manipulate the many queues which are necessary to keep track of what is going on.

MULTIPLE PAGES

Present proposals are to acquire a single page at a time. If we were to try to get several pages, how would we know which pages to get? We might get successive pages such that if page 456 were requested, it would also bring in pages 457, 458, etc. We could not expect much help from this technique.

On the other hand, with the programmer or the compiler we might have further information which would suggest those pages which would be required in the immediate future.

Thus the multiprogram solution is best approached by enlisting the aid of the compiler or the programmer especially in the case where assembly language is being used.

PAGING MONITOR

We can add sophistication to the paging monitor to make it operate more efficiently, but only at the cost of precious memory space. There is a trade-off. If the paging monitor could improve the selection of pages to be paged-out, this might improve overall operating efficiency.

IMPROVING SWAPPING

With swapping there are two salient problems:

1. I/O hang-up during a time slice;
2. A long swap time during which the central processor is out of business.

FOREGROUND/BACKGROUND PROGRAMMING

The suggestion here is to have a computation-bound program which requires a lot of computation and little or no I/O activity in the background. The remainder of memory would be free to house foreground programs for the multiaccess user who gets priority. But when his program gets stuck because I/O is going on, the central processor can be assigned calculations for the background program. Further, during swapping, the background program can also be put into operation to make more efficient use of time.

Note that this technique permits batch processing to go on in the background with multiaccess users in the foreground. The problem with this suggestion is that now three entities occupy main memory:

1. The software and swapping monitors which must be provided for;
2. The background program which is computer-bound;
3. The multiaccess user program.

In general, this calls for larger memories than installations might bargain for. However, the increase in efficiency should pay for the extra memory cost.

When the users' programs are small, this technique is no problem; when the users' programs are very large, the background program can be swapped-out. It is the intermediate size which hurts us most.

PRE-SEGMENTED PROGRAMS

If either the translator or the programmer supplies programs in chunks which are relatively independent and of a reasonable size, this might help us to multiprogram. We could then feed segments of several programs into the memory at the same time, and switching without swapping would be possible. (Naturally we would rather switch than swap.)

Holes may still arise unless we can request of the programmer or the translator that segments be of fairly uniform size. Beyond that, aid may come from either smarter monitor, occasional "garbage collection," and a fair amount of extended core memory.

EXTENDED CORE MEMORY

Large but slow core memories are becoming available for use as auxiliary memories. Can such memories help us with the multiaccess problem?

FOR PAGING

If we keep programs or data in an auxiliary memory, whether it be core, disk, or drum, we still have the

problem of transferring the programs or data into the main memory for use. Futhermore, proposals which suggest extended core memory as another rung in the ladder or heirarchy of memories present the problem of getting information from one auxiliary memory to another. Even though access to information in extended core is much faster than for disks or drums the transfer rate may be slower. In summary, extended core does not seem to help us very much with paging.

FOR SWAPPING

It is possible to stack multiaccess foreground programs in extended core. This would greatly reduce swapping time when small programs are involved.

Another possibility is to execute programs directly within extended core. This would require longer execution time, but would entirely eliminate swapping time. Again we are faced with trade-offs in execution. Should we have large programs like compilers in extended core for execution there; or should small foreground programs be executed in extended core, reserving fast core for compilers and other large, heavily-used programs?

JOB STACKING

For a reasonably effective time-shared system, we expect the job queue to contain jobs of several kinds: few of them will be data processing-type jobs in the usual non-time-shared sense; some will be machine-language programs generally of small size ready to work on real data; many will refer to large, already debugged programs, such as compilers, assemblers, special translators, list processors, display programs, and other service-type programs.

Now the point is this: suppose I have a Fortran job, followed by a small user job, followed by another Fortran job. If they enter the queue in this order, the Fortran compiler will have to be paged-out for the machine-language program and then swapped-in again later. By altering the position of the second Fortran job in the queue, or by changing its priority, we can save the double swapping of the very large Fortran compiler. Certainly this or a similar technique could improve the efficiency of both a paging or a swapping system.

CONCLUSIONS

I personally favor swapping as the technique which will be most frequently and effectively used in the future to solve the time-sharing problem. In contrasting and comparing this technique with paging, several observations have been made; these are summarized as follows.

1. While a user's program is in control, paging generally lengthens the running time of the program, while swapping does not lengthen the actual running time of any program.

2. Queue management is necessarily a more important function for paging; it requires monitors of larger size. These monitors take up more of the computer's time than would be required in a swapping system.

3. Swapping systems can be improved to mask the time required in transfers from auxiliary to main memory. This means that multiprogramming is a necessity. This can be achieved through either larger memories or segmented programs.

4. Extended core can help in both techniques, but probably has a more telling effect upon swapping.

5. The incorporation of automatic priority re-allocation can help in both techniques by eliminating paging or swapping time for large programs used by nonsequential jobs occupying the queue simultaneously. ▲

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Edward C. Marzo, • The William Carter Co., Needham Heights, Mass.

RESOLUTION PROGRAMMING

A powerful technique for allocating limited resources

Editor's Note: Many companies have installed computerized stock allocation systems: The William Carter Co. installed one of the first in 1960. In 1967, Carter's implemented the technique described in this article, and has since found it to be extremely successful in eliminating many disadvantages of traditional tape- and disk-oriented systems by providing efficiencies in disk accesses, execution time, and core requirements. The technique is sufficiently general so that other applications are possible.

"RESOLUTION Programming" is the name for a very powerful technique developed for use in our computerized stock allocation system. It has provided, with dramatic effect, up to 80% better utilization of inventory than a former computer allocation system. Furthermore, we believe that the technique is so simple, flexible, and powerful that it may have wide application to other problems where limited resources must be distributed or allocated to a large number of competing demands. Examples:

1. The allocation of classroom space (a limited resource) to student schedule demands;

2. The allocation of the capacities of a number of machines (limited resources) to different departmental requirements;

3. The allocation of limited manpower to competing projects.

"Resolution Programming" is best described by illustration. In general terms, however, the following framework will be helpful.

1. The inventories of the limited resources are recorded on a random access file.

2. The orders (demands) which compete for the limited resources are recorded on a file (tape, cards, or disk) and can be processed sequentially.

3. Since all orders or demands cannot be fully satisfied (resources are, by definition, limited), the resources are allocated to the orders in such a way that customer dissatisfaction is minimized and use of resources is maximized. (Extensive flexibility is available to define such things as lowest level for customer satisfaction.)

THE STOCK ALLOCATION PROBLEM

Resolution Programming is best described in relation to the classical stock allocation problem. Basically, this problem involves the allocation of **limited** stock (inventory) to a large number of competing customer orders in such a way that:

condition a: Minimum order fill conditions are satisfied;

condition b: Order priorities are recognized;

condition c: Inventory use is maximized.

Let us examine these more carefully. Note that "limited" is emphasized; that is, it is assumed there is insufficient inventory to fill all customer orders. **Condition a** (minimum conditions must be satisfied) says that a customer order for several or more items should not be "filled" unless a certain minimum is available. For example, if a customer orders ten different stock items, company policy may say to fill the order only if 70% are available, or only if a minimum weight is available, etc. Additionally, it is normally desirable to bring as many orders as possible up to the minimum fill condition; that is, the minimum should not be exceeded unless no other order can use the stock to meet its minimum.

Condition b (priorities) says that orders normally have to be handled in some ranked sequence – for example, by date of receipt. Order priorities may interrelate with **condition a** in some complex manner.

Condition c (inventory use) says that as much of the available inventory as possible must be used in accordance with **conditions a** and **b.**

The above, of course, are general rules which can be emphasized or de-emphasized in a given company.

TRADITIONAL SOLUTIONS

Many companies have installed stock allocation systems. These have generally been designed in either of two ways.

Tape Systems — The magnetic tape order file is sorted to item number sequence and matched against

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an item master inventory file. Inventory is allocated by item as long as it "lasts." The order file is then sorted back by order number and "fill/no fill" decisions are made on each order.

Random Access Systems — The inventory file is on disk or other random access device. The order file, from tape or disk, is passed against the inventory file, order by order, in priority sequence. As each order is completed, a "fill/no fill" decision is made based on the items available and the company's minimum order fill conditions. In more advanced systems, if a "no fill" decision is reached, the order is immediately reprocessed to put the allocated stock back into inventory, thus making the stock available for orders not yet processed.

The disadvantage of the tape system approach is that it provides no practical way to put stock back into inventory if an order does not meet minimum fill conditions. Thus, as many orders as possible are not brought to the minimum condition and inventory use is not maximized.

The traditional random access system provides for putting stock back, but does so very inefficiently. The entire order is usually saved in core, thus imposing some arbitrary maximum order size. All allocated items must then have another access to the disk file to correct the inventory, and the order is then extracted from core and written on the output device. In addition, the disk approach normally does not bring as many orders as possible to the minimum fill condition.

TABLE OF ABBREVIATIONS USED

Field Abbrev.	Meaning	Location of Field
DCG	Demand for Current Group	Disk Record for Item
DPG	Demand for Previous Groups	Disk Record for Item
DRT	Decision Result Table	Core (main memory)
GRPNO	Group Number	Disk Record for Item
ILO	Identity of Last Order	Disk Record for Item
INO	Item Number	Disk Record for Item and dividing trigger record.
QLO	Quantity allocated Last Order	Disk Record for Item

RESOLUTION PROGRAMMING

Resolution Programming has none of the disadvantages of the traditional tape and disk systems. Indeed, it provides significant additional advantages of great flexibility, speed, and very small core requirements. There are no artificially set maximum order sizes (an order can be for any number of items), and the technique allows great flexibility in levels of order priorities.

For convenience, Resolution Programming will be described at three levels.

Level 1: *Describes the way Resolution Programming solves the problem of "putting stock back" very efficiently.*

Level 2: *Describes how* ***Level 1*** *can be modified so that as many orders as possible are brought up to the minimum fill condition; and how additional stock is then allocated.*

Level 3: *Describes how order priorities can be established with great flexibility.*

For all three levels, it is assumed that the **item inventory file** is on a disk (or other random access device) and the input and output order files are on tape, cards, or disk. It is possible to access randomly the disk record for an item by some direct or indirect addressing technique. It is also assumed that each order in the order file can be accessed sequentially in priority sequence.

Level 1 — "Putting Stock Back"

For this level, the disk record for each item must include two extra, initially blank, fields:

1. *ILO (Identity of Last Order);*
2. *QLO (Quantity of Last Order).*

In addition, this level requires that a portion of main memory be set aside for a Decision Result Table

(DRT). One position of this table will be assigned to each order processed: the first position for the first order; the second position for the second order; etc. However, we shall show that the table may be any convenient size – it does **not** have to provide a number of positions equal to the number of orders to be processed.

Each order is processed one item at a time. For each item, the disk record is accessed and the inventory field is tested to see if the quantity on the order is available. If it **is** available:

1. The inventory field is reduced by the ordered quantity (stock is "allocated");
2. The ordered quantity is recorded in the QLO field;
3. The **address** of the position in the Decision Result Table for this order is recorded in the ILO field;
4. The ordered item is coded "allocated" and immediately written on the output card, tape, or disk;
5. The updated item inventory record is written back to disk.

If sufficient inventory is **not** available, the order item is coded "not allocated" and is written on the output card, tape, or disk. Order level accumulators are updated showing number of items ordered, number allocated, number not allocated, etc., as required.

After all items for an order have been processed, the order level accumulators are examined to see if minimum fill conditions have been satisfied. If they have, a "Y" is placed in the Decision Result Table in the position corresponding to the order. If minimum fill conditions were not satisfied, an "N" is placed in the Decision Result Table.

It is extremely important to note that stock is not "put back" at this time if a "no fill" decision is reached. Thus, the inventory fields for all items allocated on the order are "wrong." *A fundamental concept of Resolution Programming is that an inventory figure need be correct only when the next order for that item is processed.* So we wait until the next order for an item is encountered and, as soon as the disk record is read, the inventory field is corrected **before** stock availability for the new order is tested. This correction is accomplished easily by using ILO, QLO, and the Decision Result Table! The processing is simply: If ILO is not blank, check the position in the DRT identified by the value in ILO. If it is "N" (meaning this order was not filled), add QLO back to Inventory. If "Y" (meaning order was filled), no adjustment is necessary. In either case, blank out ILO and QLO.

The advantages of **Level 1** are that:

a. Stock is "put back" with no extra disk accesses;

b. An order may be for any number of items;

c. As each item record in an order is processed, it may be output immediately. There is no need to save the entire order in memory.

As we stated previously, the DRT may be any convenient size. When all positions have been assigned to incoming orders, and at the end of the run, the Decision Result Table is simply **resolved** by an automatic program interrupt which simulates an order for all items on the disk (or which does a disk search for all positive ILO fields). The DRT is then blanked-out and reused for the next set of orders.

Finally, note that the output file must be reprocessed so that "filled" and "not filled" orders can be divided for appropriate subsequent processing. If the file is on tape, a short record for each order on an extra tape (or a punched card) can be used as the dividing trigger.

Level 2 – Bringing as many orders as possible to the minimum fill condition

For illustration, assume that the minimum fill condition is based on the **number of different items ordered,** e.g., the order will be filled if 50% of the number of items ordered are available. For this level also, the disk record must include extra, initially blank, fields:

1. **ILO** } **As in Level 1**
2. **QLO** }
3. **INO (Item Number)**

Again, a Decision Result Table is required. However, each order will now be represented by one or more consecutive positions in the DRT. The number of positions will depend on the normal maximum number of items an order might have. Let's assume two positions (up to 99 items) for each order.

The processing for **Level 2** is the same as for **Level 1,** except that each item with stock allocated is numbered, first 01, second 02, etc. This number is recorded in INO and on the output order file record for the item. Thus, an output order may appear as follows:

Item #	Qty	Allocated	INO
1936	15	No	—
4218	10	Yes	01
1127	6	Yes	02
5319	9	No	—
2306	1	No	—
0795	13	Yes	03
4545	14	Yes	04
8414	8	Yes	05

Each INO value appears on the output file and on the corresponding inventory record in the disk file.

After all items of an order have been processed, the "fill/no fill" decision is made. Under our assumption of 50% required, four allocated items will meet the minimum condition. Since five are available, the fifth

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should not be allocated until all other orders have been processed. To accomplish this, an "04" is recorded in the DRT. Now, when disk records for items on that order are retrieved for future orders, only those with an INO of "04" or less will have allocation confirmed. The allocation of the item with "05" (Item No. 8414) will be reversed, making the stock available for subsequent orders.

But what happens if no other order can use that stock to reach a minimum condition? The stock can be made to revert to this order simply by performing a stock check again when the output order file is reprocessed to divide "fill" orders from "no fill" orders. This requires that the value inserted in the DRT also be written in the record which acts as the trigger to divide "fill" from "no fill" orders.

Note that **Level 2** will be most effective if the items on each order are in random sequence, since the last items are the ones held for future orders. **Level 2,** therefore, provides a simple means of bringing as many orders as possible to the minimum condition and gives extra stock to the highest priority orders.

Many refinements of **Level 2** are possible, depending on overall system requirements and design. For example:

Refinement 1. If the total demand, by item, of orders to be processed is known before the run starts, each item can be coded to indicate whether stock is adequate for all orders or not. Then the allocation process can be modified to reverse allocation of stock in excess of the minimum for limited items only.

Refinement 2. If the size of the order is known before the first record of the order is processed, allocation may be terminated as soon as the minimum is met. (Note, however, this is in conflict with *Refinement 1.*)

Refinement 3. Simple techniques can guarantee that coordinated items are shipped together. This is normally an important consideration in stock allocation systems.

Refinement 4. A Run Switch can suppress the allocation of stock in excess of the minimum fill condition.

Refinement 5. The DRT may be bit-oriented instead of character-oriented to save space.

(WARNING: Many analysts, at first glance, attempt to improve the allocation concept by decrementing the value inserted in the DRT as future references to it are made. The reader can prove to himself why this will not work.)

Level 3 — Ordinary Priority Levels

If an order file is large, it is normally impractical to rank **each** order in priority sequence. Rather, a group of orders may be considered to have approximately the same priority. For example, all orders received last week may be of the same priority and this may be considered higher than the priority of orders received this week.

Let us assume that the order file is in sequence by priority and there is some way to identify the last order at each priority. The number of priorities may be as high as required. A requirement of the allocation system, then, may be to save enough stock to cover all orders at priority 1 before allocating any to orders in priority 2; next, to save enough stock to cover all orders in the first and second priority before allocating any to orders in priority 3; etc. For example, even if no orders in priorities 1 and 2 met the minimum fill condition, the requirement for all orders in these two groups would be protected from orders in priority 3.

This is accomplished by a simple modification of **Level 2 Resolution Programming.** Three additional fields are required in each item's disk inventory record:

1. **GRPNO** (Group No. of Last Order)
2. **DPG** (Demand for all Previous Group)
3. **DCG** (Demand for the Current Group)

The processing is as follows: A "Group No." is automatically assigned to each priority. Thus, orders in the first priority are in Group No. 01; orders in the next priority are in Group No. 02; etc. As a disk inventory record is accessed, and after previous allocation is confirmed or reversed, the Group No. for the current order is compared to the GRNPO field. If it is higher:

1. Add DCG to DPG;
2. Zero DCG;
3. Insert the Current Group No. into GRPNO.

If it is not higher, no extra steps are required.

Now, in order to allocate, stock must cover DPG as well as the ordered quantity. That is, the demand for all previous groups is simply subtracted from the Stock Field for the allocation test. Finally, if allocation is not made (or is reversed), the ordered quantity (or QLO) is added to DCG.

We see, then, that **Level 3** adds a significant dimension to Resolution Programming. Again, the additional processing is insignificant and no extra disk accesses are required.

SUMMARY

Resolution Programming, so called because of the concept of continuously resolving the Decision Result Table, is a powerful concept which saves significant computer time and memory. And, even more important, it provides far greater flexibility than other techniques. ▲

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HAS THE WELL RUN DRY?

The author takes a look at the current market conditions and the problems of raising venture capital for new firms in the computer field.

Venture Capital is high risk money which has traditionally come from wealthy individuals, pools of family capital from such families as the Rockefellers, the Whitneys, and the Phippses, and from a few public funds such as American Research & Development (ARD). In the last two to three years, aggressive money managers at both banks and insurance companies have been putting a portion of their assets into this area and are taking a long-term outlook on their commitment to the venture capital field.

A secondary source of money for the venture capital field is the individual investor with a net worth range of between one million and five million dollars. These people are normally investors in high risk situations with money which they have just made in the stock market. For example, an individual in this category might have owned a stock such as University Computing and watched it go from $20 to $160, taken part of his profits from that investment and reinvested those profits in a small software consulting firm, with the thought that he could find another University Computing and be one of the original founders. The availability of money from this source is very much contingent upon the performance of the overall stock market, since normally such an individual investor has limited experience in the venture capital field with starting small young companies. If the stock he holds goes down, the investor is hesitant to put additional money into high risk start-up situations.

Thus, the availability of venture capital money has a greatly accentuated curve in relationship to the swings in the stock market. With this availability, the corresponding terms of this money are greatly accentuated. The willingness of the public to buy unseasoned companies in the "new issue market" also tends to accentuate these fluctuations and to beguile many investors and management groups into a false assumption regarding the ease of raising money.

CURRENT CONDITIONS

The market conditions of the last year have witnessed a dramatic portrayal of the aforementioned cycle, particularly in the computer industry. The investing community decided approximately two years ago that companies in the computer field could only grow and be profitable. Hence, they bid the stocks of the public companies to ridiculous heights and found money for the creation of many companies which should never have been in business. Within the last six months, the combination of tight money, a falling stock market, failure for many of the companies to meet their projections, and a reversal of the investors' attitude will likely precipitate a series of bankruptcies among small companies in the computer field. To wit, Scientific Control Corp., United Systems, Jonker, etc. The situation is very analogous to the same type of fluctuation the electronics industry went through in 1961-1962.

CRITERIA FOR OBTAINING MONEY

Even under the adverse market conditions currently existing, there is money available in the venture capital field for the good management team with a soundly conceived idea. The following are the major criteria which a venture capital investor wishes to evaluate. The first and most important criterion is the quality and track record of the management team. What have they done before? Do they have within their group the complementary skills of management, technical know-how, and marketing?

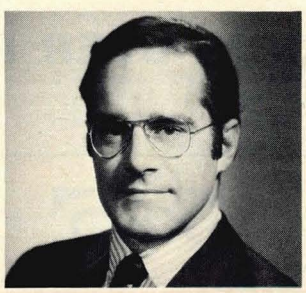
Secondly, how unique is the idea? To what extent can it be protected from someone else duplicating what the company is doing?

Thirdly, how well has the company thought out the problems of accomplishing its venture?

The investor prefers to obtain a proposal from the management team which includes an explanation of the idea, financial projections, and detailed resumes on the principals. In this instance, the investor is principally interested in the reasons for the numbers in the financial projections.

SOURCES OF ADVICE

Assume you are the president of a small company. You either have a new idea or possibly your company has been in existence for a while and wishes to raise additional capital. How should you go about raising such additional capital? There are several traditional



Robert F. Johnston has worked for several years on Wall Street with investment banking firms such as F. S. Smithers and Co. and Smith, Barney Company. He is currently running a venture capital firm, Johnston Associates, which primarily acts as representative for the managements of small companies in the computer field in search of money. He is also a consultant to Collins Securities Corporation, a young investment banking firm.

sources of advice regarding financial affairs and the raising of capital. Your accountants are frequently in touch with people who either have money or who know of sources of money. In addition, your banker and your lawyer should be asked for advice in this area.

The following are the criteria the management of the company should weigh in deciding from whom they will obtain the capital.

• The source of money should be professional investors in the venture capital field. In other words, they should already have done several high risk investments over the past three to four years. Eight out of ten venture capital investments either go bankrupt or get merged out under unfavorable terms and it is important that your investors be familiar with the problems of this area and the risks involved. Unfortunately, many of the wealthy individuals, who are playing with extra money in the stock market, assume that if Company X could start with one thousand dollars, you certainly should be successful with one hundred thousand dollars.

The second reason for dealing with professional venture capital investors is that they are aware that they will probably have to put up additional money and are prepared to do so. This is not to say professional venture capital investors always put up more money, but they are normally in a better position to evaluate the mistakes and to be constructive with suggestions as well as money. Because these people are usually exposed to a much wider range of investment alternatives, they are more selective and frequently require more advantageous terms than the less sophisticated investors. The management team has to weigh this differential of terms against the more professional approach of the venture capital investor to management problems, along with the additional ease of raising money at a later date once there is a recognized professional investor in your company.

• Important also is how comfortable you feel with your investors. The relationship between the investor in a small privately-held company and the management team is somewhat analogous to being married. Both parties are forced to go through many trials and tribulations together but there is enough room for disagreement in the explanation of missed projections, incomplete financials, incomplete information regarding management, without the additional complication of mistrust on either party's side. Because eight out of ten venture capital situations have difficulties, the management team is in the position of explaining why they didn't make their projections. There is an obvious need on the investor's side for confidence, honesty, and forthrightness of the management. There is an equal need for trust in the opposite direction because as the company acquires additional capital, management should not feel that it is being taken advantage of. Obviously, if the company has missed projections and run out of money, it is in a very poor negotiating position in terms of additional capital.

EVALUATION OF TERMS

In searching for money, the management team has to consider not only from whom it will obtain its capital, but under what terms; i.e., what percentage of the company will they give up for the money. The answers to these questions are generally a function of the overall psychology of the market and particularly a function of the specific investing group toward your project. Along with the question of what percentage of the company is the corollary problem of the financing structure of the company. Do you issue warrants to purchase the stock at a slightly higher price in the future? Is the stock held in escrow under a performance contingency for the management? Is there a right of first refusal for future financings for the investing group? The structure of these options can have serious implications for the next stage of financing, and therefore should be carefully thought out by the management of the company and advisors.

When we previously discussed sources of advice and mentioned accountants, lawyers, and bankers, we failed to include a third group who are the people whose profession it is to advise young companies specifically on these problems. These people, or groups of people, frequently are retained by the company to (a) advise it on the financing structure, and (b) locate the money for the company. These people have the advantage of knowing the implications of various alternative financing structures and can advise the company on such implications, different alternatives in terms of future financings, as well as considering alternatives which might be more saleable under the current market conditions.

These people are alternatively called promoters, finders, consultants, and several other non-printable terms. It is normally to the company's advantage to pay them in a combination of cash and stock warrants to insure their continued interest and advice. The best way to evaluate the professional money raiser is analogous to one's criteria for the investing group. Management should be comfortable with the person on a personal basis and should be familiar with one or two of his previous financings and his current relationships with those companies.

SUMMARY

The current market conditions make it difficult for obtaining venture capital, but money is available, and the potential gains on successful projects in the computer field are still very obvious to the members of the financial community. ▲

A UNIVERSAL FRONT-END CONTROL SYSTEM

Dynelec announces a processor/concentrator for a wide range of communications applications.

The new DyneMaCC 90 Multiple-access Communications Controller from Dynelec Systems Corp. of Glen Rock, N.J. is a universal front-end control system designed to achieve maximum utilization of communications lines with a minimum of main (EDP) storage and in a minimum amount of processor time. A hybrid communications system employing techniques of direct-line connection, multiplexing, and store-and-forward switching, the DyneMaCC 90 can be structured to take over a few or all of the communications functions of the central processor, and is adaptable to the I/O channels of all major computers, emulating standard periphal devices.

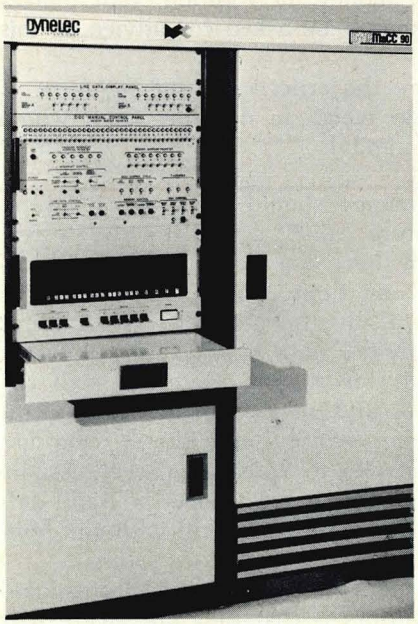


Fig. 1 The DyneMaCC 90 multi-access communications controller.

CAPACITY

A large single DyneMaCC 90 system offers up to 220 ports for local low-speed data terminals, each capable of handling input at rates from 4.5 to 300 bps. It also offers 48 full-duplex ports for asynchronous and synchronous lines. Twelve of these ports can concentrate 64 low-speed lines each, for a total of 768. The other 36 are for conventional voice-grade lines at rates from 1200 to 4800 bps. Thus, total capacity for this configuration is 1024 lines – although a typical system would probably terminate about 220 low-speed ports, both local and remote.

THROUGHPUT

In handling concentrated low-speed data from remote terminals, a DyneMaCC/DyneCoM (concentrating multiplexer) trunk system is said to be 6 to 10 times as efficient as a typical character-TDM system. With a DyneCoM 70 multiplexer used to connect remote terminals to the DyneMaCC 90 communications processor, the system becomes, in effect, an asynchronous multiplexer under program control.

COMMUNICATIONS PROCESSOR

Within the communications processor, the DyneMaCC can either transfer small blocks (the processor handles each character) where instantaneous character responses are required, or, with special line termination units, can use hardware to inform the software when a large enough block of characters has been created to effect transfer to the computer I/O (mux channel). Software provided for the communication processor includes a two-pass symbolic assembler, a Fortran compiler, diagnostic and debugging packages, and a library of miscellaneous subroutines.

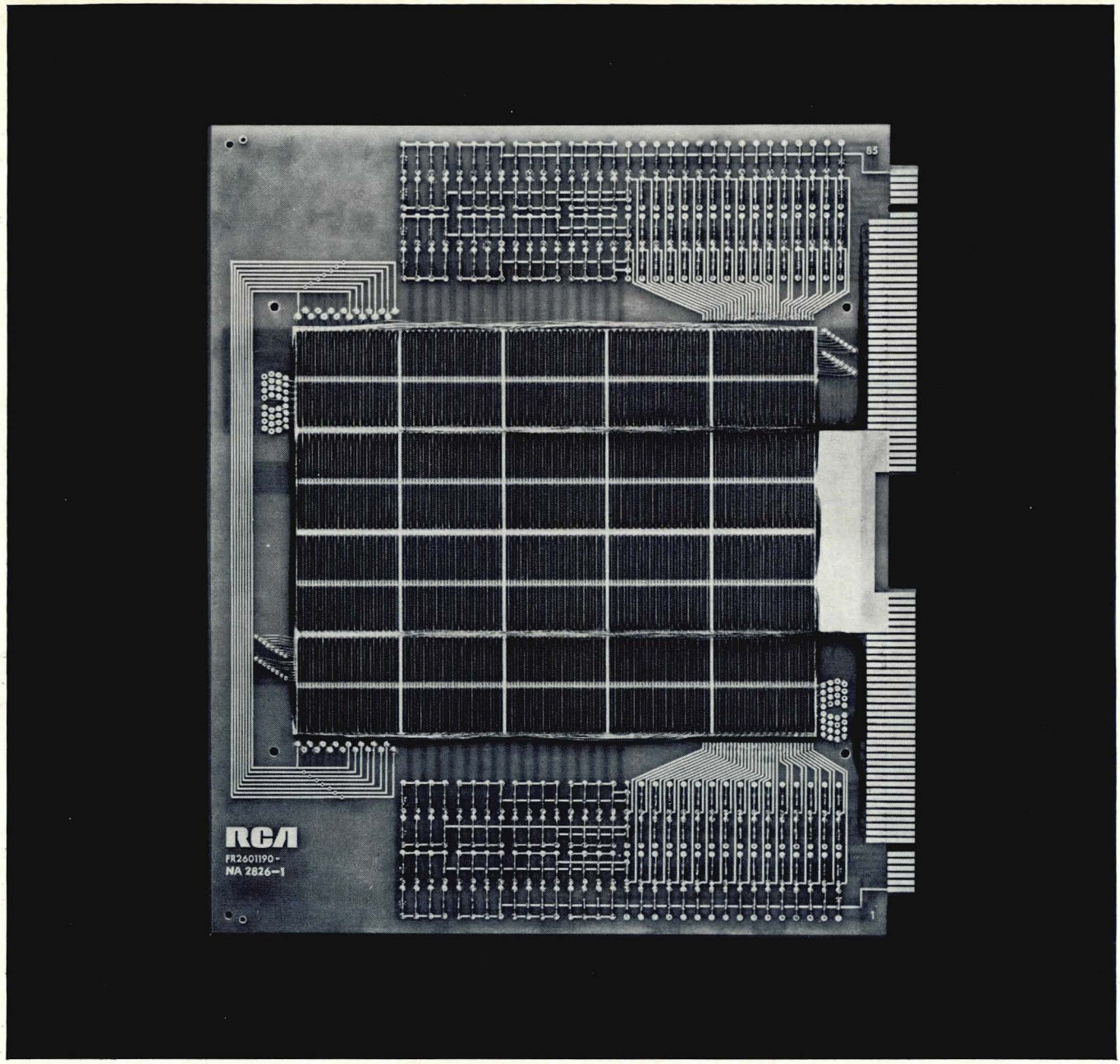
FRONT-END CAPABILITY

As a front-end, the DyneMaCC operates similarly to the mainframe peripheral being emulated. However, it incorporates extensions to peripheral buffering in the form of a disk and memory hierarchy that allows the blocking of messages and the storage and switching of traffic for load-levelling a multiple-center data communications system.

MODULARITY-FLEXIBILITY

The DyneCoM's modularity makes it easily and quickly expandable from a fixed-program unit to a fully-programmable system. Its flexibility permits it to be used both for reducing communications costs by enabling greater concentration of line data; and increasing overall system performance by relieving the central computer of communications "housekeeping." With over 50% of all computers expected to find their way into a communications environment before the end of this decade, the DyneMaCC system should be welcomed as an excellent one-package solution to what is fast becoming a universal problem.

For more information on
Dynelec Systems Corp's DyneMaCC 90
Circle No. 125 on Inquiry Card.



LEAN BABY (.44"–10"–12")

RCA's new 4K single-plane memory. The Lean Baby.
Several mini-computer manufacturers have already selected this memory for incorporation into their products because of its high performance, low cost and the added feature of design flexibility.

It's a 3-wire coincident current device with edge-card connectors. It plugs into your memory system and costs you *just over half a cent a bit including diodes*. You can pick the word length you want, 8 bits through 20, as well as the board size, core and connector style.

The continuous stringing technique used in the Lean Baby provides greater reliability than ever before. It has less than 400 solder connections and our 2-diode-per-drive-line selection matrix reduces the drive input connections from 256 to 48.

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CIRCLE NO. 87 ON INQUIRY CARD

BOOK REVIEW

PROGRAMMING LANGUAGES: History and Fundamentals

Author: Jean E. Sammet

PROGRAMMING LANGUAGES: HISTORY AND FUNDAMENTALS

By Jean E. Sammet. 785 pp. Prentice-Hall, Englewood, N.J.; $13.50 (student's edition); $18.00 (cloth).

An essential aspect of both professionalism and job effectiveness is the ability to apply a variety of tools to the solution of a given problem. The principle tool for the use of computers is the programming language. A programmer or systems analyst who claims knowledge of only one or a few similar languages lacks the tool-kit which distinguishes professionals from technicians. Besides the reference manual for the language his current assignment involves, every professional should place a copy of *PROGRAMMING LANGUAGES: HISTORY AND FUNDAMENTALS* on his bookshelf.

There is almost certainly only one fully-qualified reviewer for this book. Unfortunately, the author, Miss Jean E. Sammet, must be disqualified. Her *PROGRAMMING LANGUAGES*, with 785 pages covering nearly 120 distinct programming languages, is unquestionably the most ambitious survey of its kind yet undertaken.

Superlatives slide from the pen — unique, unparalleled, monumental, definitive, comprehensive. To begin at the end with the conclusion, this reviewer would have to rate this book as an absolutely essential part of the personal library of every serious programmer and systems analyst.

The book is carefully and systematically organized. The introductory chapters constitute a capsule introduction to what programming languages are about (I hesitate to say programming linguistics), and a plan is laid for discussion of the nontechnical (functional, environmental) and technical (syntactic, semantic, and pragmatic) aspects of each language.

In many cases, the environment in which the language emerged, in which it is used, and its evolutionary progress are essential to understanding why a language exists as it does as well as its differences from other languages. To paraphrase Frank Lloyd Wright, intent clarifies form. The histories themselves are worthwhile, as Miss Sammet debunks much computer mythology and injects amusing new insights of her own.

The introduction alone is worth the price of admission, and language designers and implementers should be required to memorize it, since many of Miss Sammet's underlying simplifications are either unknown or ignored by our linguists. It has been a stand of this reviewer that different programming languages actually are not so different: that most (but not all) are variations on a common theme. Once this theme is recognized, understanding a specific language can be quite simple. The introduction not only exhaustively lists the essential elements of programming languages (eighteen classes of statements and ten classes of data are defined and described, for example), but defines the important dimensions (succinctness, formality, etc.) by which languages can differ.

Miss Sammet groups the book's languages functionally for detailed examination, i.e., by principal application. This organization yields chapters on languages for numerical computation (e.g. FORTRAN, ALGOL); for formula manipulation (e.g. FORMAC, ALTRON); for string and list processing (e.g. LISP, SNOBOL); and for special and multipurpose applications. Only JOVIAL, PL/1, Formula ALGOL, and LISP 2 are classified as multi-purpose, although AED and EULER are equally valid candidates. The author provides a remarkably perceptive view of the practical problems of language use in these diverse areas, and describes each language in terms of its unusual or exceptional features and in contrast with other languages. The inclusion of languages of historical interest not only shows us progress, but regression: some valuable features and facilities, and some "neat tricks" have been forgotten.

There is certain to be major criticism for the author's definition of programming languages and her use of it as a basis for inclusion or exclusion. The controversial issue is her insistence that a programming language must be "free form," thus eliminating RPG and DETAB-X, for example. From a theoretical standpoint, this criterion must be regarded as completely arbitrary, since essentially, it enables discussing only languages with a one-dimensional syntax. This weakness becomes apparent in that Miss Sammet cannot help violating her own rule: almost all the languages included, particularly FORTRAN and COBOL, have some fixed-form elements, and one she includes (IPL-V) is by her own definition certainly not a programming language. Packages and embedded languages (e.g., SLIP and METEOR), however, are justifiably excluded by almost any definition.

There are systematic interrelationships between free- and fixed-format interfaces, subroutine and program packages, and imbedded language systems. The common elements and structure of this (unnamed) larger field of discourse are skirted and somewhat muddied by her definitions. This is an area on which there is need for definitive discussion, and the work of Doug Ross, and this reviewer's work *Integral Hardware/Software Design* (MODERN DATA, April '68-Feb. '69) have been attempts to confront some of the issues.

The copy supplied for review had numerous typographical errors, too many even to take the time to catalog. But these errors were either nonessential or obvious, and later copies will undoubtedly remedy them. In general, the language descriptions were felt to be accurate and complete in the baker's dozen cases where this reviewer could comment.

One of the most valuable features of this book is its "Ancillary Contents," which references nearly 600 bibliographic entries and represents nearly all the essential, useful or, in some cases, only works on languages covered. Subject, language, and author indexes are also provided, and one can find all the machines for which a system presently has been implemented. The Language Summary describes each language in a sentence, cites the relevant section, and gives the one or two best references.

For the practicing programmer, *PROGRAMMING LANGUAGES: HISTORY AND FUNDAMENTALS* is an invaluable quick reference to most of the languages he will encounter. (In many cases, the superior programmer with varied language experience can begin coding solely on the basis of the brief descriptions.) For the systems analyst and designer, the book provides sufficient material for comparing and selecting languages. Miss Sammet is to be congratulated for having assembled the first side-by-side source of virtually all important programming languages.

Reviewer: Larry L. Constantine, Consulting Editor.

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Model 3112 synchronous digital recorder is the most versatile, low-speed, non-formatting tape unit available. The Series is industry-compatible-conforming to virtually any system requirement, in addition to IBM standards. ■ Performance — 25 ips synchronous speed (37.5 ips available as an option) with recording formats of 9 channel, 800 BPI or 7 channel, 200,556 or 800 BPI—complete with Read after Write electronics. ■ Model 3112 Series has the quality and reliability of all Kennedy recorders. Contact us for details— & we're ready to deliver.

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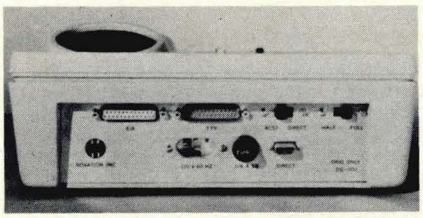
NEW PRODUCTS

GRAPHIC CONVERSION TERMINAL

The Model GC-2 Graphic Conversion Terminal converts graphic hard copy data into electrical signals for input to computers or transmission for remote display. The unit is capable of converting an 11″ x 17″ document into electrical signals in less than 60 seconds and is fully compatible with all popular tape recorders and large- and small-scale computers. Remote multi-terminal display, process control, and temporary or permanent storage of maps, charts, curves, and graphs are the most widely foreseen applications. Optional features include BCD outputs, self-contained minicomputer, display oscilloscopes, keyboard input, IBM-compatible tape recorders, X-Y output recorders, and punched tape output in popular codes. *Data Conversion Systems, State College, Pa.*

Circle No. 198 on Inquiry Card.



ACOUSTICS COUPLERS

Two acoustic data couplers are said to have the sensitivity and noise immunity of a direct-connected data set such as the Bell 103A. The DC-102A is an acoustic coupler only, while the DC-102 AD (shown) has a third rear input connector which makes it possible to operate the coupler as a direct connected data set by throwing an "Acoustic-Direct" switch. In quantities, the DC-102A is priced at $190 and the DC-102 AD at $215. *Novation, Inc., Tarzana, Cal.*

Circle No. 177 on Inquiry Card.

MULTIPLEXER-CONCENTRATOR

A time division multiplexer-concentrator, designated the M/C-70, is capable of multiplexing and/or concentrating up to 70 asynchronous full-duplex low-speed terminals in any configuration to form one high-speed voice-band signal. The M/C-70 includes multiplexer, concentrator, demultiplexer and deconcentrator, and can send and receive simultaneously. It can process three or more code/speed terminal groups, and can concentrate any set of input terminals before multiplexing them. Several Timeplex M/C-70s at different locations can be connected in tandem via voice-band lines. Other standard features include an automatic failure disconnect and spare unit fall-back capability, continuous hardware error testing, and programmable parity bit checking or insertion. Optional features include automatic code/speed adaptation, and automatic low-speed line dialing and answering. *Timeplex, Inc., Westwood, N. J.*

Circle No. 188 on Inquiry Card.

GRAPHICS MONITOR

The Model M221 Graphics CRT Monitor is capable of writing full-screen vectors in less than 25 usec and features full-scale jump, scan, and settle times of 8 usec. The 21″ CRT spot size can be as low as 0.008″. Separate X and Y amplifiers give zero cross-talk. Model 221 has all solid-state drive electronics with 100 MV/inch sensitivity. Special color oscilloscope displays and a dual-deflection system for high-speed writing are available as options. Price of the Madel M221 is $3950. *Kratos/Display Division, Canoga Park, Cal.*

Circle No. 211 on Inquiry Card.

CRT TERMINAL

The VST 1000, a new CRT terminal for time-share applications, is interchangeable with the Model 33 Teletype. The free-standing table-top unit has a capacity for 18 lines of 36 characters (folded logical 72-character line) with an additional page in recallable storage. Keyboard configuration is Teletype Model 33TZ, plus standard 10-key adding machine keyboard and 10 control keys. Characters on the 80 sq. in. screen are easily revised by non-destructive cursor control. The unit provides automatic WRU answerback and remote monitor capability. Input/output rates are 110, 150, or 300 baud. The unit has full 128-character ASCII generation and a 60 Hz refresh rate. Communications interface is with the RS232B or TTY. *Video Systems Corp., Pennsauken, N. J.*

Circle No. 206 on Inquiry Card.

MAG TAPE SYSTEM

The 9200 magnetic tape system uses up to 16 MDS Data-Recorders (Series 1100 or 6400), a multiplexer, and up to 7 tape handlers. In addition to routine keyboard data entry, the 9200 system will convert punched cards and punched paper tape data to magnetic tape data. Batch totals can be proven on a keyboard/adding machine unit, then centralized on tape. Data transmitted over long-distance telephone lines can be processed through the system to central tape. Magnetic tape data can be printed out on an MDS line printer. Key-entered data goes from the Data-Recorder to a 9202 control multiplexer that transmits the data to one of as many as seven 9207 or 9209 buffered tape handlers which record the information on magnetic tape. (The 7-channel 1100 Data-Recorders transmit to 9207 tape handlers which record the data in BCD code on 7-channel, 800 bpi tape; the 9-channel 6400 Data-Recorders use the 9209 handlers that write in ASCII code on 9-channel tape.) Any Data-Recorder can be assigned to any of the tape handlers. *Mohawk Data Sciences Corp., Herkimer, N. Y.*

Circle No. 186 on Inquiry Card.

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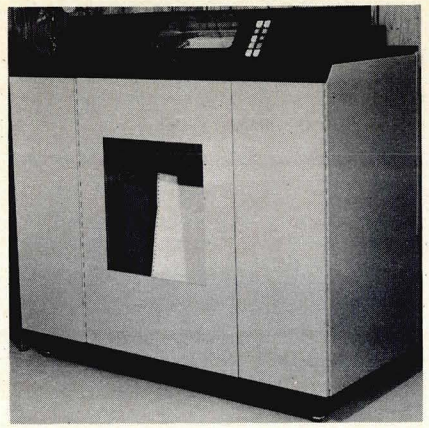
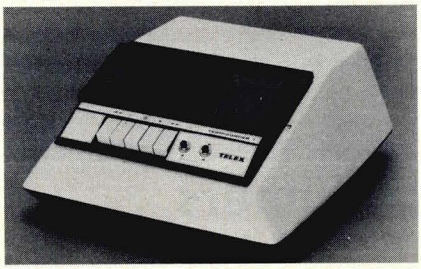


BAR PRINTER

Datamark's 300 line-per-minute printer features a new oscillating bar impact mechanism said to offer an unlimited choice of fonts, exact no premium for lower and upper case characters, and provide perfect alignment at any speed. A wide variety of interfaces is available. *Datamark, Inc., Westbury, N.Y.*

Circle No. 195 on Inquiry Card.



TERMINAL MEMORY UNIT

A new terminal memory unit, utilizing a magnetic-tape cassette, has been designed to replace paper tape equipment. The "TerMIcorder" uses standard C-60 cassettes and can be ordered either fully-interfaced or as a basic deck with write /read electronics, and either fast start/stop synchronous or incremental write/synchronous read capability. When fully interfaced, TerMIcorders are available with up to six write/read incremental character rates. Available interfaces permit acceptance of parallel or serial data and level converters are available for all signal levels. *Midwestern Instruments Div. of Telex Corp., Tulsa, Okla.*

Circle No. 179 on Inquiry Card.

DISK STORAGE FOR S/360

The Potter DD 4314 Disk Drive in conjunction with the Potter DC 5314 Controller provides a system that is completely interchangeable with the IBM 2314 Random Access Memory Unit. All programs and libraries already in use can therefore be utilized without change. The DD 4314 has a storage capacity of 29.176 million bytes and uses an 11-disk pack, IBM 2316, or equivalent. Like the IBM 2314 Disk Drive, the Potter unit incorporates hydraulic head actuators which eliminate the threat of stray electromagnetic fields and reduce the number of electrical adjustments required. The DC 5314 Controller has a transfer rate of 312,000 bytes per second or 624,000 bytes per second with packed decimal. Standard features include File Scan, Record Overflow, and a program-controlled two-channel switch which allows the controller to connect to another I/O channel. *Potter Instrument Co., Plainview, N.Y.*

Circle No. 223 on Inquiry Card.

CO-ORDINATE DIGITIZER

The PF-40 Pencil Follower is designed for such applications as machine tool numerical control, computer-aided design, and map production. The basic operation in each application involves moving a pencil or cursor (a round disk with a cross hair sight) over the graphical data placed on the digitizing table surface. The X and Y co-ordinates are displayed in five figures and sign to the nearest 0.001″ and are recorded in digital form. Data may be recorded off-line or fed directly into a computer in parallel or serial form. The PF-40 standard equipment includes a 24″ x 36″ digitizing area, a tracing cursor, a 16-character keyboard, a data record foot switch, and an output and display console. The table has continuously-adjustable height and tilt. Prices range from $11,000 to $30,000 depending on configuration. *Edwin Industries Inc., Graphic Systems Div., Silver Spring, Md.*

Circle No. 190 on Inquiry Card.

MAG TAPE SUBSYSTEMS

A full range of IBM-compatible magnetic tape subsystems (including transport), all electronics interface-controller, software drivers and diagnostics, and interconnecting cables is designed for Hewlett-Packard, Digital Equipment Corp. and other small-to-medium-size computers. Data transfer rates to 60,000 cps are achieved with 7-track as well as 9-track formats with densities of 200, 556, and 800 bpi and speeds to 75 ips. Character packing/unpacking conserves more than 50% of the buffer memory and required instructions for programming I/O operations. Models 2914 and 2914S controllers service up to 4 transports and execute 19 operations, including "read-file," without stopping between records. Other models in the series are the Model 2906 and Model 2925. Price range for complete subsystems is $11,500 to $18,590. *Daconics, Sunnyvale, Cal.*

Circle No. 199 on Inquiry Card.

MAG TAPE CLEANER

The GKI Model 7000 advanced Blade Cleaner for ½″ computer tapes features high speed, easy loading, and automatic cycling. The cleaning process utilizes an automatic tissue wiping system and an advanced convertible blade system. The cleaner makes a round trip cleaning cycle and checks both beginning- and end-of-tape markers. Program and file tapes may be cleaned without affecting recorded data. *General Kinetics, Reston, Va.*

Circle No. 202 on Inquiry Card.

CIRCLE NO. 90 ON INQUIRY CARD

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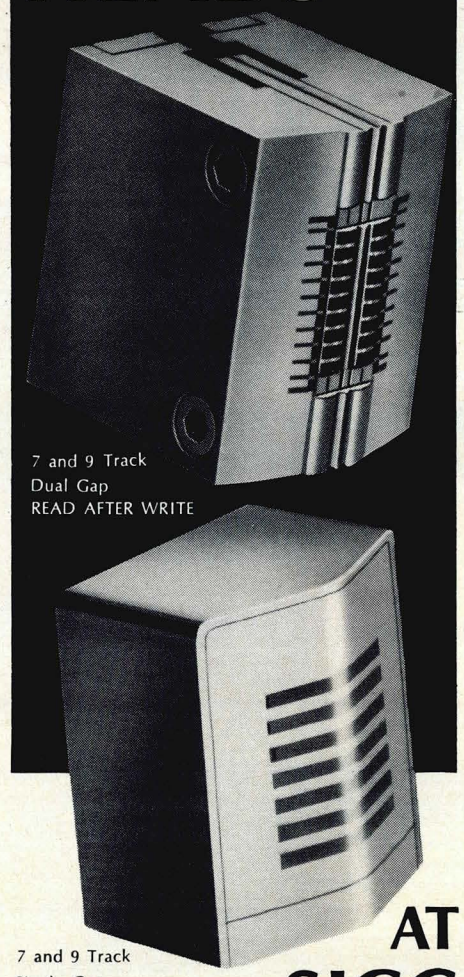

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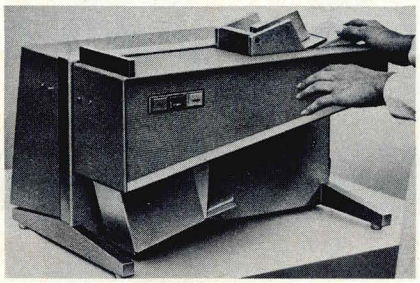
CIRCLE NO. 91 ON INQUIRY CARD

TIME RECORDER

The Simplex ScanCard Recorder imprints in USASCSOCR font the day of the week, hours, and tenths of hours on a time card for subsequent scanning by optical scanner. The card is initially prepared by imprinting the employees' name, location, department, and employee number. In addition to the imprint time fields, six 4-position hand-printed fields are used to rectify or clarify registered or lack of registered fields on the attendance document, and seven 2-position fields may be used for coding. *Simplex Time Recorder Co., Gardner, Mass.*

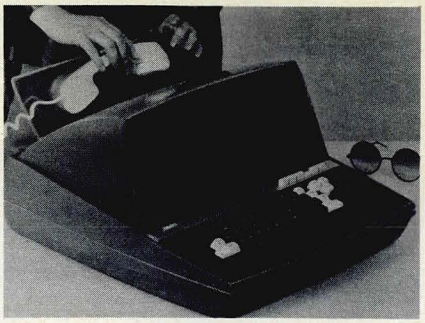
Circle No. 218 on Inquiry Card.



CARD READERS

New C300 Series card readers for table or rack-mounted installation can operate with either a general-purpose computer or remote terminal. The purchase price of the 300 card-per-minute readers is approximately $1600 with additional OEM quantity discounts. Standard features of the C300 Series include card feed stop; motor shut down in case of a card jam; and an attention light that tells the operator when the output hopper is full, the input hopper is empty, or if there is a no-pick condition — the card not being transferred to the read station. Only three illuminated controls are required: power on-off, card feed start with operator attention light, and card feed halt. Optional features include a read station light/dark check for each card feed, line drivers for signal transmission over 30 feet, and provision for 50 Hz operation. *Peripheral Dynamics Inc., Norristown, Pa.*

Circle No. 224 on Inquiry Card.



PORTABLE CRT TERMINAL

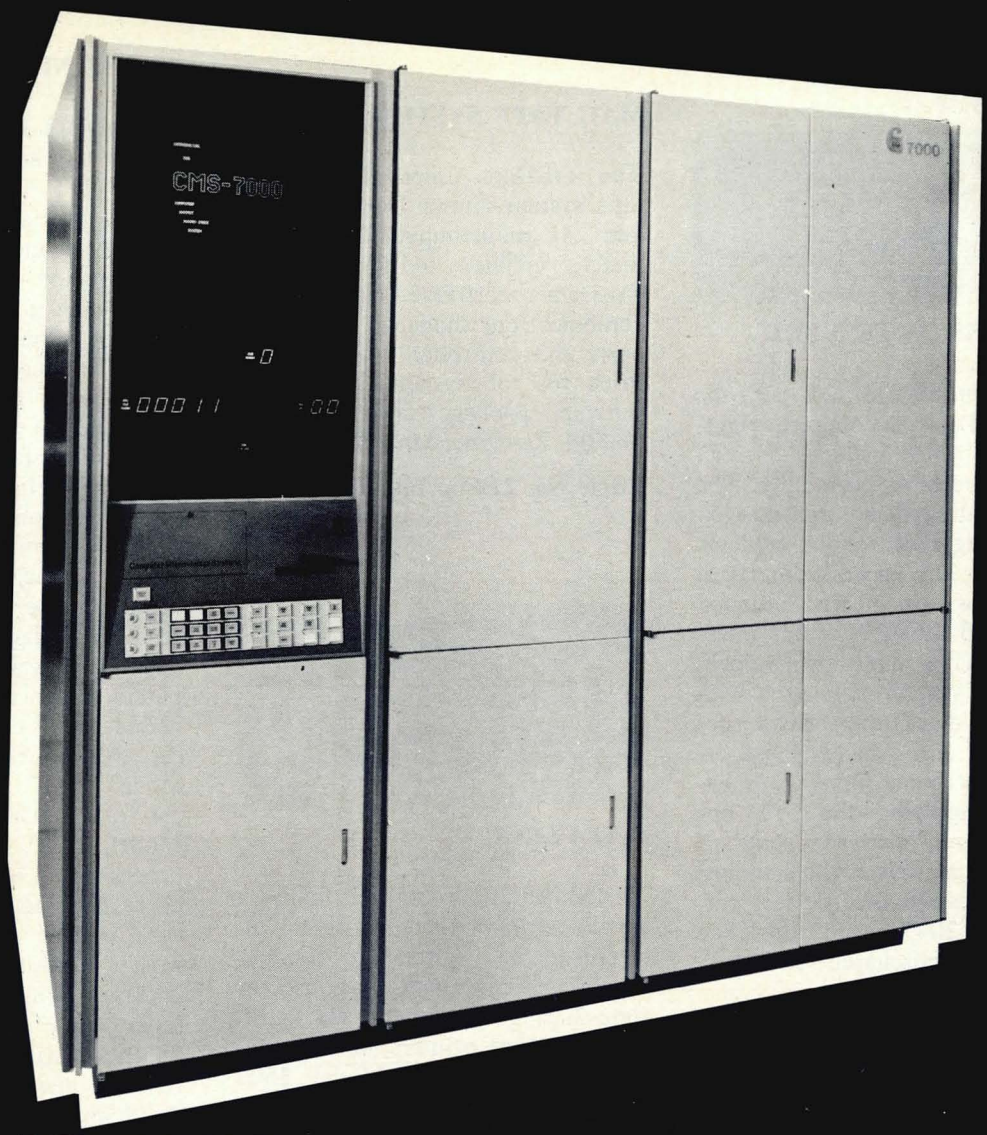
A remote, stand-alone computer terminal is described as the first fully-portable CRT terminal available in the industry. Weighing approximately 25 pounds and packaged with a retractable CRT display, the Logiport/1 includes a complete standard alphanumeric keyboard and an integral acoustic coupler for 10 or 30 cps transmission. Either of two operating models can be selected by a front-panel pushbutton. The LOCAL mode provides page transmission which allows local editing. The ON-LINE mode transmits character by character identical to a Teletype terminal. The user can select half of full duplex in either mode. The Logiport/1 is directly interchangeable with Teletype systems. The 5″ x 7″ CRT display provides sixteen 32-character lines. Unit price is under $3000. *Logitron Incorporated, Cambridge, Mass.*

Circle No. 175 on Inquiry Card.

DISK DRIVE CONTROLLER

The DC-16 Disk Drive Controller interfaces with all available minicomputers and from one to eight IBM 2311- or 2312-type disk drives. The DC-16 takes over software functions such as record address verification, cyclic redundancy check code generation and verification, formatting of record headers, and reading and writing multiple records. Using a one drive system, a minicomputer would have immediate access to 5,196,000 bytes at a transfer rate of 158,000 bytes per second. Price for the basic unit is about $6,000 in quantity. *KDI Interactive Data Systems, Inc., Irvine, Cal.*

Circle No. 196 on Inquiry Card.



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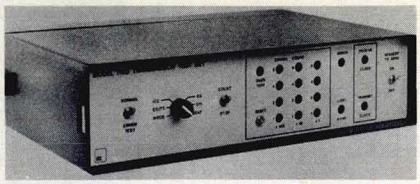


TRANSMISSION TEST SET

A new transmission test set, the Model 110D, is a compact, eight-pound unit which includes its own carrying handle for portability. The unit evaluates data transmission systems using synchronous modems operating at any speed from 10 to 330,000 bps which are equipped for RS232B/CCITT V.24 interface, supplying their own clock. The test set synchronizes itself with the received digital data stream, detects errors, and displays these errors on front panel lights. It is capable of supplying the 511 bps pseudo-random pattern standard with CCITT as well as the standard ICC and Western Electric test pattern rates of 2047 and 63 bps. The 110D may be purchased for $1450. *ICC-Milgo, Miami, Fla.*

Circle No. 181 on Inquiry Card.

CASSETTE CHANGER

An automatic tape cassette changer handles all EIA Type CP-2 tape cassettes. Data is read serially at speeds from 1-⅞ ips to 20 ips in both read and write modes. Operation is controlled manually or by external commands. Manual controls include rewind, load, on-line, fast forward, and reject. The input hopper holds up to ten cassettes. After each cassette is read, it is moved to the output stacker automatically. The next cassette is then fed into read/write position. Start/stop times are such that a single record at a time may be read. Start time is 10 msec and stop time is 15 msec. Cassette change cycle time is 10 sec. and fast forward or rewind time for a full 300 ft. cassette is 60 sec. The basic tape drive utilizes a single capstan and pinch roller. *Data Instruments Co., Sepulveda, Cal.*

Circle No. 209 on Inquiry Card.

MAG TAPE SYSTEM

The Tri-Data CartriFile magnetic tape system allows Interdata 2, 3, and 4 minicomputers to sort, match, collate, and merge data. Tri-Data's cartridge-loaded system combines four magnetic tape transports and controller in single unit. Price for the system, including a software package and cabling is $6,700. *Tri-Data, Mt. View, Cal.*

Circle No. 219 on Inquiry Card.

DATA LINK

The Model 2600 data link makes it possible for all types of digital instruments and systems to communicate directly with in-house or time-sharing computers via hardwire, Teletype printers, or data couplers. The standard Model 2600 can accommodate from one to five digital devices such as counters, DVMs, shaft encoders, data logging systems, nuclear scalers, digital panel meters, or any digital data source having a BCD or binary output. In addition to the digital data (up to 9 BCD digits or 36 binary bits per channel), a 20 by 10 format selection matrix makes it possible to control word length and to add switch-settable constants, special symbols, and line feed and carriage return commands. Front panel pushbuttons select the number of data sources to be internally multiplexed. The digital input data converted into ASCII format is serially transmitted to 110 bps. Optional bit rates to 10 KHz are available at no extra charge. A single-channel 2600 with 5 BCD digits, constants, internal multiplexer, and ASCII code conversion is priced at $3300. An expanded unit with 5 data channels and input registers is priced at $4250. *Sagetec Corporation, Burbank, Cal.*

Circle No. 222 on Inquiry Card.

THREE NEW SYSTEMS

Honeywell's EDP Division has announced three new computers. The Model 115 disk-oriented computer will compete in the $2,500-to-$6,000-per-month rental range and be marketed under the firm's package-pricing policy. The Model 115 features a main-memory cycle time of 2.75 microseconds. Basic core memory of 16K characters can be expanded in two 8K increments. Other standard features include two read/write channels; financial editing instructions; and integrated peripheral controls for disk-pack drives, punched-card equipment, and a line printer. A third read/write channel is optional. Also announced is a new family of computers designed for scientific, engineering and communication applications. Series 15 includes the Model 1530, designed for scientific/commercial use; and the Model 1540, for communication processing. Characteristics of both processors include 1.6 microsecond core memory expandable to 16K words, priority and power-failure interrupt, single addressing, and a repertoire of 72 instructions. The 1530 will run under a new disk-resident operating system, OS/15, that features a Fortran IC compiler, an assembler, a library of scientific and commercial subroutines, and a Report Program Generator for commercial data processing. The Model 1540 will be marketed for communications applications as a remote data concentrator and as a remote data concentrator batch terminal. The 1530 and the 1540 are also package-priced; typical configurations will sell in the $80K and $70K ranges, respectively. *Honeywell, EDP, Wellesley Hills, Mass.*

Circle No. 185 on Inquiry Card.

TAPE READER/MODEM

Combining both a paper tape reader and a 400 series modem, the Expedata 600 connects to an AT&T Data Access Terminal to read and transmit five- or eight-level punched paper tape data at 60 chars/sec. *Bonner-Vawter, Inc., Keene, N.H.*

Circle No. 208 on Inquiry Card.

MODULAR PROCESS COMPUTER

The GE-PAC 4010, a new modular process computer from General Electric, complements the larger GE-PAC 4020. The GE-PAC 4010 incorporates a new scanner capable of scanning up to 600 points per second in multi-channel mode, which can be quickly reconfigured and expanded in the field by plug-in connections. Signal conditioning modules are also plug-in. Up to four disk or drum storage devices, in any combination, are accommodated by a new dual-bulk memory controller. The computer employs a 24-bit word and an instruction set identical to that of the GE-PAC 4020. Additional features include a 1.6 usec memory cycle time, up to 64 interrupt levels, memory protection, relative addressing for full use of core memory, and fast block data transfer independent of a running program. A wide range of plug-in data peripherals is available. *General Electric Co., Process Computer Dept., Phoenix, Ariz.*

Circle No. 191 on Inquiry Card.

CRT TERMINALS

Alpha 101 and 102 computer display terminals are billed as "the smallest, narrowest terminals in their class." The stand-alone units measure 12″ wide x 14″ high x 20″ deep. Alpha 101 is a direct Teletype replacement with adjustable transmission speeds to 2400 baud. Alpha 102 is compatible with the IBM 360. Both units display 20 lines of 40 characters each on an 11″ CRT. Features include 4-way cursor control, character and line editing, and EIA TV compatibility. Single-unit prices begin at $3,495. *Beehive Electrotech, Inc., Salt Lake City, Utah.*

Circle No. 221 on Inquiry Card.

MAG TAPE SYSTEM

The Model 2017 Magnetic Tape System records at speeds to 37.5 ips and at packing densities to 800 bpi. Featuring 7- or 9-track interchangeability, the system is available in read-after-write, read-only, and write-only configurations. *Bucode Inc., Hauppage, N.Y.*

Circle No. 207 on Inquiry Card.

MINI-COMPUTER CONSOLE

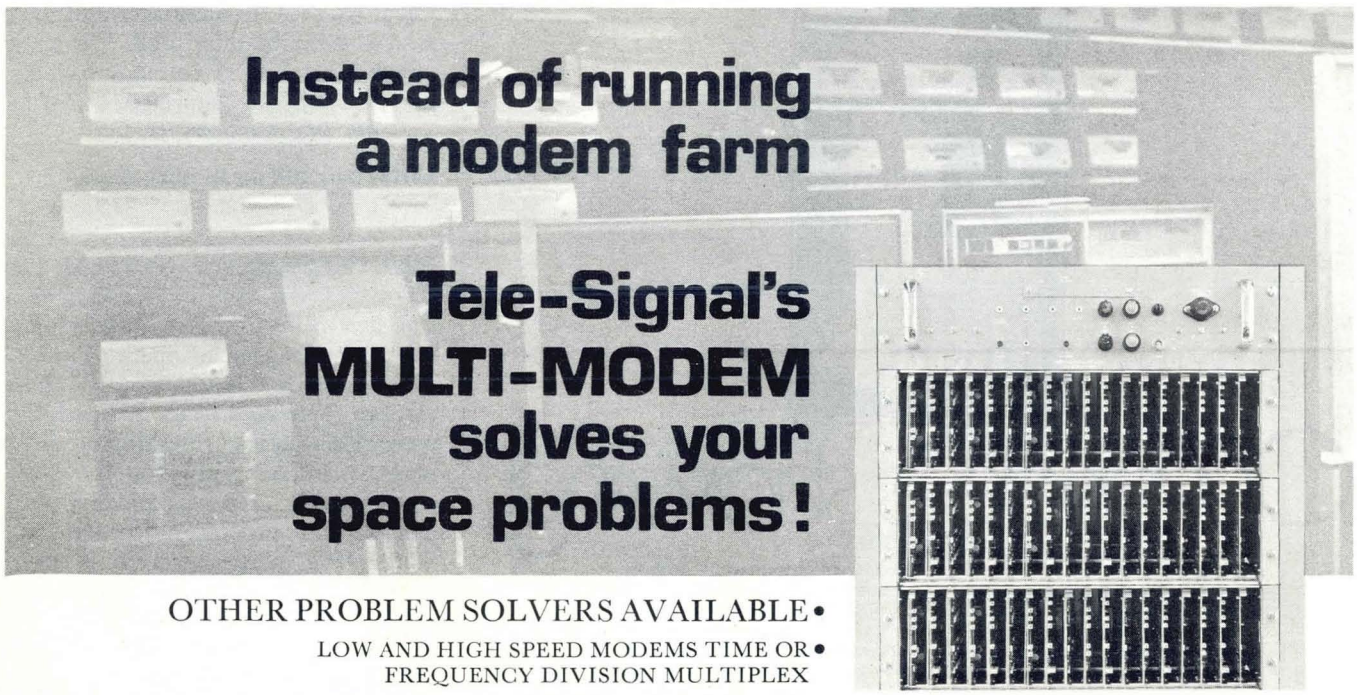
The Mini-Computer Console 8310 combines the keyboard and printer functions of the Teletype Model 33 with the recording and storage functions of magnetic tape cassettes. *Computer Devices Inc., Cambridge, Mass.*

Circle No. 203 on Inquiry Card.

PORTABLE STRIP PRINTER

The Model 5064 Portable Strip Printer weighs less than 4 lbs. and measures less than 8″ in its longest dimension. Printing speed is 50 cps, asynchronously, and the unit is said to operate at the lowest noise level yet attained for this type of device. The 64-character ASCII subset of characters is spaced 9 to the inch. Optional features include a serial or parallel data buffer register, a serial data buffer with auto-print command, external paper advance, auto-start operation using carrier control, and a code conversion device. The unit is priced at $500 in quantities between 10 and 100. *Dataline, Inc., King of Prussia, Pa.*

Circle No. 201 on Inquiry Card.



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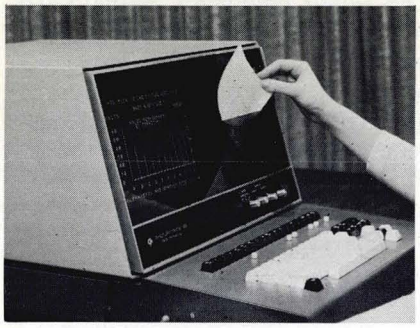
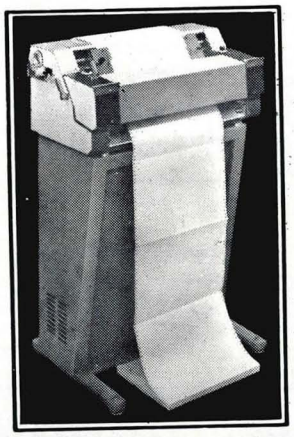


HARD COPY WITH CRT DISPLAY

Photophysics' "45" desk-top CRT data terminal features hard copy output. An electro-optical printout process produces a 5″ x 5″ photoprint of data display on the CRT in less than seven seconds after pressing the print button, additional copies are output at two second intervals. The entire terminal, including keyboard, measures 13½″ x 19″ x 30″. The paper is supplied on rolls capable of 1,200 printouts without reloading, and is priced at less than one cent per copy. The 9″ CRT can display up to 1000 characters in 25 lines of 40 characters each, as well as bar charts and graphs. The keyboard provides 48 data keys, 30 control keys with a wide variety of editing features such as full cursor address control, full format/blink control, insert and delete functions, character repeat, double space, and frame roll. The Photophysics "45" is compatible with most existing terminals — CRT or Teletype — and interfaces with acoustic couplers, data sets, or modems. It can also be utilized in parallel or direct computer connections. ASCII code is used in data transfers with rates of 110, 150, 300, 600, 1200, and 2400 bauds available. RS232 C communication interface is used. Price for the complete terminal is $15,000 in small quantities. *Photophysics Data Systems, Mountain View, Cal.*

Circle No. 178 on Inquiry Card.



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(AT BOOTHS 43013-14)

All modesty aside, we think our new Data Printer V-132 variable-width Medium Speed Printer is just a cut or two better than anything you're likely to see at the SJCC. In fact, we think it's the best printer at the entire Conference. (Except for our other printers, of course!)

Our new V-132 incorporates the same dependable operational and design characteristics as our popular F-80 and F-132 models, but with one important difference: the V-132 will accommodate form widths from 3½ to 19½ inches.

Units include: 600 LPM printer mechanism; pedestal mounted electronics, with a single-line memory; and 8 or 12 channel Vertical Format Unit on the F-132 and V-132. Sound deadening enclosures are also available. You can, of course, purchase mechanisms only.

Why not call or write us for additional information? Better yet, drop over to our booth (and a few others) at the SJCC where our pride is showing.

Data Printer Corp

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CIRCLE NO. 94 ON INQUIRY CARD

MAG TAPE TRANSPORT

A versatile magnetic tape drive for specialized audio, instrumentation, and communications applications is capable of variable speeds to 120 ips (as well as in discrete steps) with rapid start-stop characteristics. The unit has independent reel servos and constant tape tension in all modes. A direct drive capstan servo can be controlled from its own internal oscillator or from an external source. Rewind speed is 500 ips. The transport can accomodate up to 10½″ NAB reels. *Magnetic Recording Systems, Westbury, N.Y.*

Circle No. 176 on Inquiry Card.

CREDIT TERMINAL

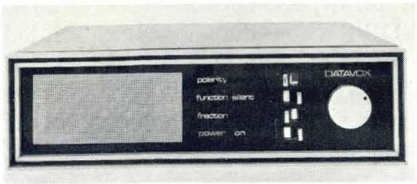
A new counter-top credit authorization terminal enables retail stores to convert existing manual credit card imprinters to total control credit authorization terminals. A store's existing manual imprinters fit into a well in the terminal. Sales people enter credit card numbers on a standard keyboard, relaying the data to the system's central memory. If credit is approved, the terminal releases the imprinter and the sales slip can be imprinted. The terminals lease for $5 per month, less the cost of the imprinter. *Credit Systems, Inc., Colmar, Pa.*

Circle No. 205 on Inquiry Card.

MULTI-TERMINAL SYSTEM

The new Mini-Comp multi-terminal system is designed to operate up to 48 terminals simultaneously, including Teletypes, automatic I/O typewriters, keyboards, graphic displays, printers, and plotters. The new system can be expanded from one central processor to two or more. The core memory is expandable from 12K to 32K16-bit words. On-line high-speed mass storage is available from 262K words on up. The system, without terminals, is priced from $42,900. If leased, the cost per terminal in a system with 48 ASR33 Teletype terminals can be as low as $100 per month. *Mini-Comp, Inc., Natick, Mass.*

Circle No. 220 on Inquiry Card.



DIGITAL-TO-VOICE CONVERTER

The Datavox 1 digital-to-voice converter reads numbers normally from 0.00001 to 999.99, reads numbers as digits from 0.00001 to 9999.9, and announces polarity and function, e.g., volts, amps, ohms, frequency, etc. in natural spoken English. An internal amplifier drives an internal speaker, and a front-panel jack permits use of private earphone, or remote speakers. Panel switches inhibit polarity or function announcements. Full numbers or individual digits may be selected according to operator preference. Most digital instruments with a maximum of five digits can be adapted to the Datavox (over-range digits produce an internal voice warning). In many cases only adapter cables are necessary. For special applications the Datavox can be furnished with unique messages and vocabularies in addition to the number-reading capability. The Datavox unit is entirely housed in a case 12¼ by 3½ by 11 inches, and weighs 9 pounds. *Instrumentation Systems Inc., Albuquerque, New Mexico*

Circle No. 182 on Inquiry Card.

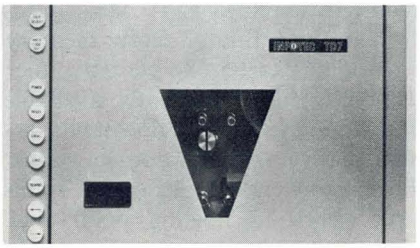
REMOTE PROCESSING TERMINALS

The Hetra T Series Remote Processing Terminal family incorporates the Hetra Series 200 communications and commercial business applications processor. The T Series family is comprised of the T/I, T/II, and T/III Remote Processing Terminals, each of which comes in a variety of configurations. T Series Terminals' prices begin at $10,000 per system. Modular design of the T Series permits all three systems to utilize common peripherals and interfaces. The systems are provided with special hardware/software features to make them compatible with the equipment of other computer manufacturers, e.g., the communications interfaces and the variable instruction and data word length permits on-line compatibility with IBM 360, Univac 9000 and 1108, XDS Sigma, etc. Although the T Series Terminals' internal coding is ASCII, data represented in EBCDIC, Binary Baudot, and other common codes can be processed. *Hetra, Melbourne, Fla.*

Circle No. 187 on Inquiry Card.

MINI-REEL TAPE TRANSPORTS

Two improved, low-cost magnetic tape transports, the Infotec models TD-7/MOD 1 and TD-9/MOD 1, feature an increased reel size capacity of 7 inches and tape speeds to 7½ ips. This increase results in a maximum storage capacity of 5.5 million characters and a data transfer rate of 6,000 cps. Tape width is ½-inch and tape format is 7- or 9-track IBM compatible. The transports contain read and write electronics, motor control electronics, power supplies, and a tape cleaner. Both units are priced at $1850 each in quantity. *Infotec, Inc., Plainview, N.Y.*



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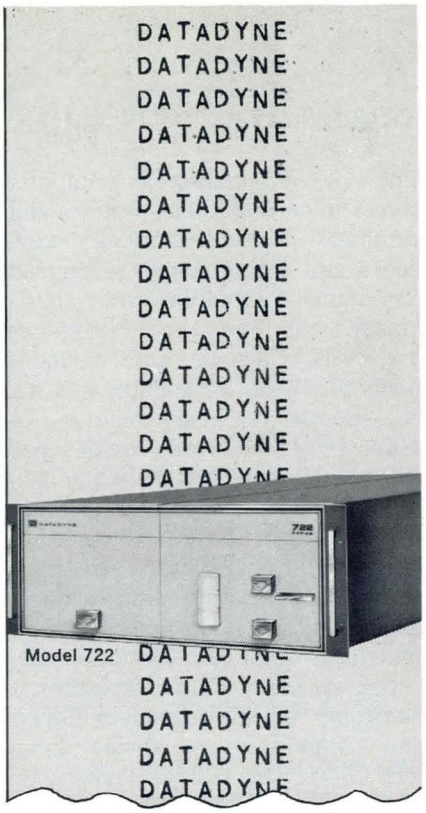

World's Fastest Low-Cost Digital Printers

That's only half the story. Datadyne Printers are the only line printers with a full complement of 64 alphanumeric characters (ASCII). That means you can print anything.

And if you're concerned about reliability at such low cost . . . we'll pay you double the difference if you can buy more reliability for less.

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CIRCLE NO. 95 ON INQUIRY CARD

SMALL-SCALE COMPUTER

The GE-58 small-scale computer comes in card and disk systems and combines a direct-data-entry keyboard and digital display. Designed for small-to-medium-sized businesses and first-time computer users, its magnetic core memory holds 5K bytes, expandable to 10K. A separate read-only memory of 1024 or 1536 words (with each word equal to 40 bits including parity) and 350-nanosecond memory cycle, performs basic arithmetic input/output operations, and such special activities as disk management and data communications functions. Average instruction-execution speeds are 115-microseconds add time, 3.5-milliseconds multiply, and 20-milliseconds divide time. The GE-58 has 100 index registers; eight high-speed and three standard I/O channels. Maximum word transfer on the high-speed channels is 400,000 bytes per second. A basic configuration comprises a central processor, a data entry station with alphanumeric and numeric keyboards, a 100 or 200 lpm printer with 96 or 128 positions, a 100 or 200 cpm reader, and a 40 cpm punch. Programs already available for the smaller related GE-55 system may be used on the GE-58. Monthly rental for a basic GE-58 system ranges from $910 to $2200 depending on whether the system is a card or disk version. Sales price ranges upward from $35,490. *General Electric Co., Schenectady, N.Y.*

Circle No. 189 on Inquiry Card.

DIGITAL TAPE UNIT

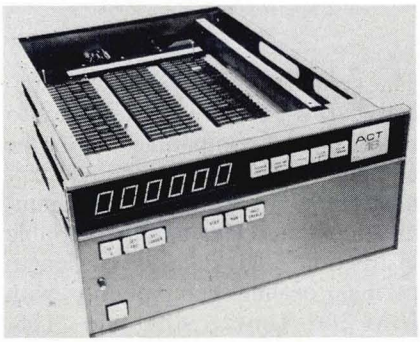
The Model 1500 writes IBM-compatible tape on reel sizes up to 10-½" (2400 ft.). The unit is available in either incremental, continuous, or combined incremental/continuous versions. Overall dimensions are 19" wide, 24-½" high, 16" deep. Weight is 50 pounds. Prices begin at $3,000. *Digi-Data Corp., Bladensburg, Md.*

Circle No. 214 on Inquiry Card

MAN/MACHINE-READABLE TAPE

Dual Image, a modular data recording and retrieval system, provides both a human-readable character and a machine-readable code on 11/16" paper tape. The new media is especially suited for remote data entry since information can be entered either at typing speeds via the keyboard or from a variety of digital devices at rates up to 75 cps. The system transmits data at speeds up to 1000 cps. Additional features of the Dual Image system include: asynchronous reading at 120 cps; unlimited use of white space within the record; and full 128-character printing set. *Interface Mechanisms, Inc., Mountlake Terrace, Washington.*

Circle No. 212 on Inquiry Card.



MINICOMPUTERS

The ACT-16 and ACT-18 Micro/Magnum minicomputers are designed for use in hazardous environments. Standard features include: 1μs memory cycle time, six memory index registers, simple but powerful command structure, parallel I/O bussing, octal readout on front panel, DMA interface, integrated circuit and MSI electronics, and lithium core memory expandable to 65,536 words (either 16 or 18-bits). Presently available software includes: relocatable assembler (single or double pass), Basic, conversational Fortran, multiple precision floating point routines up to seven words long, mathematical sub-routines, several real-time packages, and hardware diagnostic routines. The basic models are priced under $10,000. *American Computer Technology, Inc., Northridge, Cal.*

Circle No. 194 on Inquiry Card.

PDP-8 PRINTER

A printer system for use with DEC PDP-8 computers provides printed output at 250 cps on lines up to 136 characters using the ink-jet printing technique. Included in the system, called the Eclectic 740, are an A. B. Dick Videojet printer and complete hardware and software interfacing. *Eclectic Computer Corp., Dallas, Texas.*

Circle No. 192 on Inquiry Card.

NEW STORAGE; FAST CHANNEL FOR S/360 85, 195

Two new devices designed for S/360 Models 85 and 195 are the IBM 2880 block multiplexer channel, with a maximum data rate of 3 million bytes per second, double the rate available with other IBM channels; and the IBM 2305 fixed head storage facility, for direct, fast access to a maximum of 22.4 million bytes of information. With the new block multiplexer, up to 12 high-speed data channels can be attached to the Model 85 and up to 13 to the Model 195. Previously, six was the maximum number of channels that could be used with these models. Data blocks from direct access storage devices, such as the 2305, can be multiplexed along the 2880 channel's single data path. The 2305 storage facility attaches to the new channel and comes with one or two disk drives, each housing six 14-inch disks (twelve recording surfaces). One version of the 2305 offers capacities of 5.4 million or 10.8 million bytes, an average access time of 2.5 milliseconds, and a transfer rate of 3 million bytes per second. Another model has capacities of 11.2 million or 22.4 million bytes, with average access time of 5 milliseconds, and transfer rate of 1.5 million bytes per second. Monthly rental prices for the 2880 channel range from $3,000 to $4.950; purchase prices from $141,000 to $232,650. Monthly rental prices range from $6.400 to $12,800 for the IBM 2305 storage facility. Purchase prices are from $300,800 to $601,600. *IBM Data Processing Div., White Plains, N.Y.*

Circle No. 184 on Inquiry Card.

DATA COUPLER

The Model DC-22 Universal Data Coupler permits the user to select full- or half-duplex modes with acoustic, magnetic, or direct (DAA) coupling, and provides the appropriate interface for Teletype or EIA terminals. The coupler has separate power and carrier indicators. Single unit price is $298. *Prentice Electronics Corp., Palo Alto, Cal.*

Circle No. 213 on Inquiry Card.

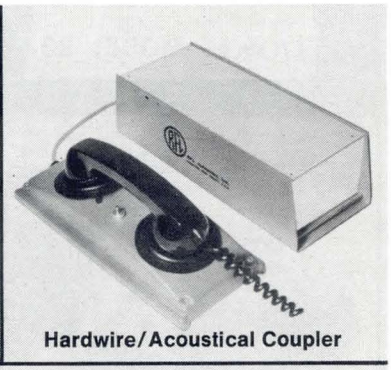
MULTIPLEXER

The DyneCoM 70W, a compact, low-cost communications multiplexer, can concentrate intermixed speeds and codes from 2 to 64 remote low-speed asynchronous terminals over a single 2400 bps voice-grade line. The standard DyneCoM 70W 22-channel unit, housed in a 10″ high cabinet, automatically intermixes and simultaneously operates each low-speed data circuit at four different clocking speeds in the 45.5 to 300 bps range, and operates with dedicated or dial-up terminals having code lengths from 7.5 to 11 bits. Operational features include synchronous channel speeds to 9600 bps to provide capability for hundreds of data terminals operating simultaneously. Unlike conventional time division multiplexers, the DyneCoM 70W does not reduce the number of ports available as higher speed terminals are added. Built-in visual diagnostic capabilities allow manual selection of individual data channels for loop-back or lock-out control for ease of checking. Plug-in card modules permit future changes in equipment configurations. *Dynelec Systems, Glen Rock, N. J.*

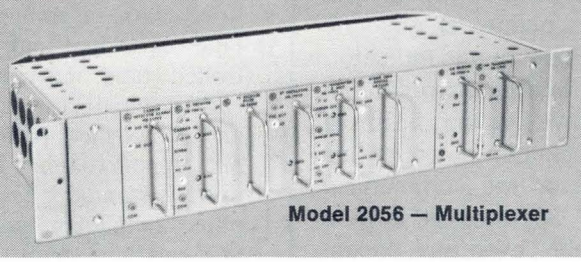
Circle No. 183 on Inquiry Card.

RFL Builds Data Sets to meet every need

Desk Set


Hardwire/Acoustical Coupler

Model 3952 High Speed Data Set


Model 2056 — Multiplexer

No matter what your data communication needs, look to RFL for the ultimate in dependable high-speed data communication equipment. RFL Data Sets handle computer, telegraph and telemeter data in combination or on an individual basis. The Model 2056 series provides the latest in transistorized multiplexing equipment — permitting the use of up to 23 channels over a single circuit, and RFL's "Plug-in" interchangeability feature gives you a choice of data speeds up to 2400 bits per second.

Rack mounting or desk type models are available . . . of course all are Bell compatible.

RFL offers an outright purchase or rental plan . . . so if you have requirements for data communications equipment, be sure to check RFL . . . we make a set to fit your needs. We've been building quality data sets for over 12 years . . . with prompt delivery.

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Acoustic Coupler

I/Onex MODEL 30

■ Fully compatible with Bell System 103 Data Set. ■ Operates up to 300 baud with standard phone. ■ Absolute carrier detector and indicator. ■ Solid wood construction in mahogany or walnut finish. ■ Phase-lock-loop detection assures error-free communication. ■ Operates at half or full duplex over any unconditioned two-wire system. ■ Teletype loop current, EIA and IC logic interfaces are standard.

■ From the I/Onex Division of Sonex Inc. ■ Also manufactures modems, multiplexers and OEM assemblies. ■ Units in operation in Booth 50007 at SJCC.

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CIRCLE NO. 97 ON INQUIRY CARD

DATA ACQUISITION SYSTEM

The DDS 1103 Data Acquisition System accepts bipolar analog voltages up to ±10 volts. The data is converted into a 12-bit binary value and recorded in either binary or BCD format on a synchronous IBM-compatible tape. The system is said to be unique in that it includes memory for data collection prior to recording onto tape. Thus, the system operates equally as well at 1 sample per second or slower as it does at 50,000 samples per second with no loss of critical information. The basic system is priced at $11,250. *Digital Data Systems, Northridge, Cal.*

Circle No. 200 on Inquiry Card.

PARALLEL MODEM

A parallel-input simplex modem designated the GDC-402C accepts 5-, 6-, or 8-level tape reader inputs (paper or magnetic) and converts the data to parallel tones for transmission over the public telephone network. The modem is used in data collection systems and can be adapted to most parallel information applications — including credit card and optical character readers. The modem transmits nine tone channels in parallel (eight data, one timing). The unit operates at a speed of 75 cps (effective data rate of 600 baud) and is compatible with the AT&T 402D receiver. It is available in desk-top configuration or custom OEM package. *General DataComm Ind., Norwalk, Conn.*

Circle No. 193 on Inquiry Card.

AUTO-LOADING TAPE DRIVES

A new series of digital magnetic tape drives priced under $3000 offers two unique features in this price class: a computer-compatible tape cartridge and vacuum controlled tape movement. The tape cartridge reduces operator handling and allows the tape to be used without contamination from dirt and dust. A standard 8½″ reel of computer-compatible tape is placed in the cartridge and started on the take-up reel. When the cartridge is locked and placed into the tape drive, the unit will automatically thread the tape and advance it to load point (BOT). On an "unload" signal, the tape will automatically rewind and retract into the cartridge which then ejects for operator access. The tape transport unit uses dual vacuum capstans to move the tape. Vacuum is also used to control reel locking on hubs, tape loading and unloading, tape positioning on read/write head, tape guiding, tape motion, tape braking, and tape buffering. The V-SERIES is designed for standard ½-inch computer-compatible magnetic tape operated at velocities ranging from 18¾ ips to 37½ ips with data transfer rates of from 15KC to 30KC. At present, single and dual gap head units recording on 7- or 9-channel tape are offered for packing densities up to 800 bpi. Recording mode is continuous NRZI-IBM compatible with a start/stop time of 12 millisec and a start/stop distance of 0.040-inch at 18¾ ips. The drives are constructed in "packs" to enable customized configurations. Price of a single unit depends upon the number of "packs" specified. *Digital Information Devices, Inc., Lionville, Pa.*

Circle No. 197 on Inquiry Card.

LINE PRINTER TERMINAL

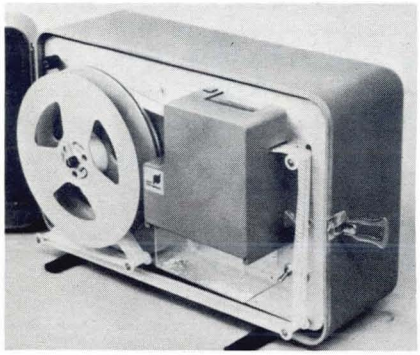
A new terminal printer system can be used to print data received over a telephone line at its maximum capacity, using a Model 201, 202, or similar Dataphone. The interface is easily tailored to operate with any computer. Specifications are geared to data communications, low-cost tape-to-printer and card-to-printer systems, and as small-scale computer outputs. Worst case print speed is 300 lines per minute with a full 64-character type font. 96 and 128 character fonts are available, including optical scanning characters, upper and lower case letters, and special symbols. *Datamark, Inc., Westbury, L. I., N. Y.*

Circle No. 215 on Inquiry Card.

1108 SHARED PROCESSING SYSTEM

The Univac 1108 Shared Processing System, (1108 SP) is a two-processor configuration: one for I/O; one for computation. During idle cycles, the I/O processor also has the ability to perform computations under the direction of a common Executive Control System. Features include partial word addressability in 6-, 9-, 12-, and 18-bit portions, as well as full-word (36 bits) and double-word (72 bits) addressing available to both processors; high-speed random access auxiliary storage; privileged mode for the Executive Operating System in both processors; and a Guard Mode for user programs employed on both processors. Both the hardware and software SP are fully compatible with the present 1108 Unit and Multiprocessor Systems, and also with the Univac 1106 System. Monthly rental cost for a typical Univac 1108 SP System including maintenance is $67,500. Outright purchase price is $2,670,000. *Univac Div. of Sperry Rand Corp., Philadelphia, Pa.*

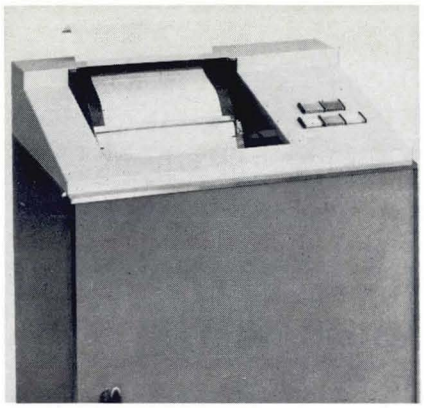
Circle No. 226 on Inquiry Card.



PAPER TAPE PERFORATOR

The "dijitpunch" 400 is a portable paper tape perforator that accepts low level BCD inputs and records data in computer compatible code. Dijitpunch applications include monitoring devices such as digital voltmeters, counters, scalers, cash registers, A/D converters, and keyboards. Features include asynchronous operation up to 10 chars/sec. and self-contained tape handling. Single unit price is $895. *Pivan Data Systems, Lincolnwood, Ill.*

Circle No. 210 on Inquiry Card.



MINICOMPUTER PRINTER

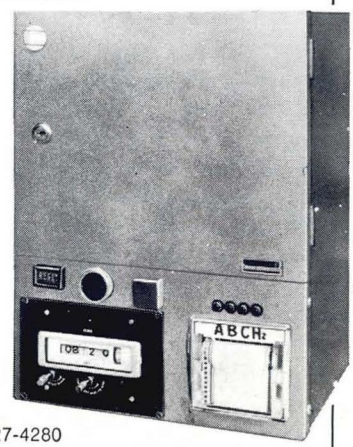
The Vogue/Shepard Model 880D computer line printer contains a direct built-in interface to DEC PDP-8, HP2116, Varian 620/i, or Honeywell 316/516 minicomputers. The 880D prints 80 columns wide at speeds up to 400 lpm. Price is $7600, including interface. *Shepard Div. of Vogue Instrument Corp., Richmond Hill, N.Y.*

Circle No. 216 on Inquiry Card.

Are you processing undetected computer error?

Chances are good that you are!
Consider this. **Typical** computer specifications require a power input range of −8% to +10% of voltage and a frequency stability of ± ½ Hz. **Typical** fluctuations greater than 10% for as much as ¾ Hz are regularly experienced by leading utilities. If undetected, these fluctuations can cause computer errors resulting in costly down time and program reruns.

The Airoyal System Monitor provides visual and audible warnings of any deviation in power (as well as in temperature and humidity, optionally) and fixes the time of fluctuation on a digital clock. The cost is generally recovered the first time the horn blows. For complete information, send for our catalog.



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CIRCLE NO. 98 ON INQUIRY CARD

NEW SOFTWARE AND SERVICES

HOSPITAL LABS PACKAGE

A program to reduce clerical work in hospital laboratories and speed clinic test reports, called (SLIS) Shared Laboratory Information System, organizes doctors' orders for tests, validates the results, and directs an IBM S/360 Model 25 and up to print test reports and post charges to patients' accounts. The program can be used by a single hospital or several hospitals sharing a central computer. In a shared system, each hospital would use its own test procedures and would have access only to its own information. The program is compatible with IBM's Shared Hospital Accounting System (SHAS) and operates with standard SHAS executive routines under DOS. Hospital admission procedures, master files, record formats, and management reports are common to both programs. SLIS is scheduled to be available in the third quarter of 1970 at a monthly charge of $250, under a license agreement. *International Business Machines, White Plains, N.Y.*

Circle No. 245 on Inquiry Card.

T-S CALCULATOR PROGRAM

COMPUTE, (for Time-Sharing Desk Calculator Program) is written primarily in Fortran IV. The program operates under the IBM 360/67 Time-Sharing System (TSS) and allows the TSS user to perform various numerical calculations without writing Fortran programs. The user may thus solve various numerical problems while at the TSS terminal by simply communicating with COMPUTE. The program is priced at $310. *COSMIC, Barrow Hall, Univ. of Ga., Athens, Ga.*

Circle No. 239 on Inquiry Card.

USAGE ANALYZER

Computer Utilization Accounting System (CUAS) is a modular software package which analyzes computer equipment usage by such categories as production, test, maintenance, operator error, and machine error. Results are offered by application, job, machine, shift, time of day, and run code. CUAS is written in Cobol under DOS and is designed to run on a 65K-S/360, Model 30 or its equivalent. The system can run in a stand-alone or a multiprogramming environment. It requires the use of one disk drive and four tape drives. *Implementation Div., Data Management Services, Inc., Philadelphia, Pa.*

Circle No. 241 on Inquiry Card.

RETRIEVAL SYSTEM

A retrieval system software package, MRS, to implement applications utilizing the DSI "400" terminal viewer, consists of two modular sets of programs. The data base module makes provision for programs relating to: formatting files and records for COM microfilming; automatic extraction of search keys for COM data; file and list structuring of search keys for retrieval; update file structuring for selective retrieval; and transaction file formatting of updates for master file merging. The search and retrieval module employs a comprehensive terminal language to specify search criteria and limits. Utilization of this language permits the DSI "400" subscriber to retrieve information from the data base using equality or the nearest match between the search query and items on file. There is no practical limit to the search variable which can be specified. *DSI Systems Inc., Rockville, Md.*

Circle No. 243 on Inquiry Card.

VARIAN 620/i OPERATING SYSTEM

A Master Operating System (MOS) for the Varian 620 minicomputer includes I/O, system executive, system loader, assembler, one-pass Fortran IV compiler, and maintenance and debugging packages. The MOS software system is applicable to any 620/i installation with a minimum of 8K memory, a Teletype, and either a drum or tape memory. The latter are used by the system to store and process various parts of the MOS software and to act as a reservoir for the user programs generated by MOS. In addition, the system is said to accommodate any combination of line printers, high-speed paper tape reader/punches, cardreaders, and additional magnetic tape units. The programs generated by MOS using the assembler or Fortran compiler are in the form of compatible, relocatable linking object codes. *Varian Data Machines, Irvine, Cal.*

Circle No. 262 on Inquiry Card.

COBOL GENERATOR

SYM/BOL, a new symbolic Cobol generator, has been written especially for IBM 360 DOS/TOS. SYM/BOL operands relate directly to Cobol providing capabilities limited only by the basic Cobol limitations. SYM/BOL is said to differ from other Cobol generators in that, besides its use as a generator, it can also be used as a source language. Developers claim anything that can be done in Cobol can be done with SYM/BOL 40 to 50 per cent faster. Cost is $2,100 for the first installation. *Management Information Systems, Amarillo, Texas.*

Circle No. 261 on Inquiry Card.

CIRCLE NO. 100 ON INQUIRY CARD

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H1603. Honeywell's new real-time control system. Takes on thousands of digital and analog signals. Costs less than you'd expect to pay for a digital computer alone.

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The H1603 has Honeywell's newest general purpose 16-bit computer – H316. And the new modular Real-Time Interface unit. Both in one cabinet. With space for 128 analog and 256 digital inputs. Expandable to 2,048 and 4,096. Does multiplexing. Isolation. Signal conditioning.

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BAL DEBUGGER

A command language, BAL-FIX, enables a programmer to perform interactive debugging of BAL programs on any IBM 360 computer. BAL-FIX reduces the time required to locate and correct programming errors and perform the test operations required for batch debugging. The package is compatible with the DOS supervisor, and comes as a card deck ready to be loaded into the system library. Only one additional card is required at the beginning of the deck for a problem program. *PDA Systems. Inc., New York, N.Y.*

Circle No. 263 on Inquiry Card.

LETTER GENERATOR

Using control cards containing data unique to each letter, GLP (for Generalized Letter Generator) automatically inserts variable information and performs format adjustments. GLP operates under S/360 DOS, is written in assembler language, and requires a minimum partition size of 40K in addition to the standard DOS minimum I/O configuration. *Programming Sciences Corp., Wash., D.C.*

Circle No. 264 on Inquiry Card.

T-S COBOL PRE-COMPILER

The Terminal-Oriented Business Applications Programming System (TOCAP) is intended for Cobol programmers using time-sharing terminals. TOCAP, is, itself written in standard Cobol to ensure compatibility with present time-sharing systems supporting a Cobol compiler. From a functional aspect, TOCAP acts as a pre-compiler and accepts shorthand Cobol statements, free-format decision tables, library subroutines, and source language debugging statements which it translates into complete standard Cobol statements. *Data Technology, Alexandria, Va.*

Circle No. 246 on Inquiry Card.

RECORD SELECTION SUBPROGRAM

Designed to increase the effectiveness of selecting records from IBM S/360 data files, FAST (File Analysis and Selection Techniques) responds to special requests for specific file information. Its features include: (1) the ability to select a subset of data from a file in response to a special request; (2) Comparison of one record field to another record field or an alpha or numeric literal; (3) Variable range selection; and (4) Specific value selection. Typical applications are: personnel searches, accounts receivable analysis, statistical analysis, and exception reporting. The complete purchase price of $650 includes the relocatable object deck of the FAST subprogram, complete documentation, and a Cobol mainline program with file and record definitions for one user file. FAST is written in Bal to be inserted in Bal or Cobol programs used with almost any type of disk or tape file. *URS Data Sciences Co., San Mateo, Cal.*

Circle No. 260 on Inquiry Card.

SHIPPERS' "QUICK-RATE" SERVICE

A specialized data base service for use by company shipping departments and govt. agencies is available on magnetic tape or as a hardcover directory. The "Quick-Rate" data base consists of 1.5 million motor carrier class rates, all REA tariff 33 and 11B commodity rates, all package rates, such as UPS, parcel post and air parcel post, and air express. The 28-program system, which can assemble for any shipping and receiving points in the continental U.S. all the rates that apply between the two locations, requires a minimum of 128K words of core and operates under 360/40 OS. The data base is updated as rate changes occur. *Numerax, Inc., Englewood Cliffs, N.J.*

Circle No. 254 on Inquiry Card.

DISPLAY PACKAGE

GRAPHICS is a proprietary software system for controlling key-driven display devices, including the IBM 2260. The system is said to offer medium-scale EDP users (IBM 360/30, 360/40, H-200, etc) the opportunity to install complex inquiry, data entry, and file update application rapidly with minimal programming effort. The GRAPHICS control program, which is written in Cobol, uses a common overlay area for all one-time system functions and application programs. It operates in a single partition (24K minimum), and interfaces with existing operating systems. Application programs can be written in any language using standard program linkages. GRAPHICS can be purchased for $15,000 or may be leased for $400 per month (36 months minimum). Included in the price is three weeks of on-site installation assistance. *turnkey systems inc., Norwalk, Conn.*

Circle No. 258 on Inquiry Card.

CROSS ASSEMBLER FOR VARIAN 620/i

A Fortran-implemented package for off-line assemblies of machine language programs for the Varian 620/i computer will accept the Varian DAS Assembly language in order to generate 620/i object programs. The package has been used operationally on the IBM 360/40, IC-6000, IBM-7094, and CDC-6400/6600 computers and is said to be adaptable to many different configurations. Significant features are: an extended set of diagnostics and in-line error messages; alphabetized symbol table listing (1200 symbols); standard symbolic listing with page size control and a summary listing of source cards input, error count, lines printed, etc.; batched assemblies; and option for 16- or 18-bit word size. A copyrighted Fortran IV package for the IBM 360 is available for $750, which includes a sequenced source deck, source listing, user instructions, and maintenance documentation. *Code Inc., Los Angeles, Cal.*

Circle No. 235 on Inquiry Card.

ACCOUNTS PAYABLE PACKAGE

A $5000 accounts payable package is written in Cobol for use on S/360 configurations having memory capacities of 32,000-bytes or larger and disk or tape-and-disk external storage. Major features include extensive editing of all input data, manual or automatic due date calculation, pre-payment audit ability, automatic check writing and reconciliation, and multilevel expenses analysis. Numerous controls and audit trails are maintained automatically by the programming system, and a payables activity report feature produces detailed listings of new payable items, amounts paid, and trial balances in one concise listing. Twelve different reports are produced as a byproduct of the payables processing function. The $5000 purchase price includes all programs and documentation. Installation and special customizing efforts are additional. *Keane Associates Inc., Weston, Mass.*

Circle No. 252 on Inquiry Card.

CONTOUR-PLOTTING SOFTWARE

Contour-Plot, a contouring system designed to operate with any Houston Instrument plotter or plotting system (on-line, off-line, or time-shared), uses a verb-oriented language said to require minimal user training and/or programming experience. Options include the ability to perform operations on multiple surfaces; provision for isometric and other 3-dimensional views; routines for statistical surface fitting (smoothing); and a profile plot which allows viewing slices of a given contour. A minimum system would require 16K words of memory (32 bits per word or greater), or 32K words of memory (16 bits per word or greater), plus at least two mass storage devices (tape or disk), and one input device (card reader, paper tape reader, tape, or disk). *Houston Instrument, Div. of Bausch & Lomb, Bellaire, Texas.*

Circle No. 250 on Inquiry Card.

PACKAGE RESTRICTION PROGRAM

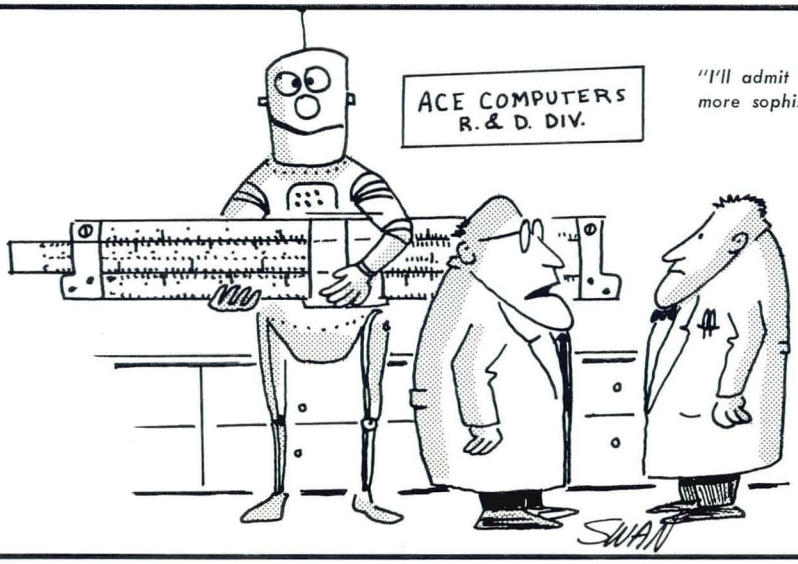
COP, Customer Orienting Program permits automatic tailoring of master program decks to the requirements of an individual customer, thus reducing the risk of unauthorized duplication of the proprietary package. As an editing program, COP permits the embedding into the customer deck of the user's name or other identifying information. It also provides a mechanism for automatically deleting master deck components which have not been purchased by the customer. COP was developed in conjunction with DOCUMATIC, an automatic documentation system for S/360 RPG programs. Each time a new system is ordered, COP tailors the master DOCUMATIC deck to (1) insert the customer's name; (2) trip software locks which cause DOCUMATIC to malfunction if the customer name is tampered with; (3) restrict the memory size to that of the customer's installation; and (4) eliminate modules not purchased by the customer. COP sells for $1000. *Data Usage Corp., Fort Lee, N.J.*

Circle No. 244 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.



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T103G2SA

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T202DS

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2,000 BPS HALF DUPLEX

T201A1/2S

T201A1/2SA

Kick the smoke habit

Smoke signals are fine for giving the Indian sign. They're far too slow for pow-wowing with a remote computer. Still, there are people using puff-at-a-time, typewriterlike devices that take many moons to complete printouts . . . while computer time is elapsing and running up the bill.

Typeliner is the all new terminal printer that brings remote data printers out of the pioneer age. It has space age specs like 100 lines per minute, ASCII 64 character set, plug-to-plug compatibility with CRT display terminals and modems.

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Very little wampum rents the Typeliner. You can have one for $245.00 per month with delivery within 90 days. And you needn't worry about service. The Typeliner was designed to shrug off maintenance that other mechanical marvels require.

If you're ready to give up that old tribal custom of using a character-at-a-time printer, let us tell you about the Typeliner. Circle the bingo card; write or phone our big marketing chief, Chandler J Williams. Then watch our smoke.

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CIRCLE NO. 102 ON INQUIRY CARD

NEW SOFTWARE AND SERVICES

HONEYWELL DISK SOFTWARE

Three new software products designed for use on small-scale, disk-oriented Honeywell computer systems are: Fortran F (disk) compiler for Series 200 computers with a minimum of 24,586 characters of main memory; Mod 1 (Mass Storage Resident) Cobol compiler for Series 200 computers with a minimum of 32,768 characters of main memory; and 110 Cobol Programming System for Series 200 computers with a minimum of 16,384 characters of main memory. The Fortran compiler is a pure disk version of the present mixed disk/tape Fortran F compiler and is designed to operate under the Mod 1 (Mass Storage Resident) Operating System. The Cobol compiler is similarly designed for the Mod 1 Operating System and allows the user to operate in a pure disk or mixed disk/tape environment. The 110 Cobol Programming System is a simplified application-oriented system which makes use of the Cobal C compiler and Easy-tab Programs. *Honeywell EDP, Wellesley, Mass.*

Circle No. 249 on Inquiry Card.

AUTOMATIC FLOWCHARTER

LOGIGRAM, a modular system for automatic flowcharting and documentation, accepts Cobol, RPG, ALC/Bal, and Autocoder. LOGIGRAM will operate on any S/360 Series computer having at least 32K storage, and can be modified to work with other major computer systems such as the RCA Spectra 70 and Univac 9000. The program operates under DOS, OS, or its own supervisor. Prices range from $1800 for an RPG or Autocoder module to $8000 for the four-language system. Options include a Cobol compiler which can be added to the basic LOGIGRAM module for $500, and an RPG-to-Cobol converter for $3500. *Computer Time & Software Sales, Inc., Los Angeles, Cal.*

Circle No. 236 on Inquiry Card.

ACCOUNTS RECEIVABLE

A multiple-client accounts receivable system economizes processing time by performing all operations in one pass of the master file. CASARS (CAS's Accounts Receivable System) provides automatic repeat invoicing, G/L account dollar summary totals, variable heading and trailing messages on statements, work-in-process accounting, and client combinations of open-items/balance forward statements and aged reports. In addition it produces a journal of original entry, accounts receivable, maintenance report, customer master list, aged accounts receivable, and prints statements (two at a time) and mailing labels (as many as four at once). Four COBOL programs and two sorts comprise the total CASARS package, which may be purchased for $15,000. *Applied Systems, Inc., Encino, Cal.*

Circle No. 240 on Inquiry Card.

SYSTEM OPTIMIZATION PACKAGE

A package combining systems engineering techniques with digital simulation language and linear programming, designated SWAPSO (for Stone & Webster All Purpose Simulator and Optimizer), is said to extend to systems analysis approaches in optimizing the economics of a variety of large, complex processes. SWAPSO can be used in preconstruction analysis of hydrocarbon cracking units, chemical refinery complexes, water desalination plants, and in simulation studies of business operations and the general economy. SWAPSO provides: Simulation of the dynamic behavior of continuous processes, or based on either theoretical or actual data; continuous updating of the coefficients of empirical equations with operating plant performance data by statistical subprograms; a model linearization procedure; and optimization of operation profitability by non-linear programming techniques, or by steepest ascent hill climbing procedures. *Stone & Webster Engineering, Inc., Boston, Mass.*

Circle No. 256 on Inquiry Card.

VIDEO STORAGE AND RETRIEVAL

SAVITAR (Sanders Associates Video Input/Output Terminal Access Resource) is an English-like language information storage and retrieval system designed for use between the Sanders 720 Data Display System and the IBM S/360. SAVITAR, which requires about 100K of storage and performs under MFT or MVT permits, on-line creation of fixed formats which can be stored in the central processing unit for later use in adding, revising, or deleting "pages" of data. Any number of display systems can be supported. All data files are in standard OS/360 formats enabling batch programs to operate on the same data, and typical response time is said to be less than four seconds. The program also features random and sequential access, page level data privacy, ability to access a page by any one of several keys in the page, storage of many pages with the same key values, file "browsing," and the ability to copy a page or a fixed format. *Sanders Associates, Nashua, N.H.*

Circle No. 255 on Inquiry Card.

DOS EXECUTIVE SUPERVISOR

HAL (Highly Automated Logic) is an Executive Control Supervisor that assumes full control of an S/360, bypasses the need for JCL, and supplies functions normally performed by a human operator. HAL stores and automatically executes primitive procedures (JCL decks) and super procedures (combinations of primitive and other super procedures), as well as standard procedures such as compile, compile/execute, etc. The new operating supervisor is 100% compatible with DOS but requires no additional resident core and operates in on-demand time slices. HAL requires a minimum of one disk and 32K of core. It consists of a control software module and a set of operational and planned function modules. *Exact Systems and Programming Corp., Thornwood, N.Y.*

Circle No. 248 on Inquiry Card.

ACCOUNTING SYSTEM

Described as a complete automated accounting system, the Integrated Accounting and Business Management System consists of modules for Accounts Payable, Accounts Receivable, Payroll, and General Ledger. The system is written in Cobol, and is available for IBM, Honeywell, Burroughs, and NCR equipment. Originally designed for the IBM 360/30, it can operate within 32K of core. The system is marketed at $32,000 under a perpetual licensing agreement, which includes source decks, user, and operator documentation. The price also includes an analyst to assist in installing the system, educating the client's personnel in its use, and making such modifications as may be necessary to tailor the system to the client's particular needs. *Delta Data Systems, Inc., College Park, Md.*

Circle No. 247 on Inquiry Card.

CONTROL SYSTEM PROGRAM

MOFACS is a time-sharing computer program (with batch version available) to synthesize the feedback and compensation parameters for control of a multi-order system. Its purpose is to design the best possible feedback network needed to gain a specific transient response, which is dictated by the design engineer. The feedback can be either linear or non-linear. MOFACS is also capable of identifying systems from actual laboratory or field data. The user supplies the measured transient response and the known system parameters, and MOFACS will identify the unknown parameters of the existing system The program provides for the verification of input, printout of the characteristic equation of the plant, lead and lag compensation, and the feedback coefficients. *Time-Sharing Enterprises, Inc., King of Prussia, Pa.*

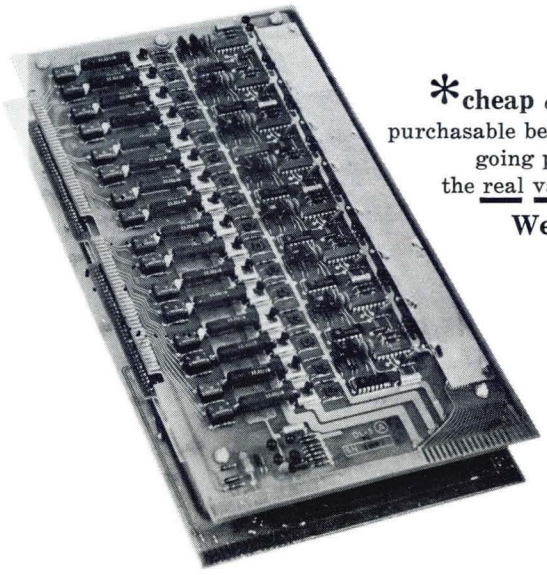
Circle No. 257 on Inquiry Card.

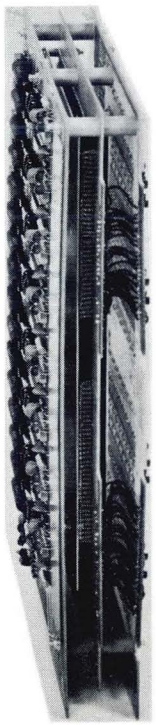
TERMINAL CONTROL SYSTEM

ARTIC (Associometrics Remote Terminal Inquiry Control System) permits users of the IBM Disk Operating System to satisfy the technical software requirements of a teleprocessing system, while allowing the programming of inquiry processing applications to be written in high-level languages, such as COBOL. ARTIC supports Teletype units, various types of CRT and audio response units, and the IBM 2740 terminal. To expedite inquiry processing, ARTIC uses the multi-tasking capabilities of DOS, which allows up to ten programs or tasks to be executed asynchronously within a partition. To simplify multi-tasking, ARTIC provides its own data management subsystem, ADAM (Associometrics DAta Management system), which supports index sequential and direct-access file organization. *Associometrics Inc., Dallas, Texas.*

Circle No. 238 on Inquiry Card.

ecom C...{cheap*}





***cheap** *adj.* **1a:** purchasable below the going price or the real value... **Webster.**

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CIRCLE NO. 103 ON INQUIRY CARD

NEW LITERATURE

DATA SERVICES

A 20-page brochure describes six data processing services offered by Honeywell data centers in 16 cities. The services consist of time-sharing, remote batch and on-site batch data processing machine time, contract software, systems consulting, and facilities management. *Honeywell Information Services Div., Minneapolis, Minn.*

Circle No. 312 on Inquiry Card.

RENT VS. PURCHASE

Report entitled "There's More Money in Renting," compares rental programs with outright sales from the viewpoints of both the manufacturer/distributor and the end user. *Cavanagh Computer Leasing Co., New York, N.Y.*

Circle No. 301 on Inquiry Card.

CAPABILITIES BROCHURE

The services and facilities of MetaSystems Corp., an organization of software specialists and computing consultants, are described in a 12-page illustrated capabilities brochure. *MetaSystems Corp., Trenton, N.J.*

Circle No. 324 on Inquiry Card.

CODING KEYBOARD

Brochure describes the Mercutronic Coding Keyboard, which uses a mechanical switching approach based on the movement of mercury in a sealed flexible tube. Encoding for up to 10 bits is performed within each switch module (key) – there are no printed circuit boards and no soldered connections. *Mechanical Enterprises, Inc., Alexandria, Va.*

Circle No. 322 on Inquiry Card.

MEMORY SYSTEM APPLICATIONS

A 28-page application book, "How to Use Digital Magnetic Core Memories," covers the areas of digital data links, instrumentation systems, business data machines, process control and monitoring, telemetry and communications, data processing and organizing. *Ferroxcube Corp., Saugerties, N.Y.*

Circle No. 319 on Inquiry Card.

COMPUTER CORROSION CONTROL

"Purafil For Corrosion Control" in computer facilities is the subject of a 12-page technical bulletin. Prepared for architects, consulting engineers, plant engineers, contractors, and building owners and operators, the report reviews the use of Purafil Environmental Control Systems for removing gaseous pollutants and/or toxicants from corrosive interior atmosphere affecting computer operations. *Borg-Warner Corp., Marbon Div., Washington, W. Va.*

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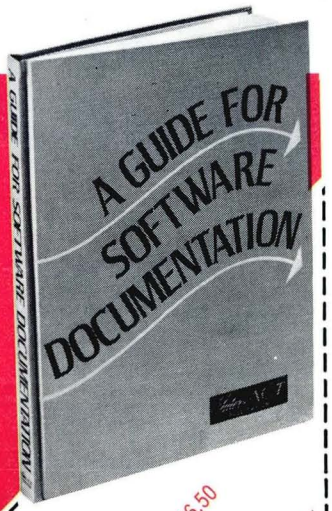

This book contains 14 carefully prepared models of documentation which must be prepared for computer software and applications products. Each model or outline can serve many purposes for the practicing systems analyst/programmer at any level; from usage as a tool to aid in the organization of raw subject matter through use as a check list to aid in document completion.

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EXPANDABLE CORE MEMORY

Four-page technical brochure describes a field-expandable 18-bit core memory system designed for use in mini-computers, machine controllers, and peripherals. The ExpandaCore-18 requires only three inches of rack space for a full 16K memory. The basic 4K memory is expanded to 16K by adding 4K storage boards containing the core stack and associated drive and sense circuitry. *Cambridge Memories, Inc., Newtonville, Mass.*

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DATA TRANSMISSION CARD READER

Bulletin describes new low-cost, solid-state, manually-fed 80-column alphanumeric tab card reader for data transmission via the Bell System's 401 Series "Data-Phone" data sets. *Datron Systems, Inc., Mountain Lakes, N.J.*

Circle No. 311 on Inquiry Card.

CONTRACT SERVICES

Contract services which are said to save 40 percent in implementing programming design, coding, testing, and documentation are described in a new 4-page brochure titled "Applying Computer Science to the Problems of Management." *International Data Applications, Inc., Montgomeryville, Pa.*

Circle No. 329 on Inquiry Card.

I/O SYSTEMS BROCHURE

A 4-page fully-illustrated brochure describes "Transplot" hybrid controllers and graphic systems. The Transplot line is said to handle the entire range of functions formerly restricted to incremental plotters. The brochure contains information on standard and optional built-in digital interfaces, as well as special parallel interfaces for specified computers. *I/O Systems, Inc., Natick, Mass.*

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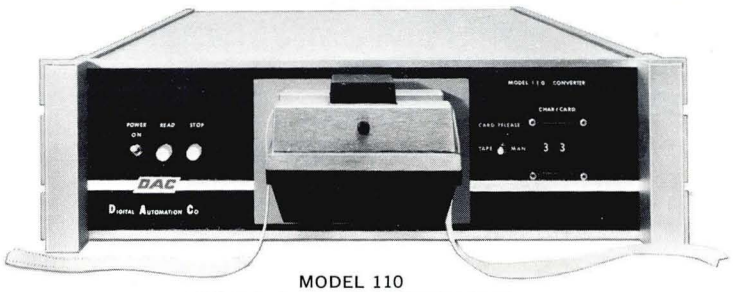

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EQUIPMENT SERVICES

An equipment services program which involves the purchase, sale, and lease of computer equipment; the design of individual equipment plans; and purchase-lease-back agreements on previously-installed equipment is described in a new brochure. *Executive Computer Systems, Oak Brook, Ill.*

Circle No. 318 on Inquiry Card.

LINE CONDITIONING GUIDE

Line conditioning specifications for communications channels as described in AT&T's Bell Systems Practices and according to FCC Tariff 260 have been put into an easy-to-read, sturdy slide chart. This guide describes all the characteristics and requirements for unconditioned, C1, C2, and C4 conditioned telephone channels. *Rixon Electronics, Inc., Silver Spring, Md.*

Circle No. 328 on Inquiry Card.

DATA COLLECTION SYSTEM

A 4-page, 2-color brochure describes the SDA-770 System, an industrial data acquisition system for non-clerical production workers. *Sierra Research Corp., Burlington, Mass.*

Circle No. 330 on Inquiry Card.

STORAGE CONTROL UNIT

A four-page brochure from Information Storage Systems, Inc. describes the ISS Model 728 storage control unit for operating the eleven-high ISS 714 disk storage drives. The 714/728 configuration is plug-for-plug compatible with the IBM 2314 selector channel. *Information Storage Systems, Inc., Cupertino, Cal.*

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MANAGEMENT METHODS

Line managers and systems staff can learn to quantify and formulate their problems for computer solution through ENTELEK's programmed, self-study courses described in a new, 8-page brochure. Courses include Linear Programming for Management, Planning and Scheduling with PERT and CPM, Inventory Management, Sales Forecasting, and Analysis of Financial Statements. *ENTELEK Inc., Newburyport, Mass.*

Circle No. 314 on Inquiry Card.

ADVANCED OCR

Advanced optical character recognition, with the capability of acquiring new fonts "on-line," is described in a newly-revised brochure. According to the brochure's text, the CompuScan Model 370 "learns" new fonts directly from the material being scanned, permitting the reading of intermixed composition, even Greek, Cyrillic, and Hebrew characters. The Model 370 is also said to convert to computer language alphanumeric data in combination with such graphical material as infra-red spectra, charts, mechanical drawings, signatures, fingerprints, and graphs. *CompuScan, Inc., Leonia, N.J.*

Circle No. 303 on Inquiry Card.

PROGRAMMABLE DATA TERMINAL

A 10-page brochure describes the Daedulus Model 711 programmable data terminal. Included are specifications and prices, on-line and off-line operating characteristics, instruction repertoire, batch and conversational mode applications, and transmission speeds. *Daedalus Computer Products, Inc., No. Syracuse, N.Y.*

Circle No. 306 on Inquiry Card.

DATA SETS

A 24-page technical note describes general operating features of the VA300 line of low-speed, Bell 103A-compatible data sets, which provide full-duplex FM transmission of synchronous serial binary data at speeds from 0 to 300 bps over a switched or direct dial telephone network. *Vadic Corp., Palo Alto, Cal.*

Circle No. 332 on Inquiry Card.

HIGH-SPEED DATA SET

International Communications Corp., A Milgo subsidiary, has published an illustrated data sheet which provides operating characteristics and applications information on its new 9600 bps modem. Modem 5500/96 transmits and receives data simultaneously over C2 (Schedule 4B) conditioned voice-grade lines. It incorporates design and production techniques used in ICC's Modem 4400 series of data sets, allowing high-speed transmission over lower-grade lines than previously required. *International Communications Corp., Miami, Fla.*

Circle No. 323 on Inquiry Card.

MULTIPLEX SYSTEM

The new Lynch B310 T-PCM Cable Carrier System for voice and data is described in a 12-page brochure. The B310 System is a 24-channel, solid-state multiplexer using pulse code modulation and time-division techniques. It is compatible with the Western Electric "T1" PCM System and may be used terminal-to-terminal via Lynch and/or WE "T1" Repeaters. *Lynch Communications Systems, San Francisco, Cal.*

Circle No. 317 on Inquiry Card.

2000/2400 BPS MODEM

The TT-201 Data Set, a compact modem compatible with the Bell 201, is described in a 4-page folder. The TT-201 is designed for integral installation in terminals or other data processing equipment operating in the 2000/2400 bps range. The entire modem is packaged on two cards measuring 6 x 12 inches, making it the smallest data set available in this speed range. *Tel-Tech Corp., Silver Spring, Md.*

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KEY-EDIT provides a far more pleasant working environment. This easy-to-learn system is virtually noiseless. Data handling is minimal.

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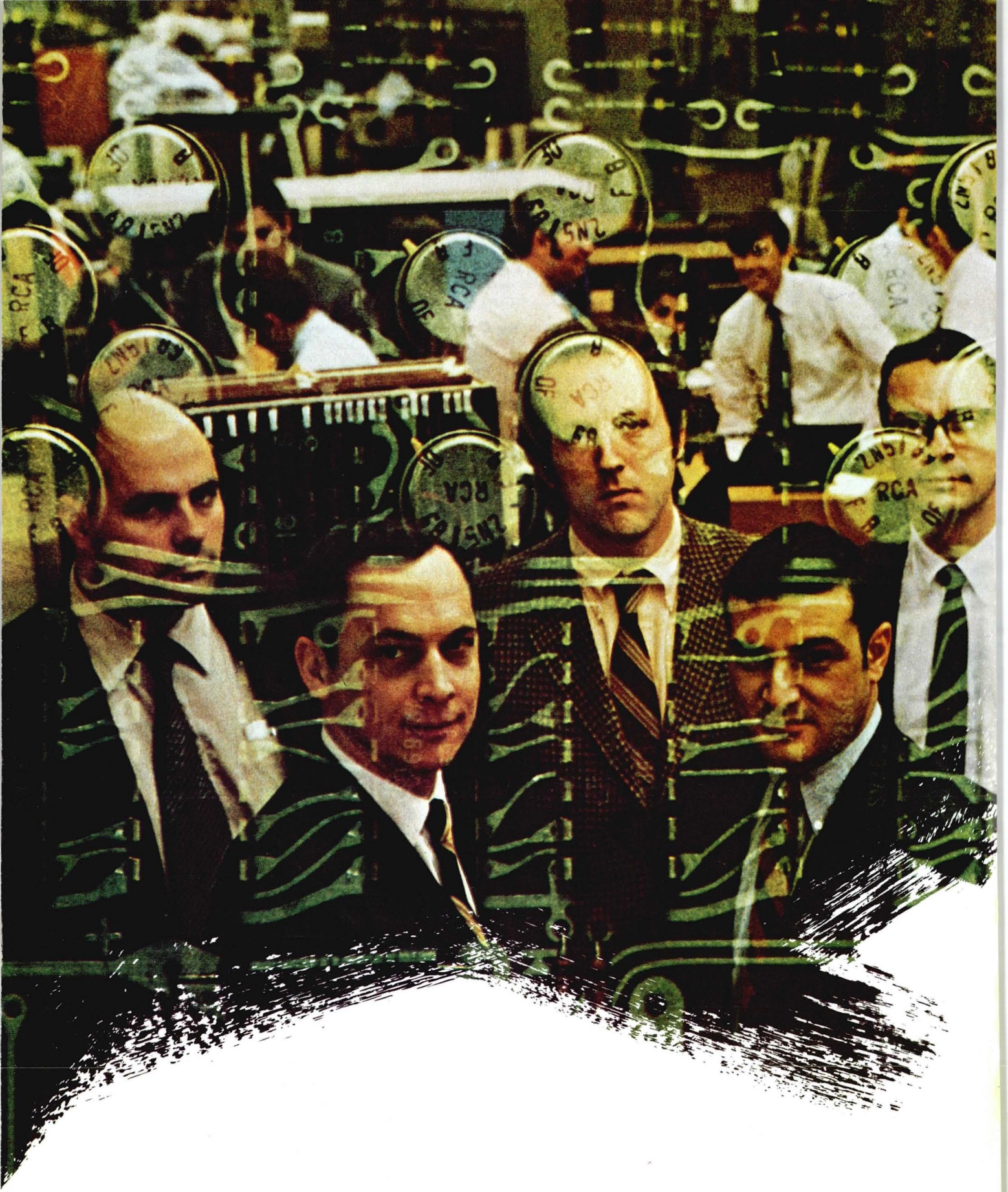
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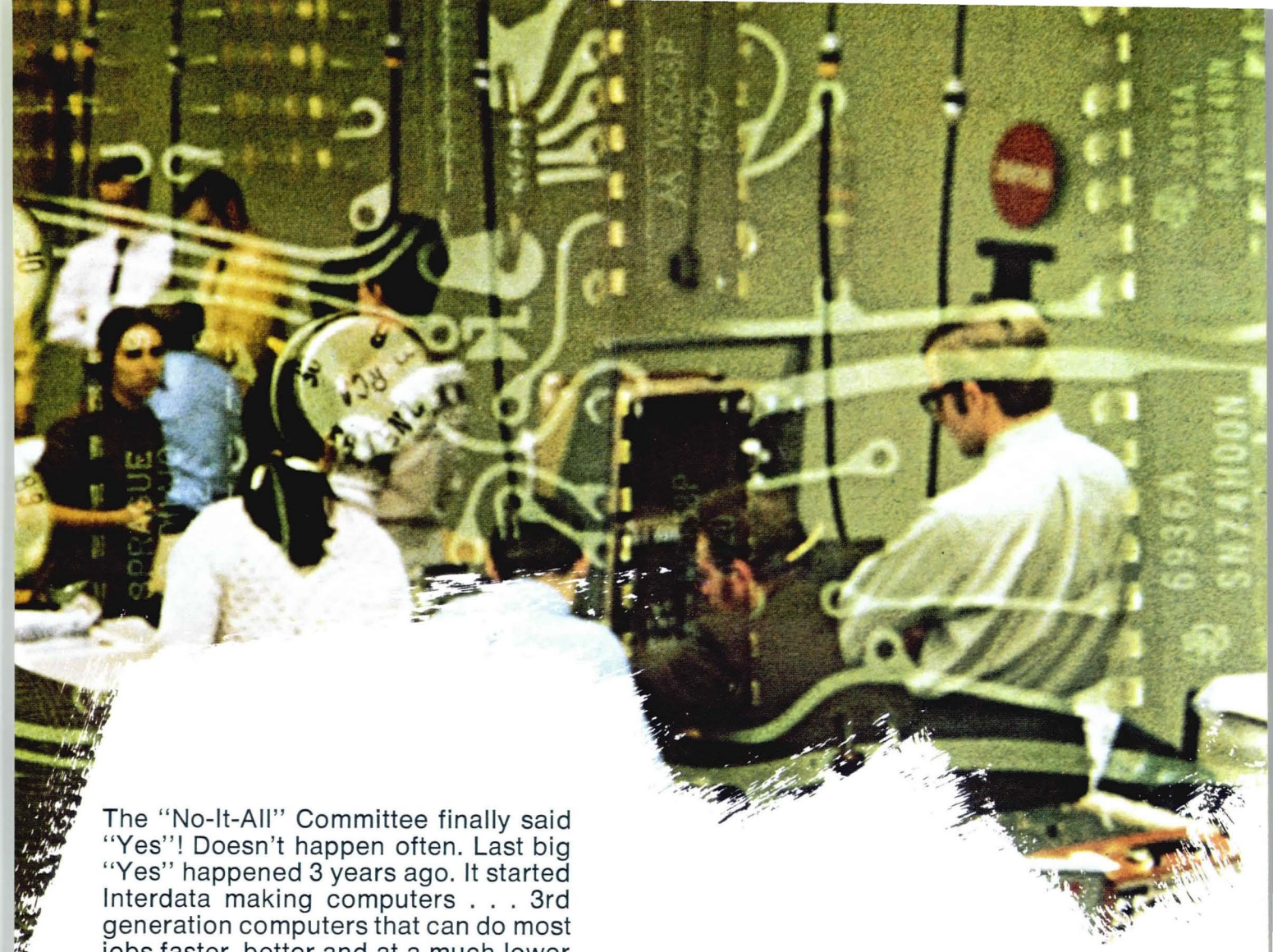

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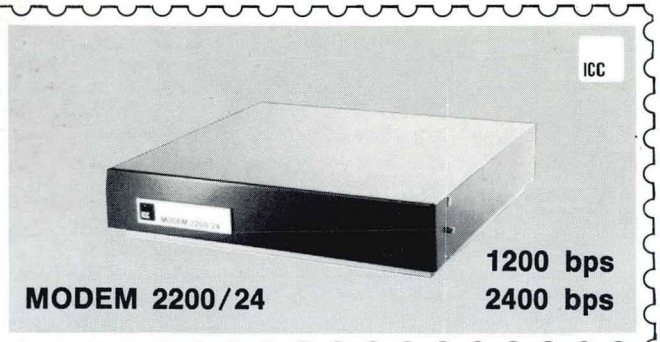

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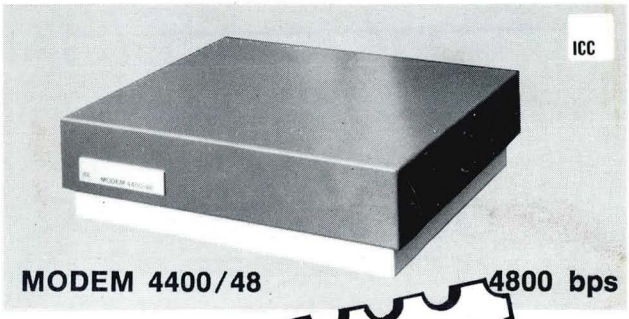

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