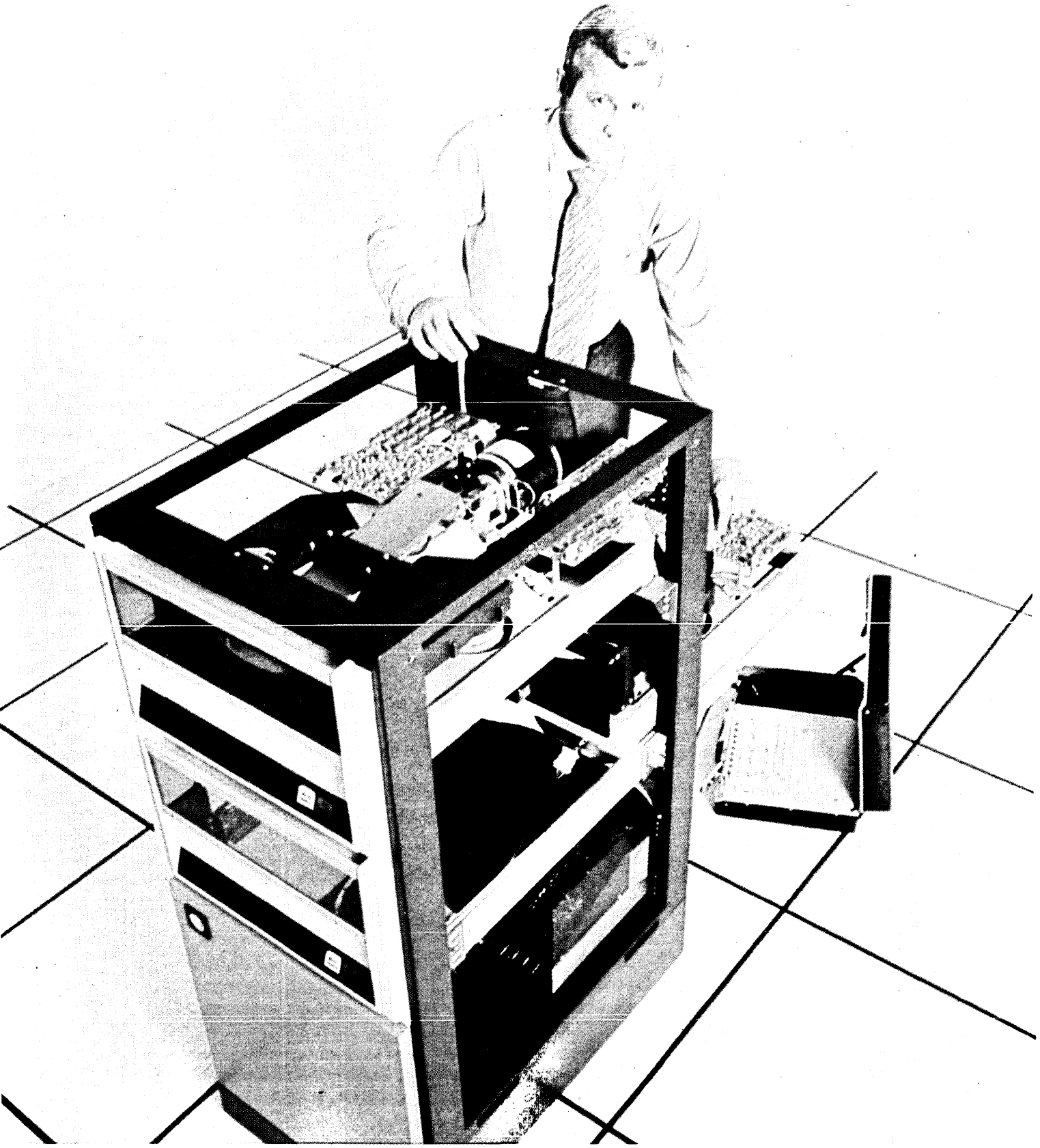
DATAMATION 70®

October 15

plug-to-plug compatibility



Anatomy of the Caelus® Disk Cartridge Drive

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

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CIRCLE 1 ON READER CARD

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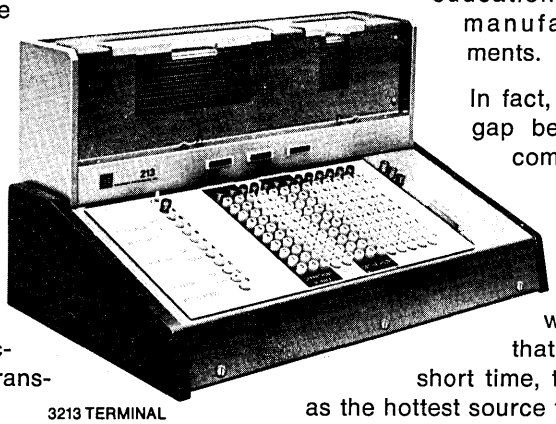
. . . except for some of the world's outstanding manufacturers* who save time, money and man-hours with CII source data collection systems.

We're the great unknown. Except for a number of installations within some of the best known firms in the country.

They're taking advantage of Colorado Instruments' brand of source data collection systems: Peripheral components that collect data from its source . . . the man on the job . . . and transmit it on or off-line to the computer. Fast. Reliably. Economically.



3213 TERMINAL

Source data collection eliminates keypunching. Eliminates record keeping. Reduces cost. Increases accuracy. Increases speed of transmission.

And because of the flexible modularity of CII components, applications are open to the boundaries of imaginative systems design. We've applied our very special logic to solving problems in time and attendance recording, production reporting, inventory and materials control and ordering, purchasing and receiving, machine loading, and a variety of others. In offices. In libraries. In hospitals. In educational institutions and manufacturing environments.

In fact, wherever there's a gap between people and computers.

So we're taking this time and space—at no small expense—to tell you how good we really are. And that we intend, within a short time, to be widely known as the hottest source for source data collection systems in the world.

You can help by getting to know Colorado Instruments. Write for literature, or call toll free 800/525-1625.

*Names available upon request

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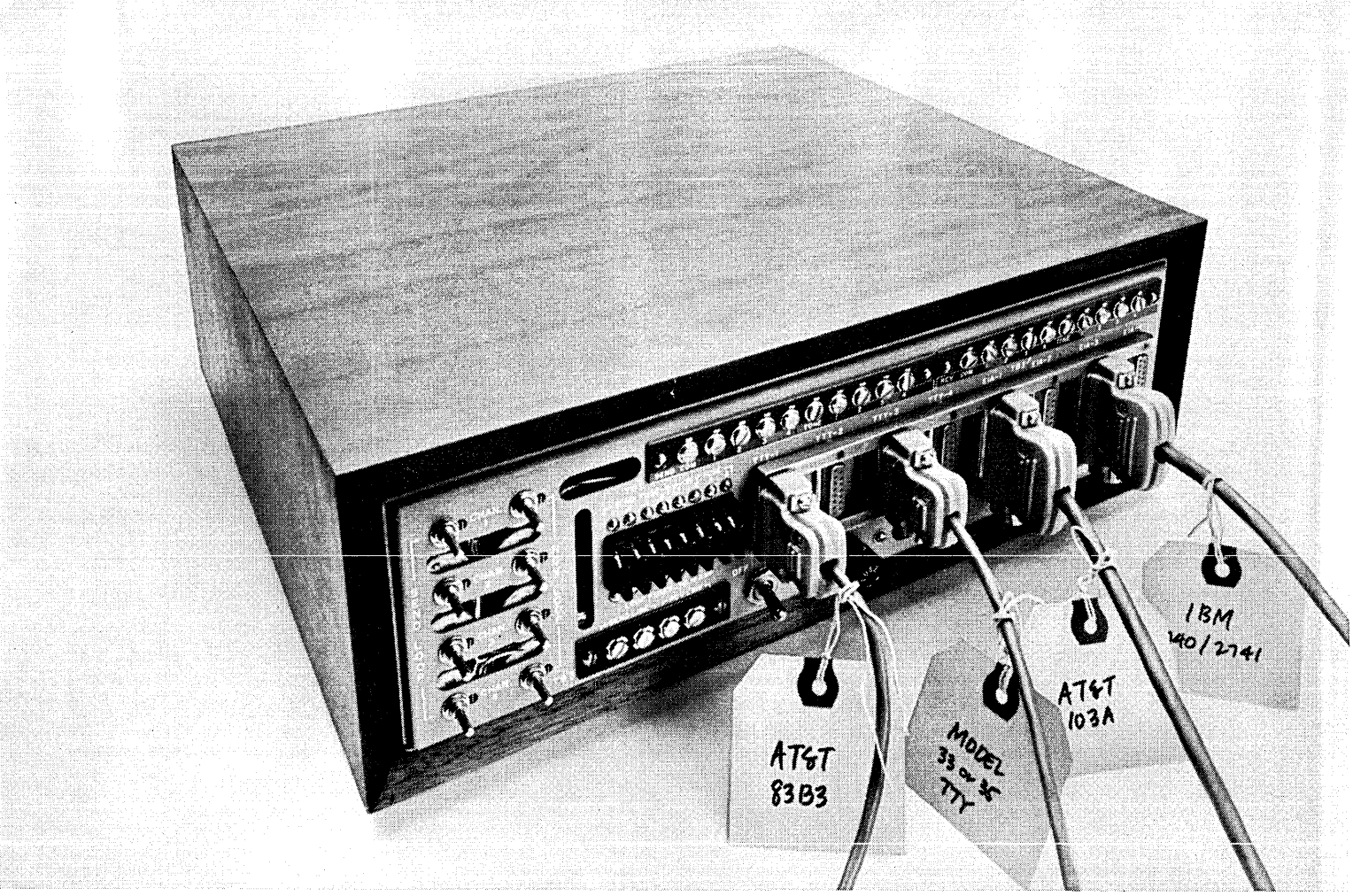
CI-211



It lets you talk to your computer without running your phone bills sky-high.

With our Frequency Division Multiplexer you can link your computer and terminals with the least number of phone lines.

And at the least expense.

It's the only FDM that has 20 ma, 60 ma, and EIA interfaces standard in every unit. So it will interface with any terminal or computer on the market—which makes it real off-the-shelf stuff.

(That's one reason we can deliver a system in 30 days and have it running on the 31st.)

Our multiplexer is really a set of modems, each tuned to a different frequency. We make 4-channel and 1-channel units. So it's easy to set up an FDM system with the exact number of terminals you have at any location.

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At speeds of 110 baud, the system can handle up to 18 channels on a voice-grade line. It allows data transmission at speeds from 75 to 600 bps.

Once they're installed, there's no reason why our FDM's won't work forever. But if anything goes wrong, we have a nationwide service organization that will fix the trouble fast.

You can lease or buy our FDM system at very favorable prices. (One of our customers replaced his old system with ours at a saving of $3000 per month.)

Ultronic runs one of the world's largest communication systems. Since we sell a complete line of communication products, including video terminals, front-end processors and Time Division Multiplexers, we have no axe to grind when it comes to advising you on your multiplexing needs.

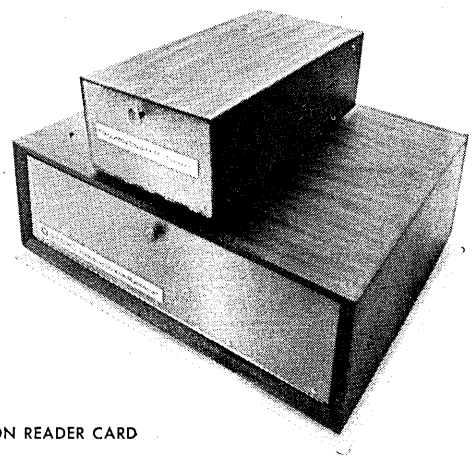
The kind of data you send from point to point is, of course, your business.

How to get it there cheaper is our business.

We'll explain if you call 609-235-7300. Or write: Ultronic Systems Corporation, Mount Laurel Industrial Park, Moorestown, N.J. 08057.

ULTRONIC SYSTEMS

General Telephone & Electronics



CIRCLE 25 ON READER CARD

DATAMATION 70®

OCTOBER 15, 1970

volume 16 number 13

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To serve the medical community, edp must not only improve institutional procedures, but must also improve patient care and provide maximum security of data. The medical services in the Buffalo area have proposed and are developing an areawide health data network to do this.

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The author argues that the matrix form of management is more flexible, adaptive, and efficient than the functional or the project structure. The limitations and advantages of each are discussed.

59 Program Control

Given an understanding of the stages in the progress of a programming project, standard management techniques can be applied effectively.

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As money stays tight and purchases look less and less attractive, leasing companies expect to look more attractive to the customer with the uptight budget.

Disorder on campuses grows and the computer facilities have become a primary target of the militants, with extensive damage wreaked at the Univ. of Wisconsin and Fresno State.

AT&T gives a little, maybe, in its battle with independent peripheral makers by agreeing to certify, perhaps, certain foreign attachments.

About the Cover

Flexibility—here, the free-flowing movement of information through a continually modifying pattern; without interruption, without hang-ups. That's what compatibility is all about. Our design is by Barbara Benson.

OCTOBER 15, 1970
volume 16 number 13

DATAMATION®

This issue 105,616 copies

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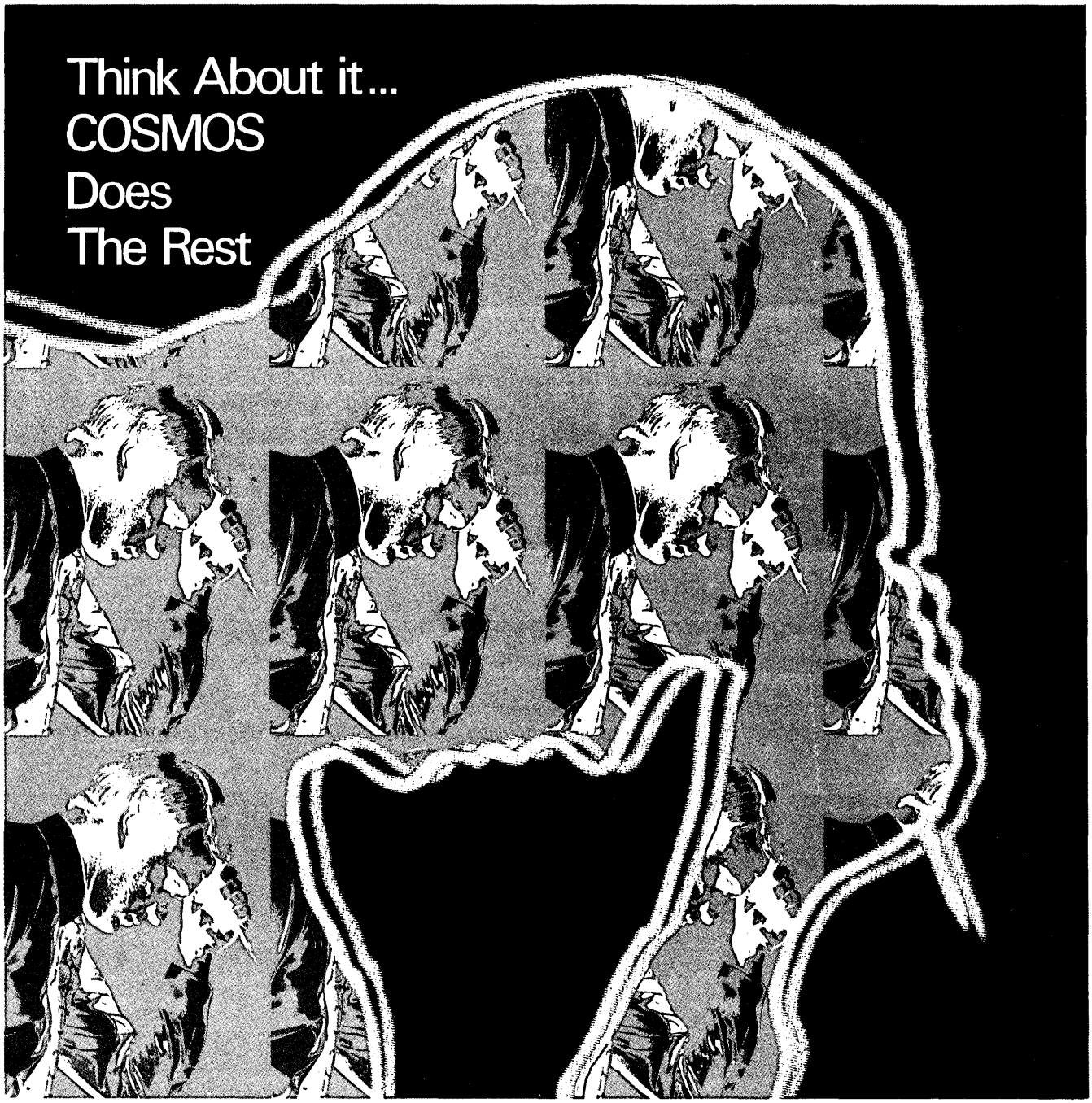

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CIRCLE 38 ON READER CARD

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YOUR UTILITY SERVICE IS THE BEST BARGAIN TODAY!

OPTICAL SPEED READING

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

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

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

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

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

Reads 90,000 documents an hour

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

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

A single reader can replace up to 90 keypunch stations

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

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

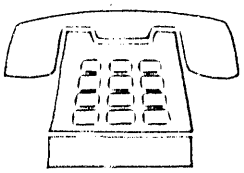
At last: an OCR that keeps pace with large-scale computers

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

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

Control Data has all the answers for you

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



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Or if you prefer, write directly to:
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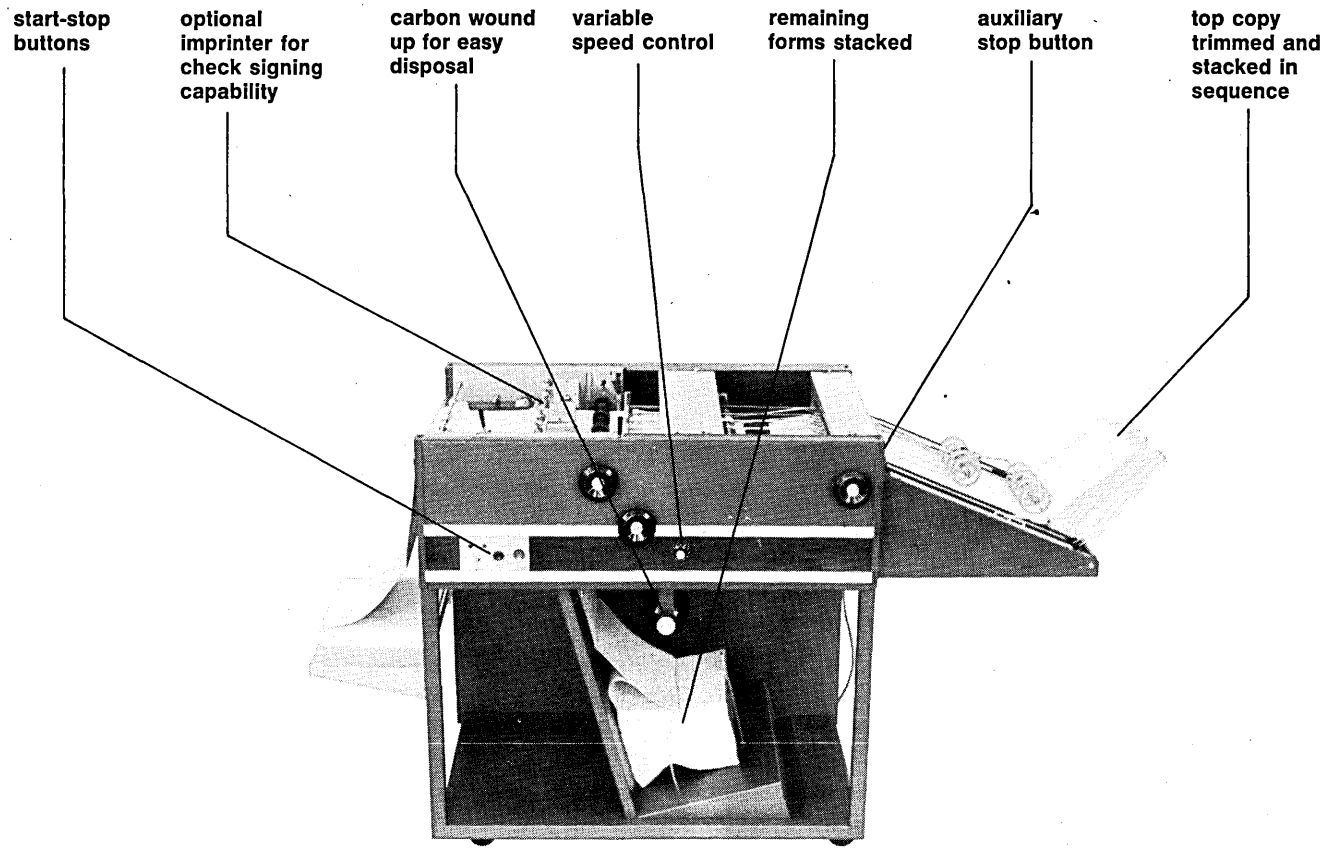
P.O. Box 1980
Minneapolis, Minnesota 55111

CONTROL DATA
CORPORATION

CIRCLE 31 ON READER CARD

New Tab one-pass Burster/ Decollator/Imprinter/ Slitter/Stacker.



The new 2380 Burster from Tab combines the operations of several machines to save you time and money. We call it **Multi-processing:**

In one pass you slit and burst the top copy. Decollate and fan fold the rest. You save one pass through your decollator. Add the optional imprinter—and you save another pass through your imprinting machine.

Set-up is fast and easy with Tab's patented tractor feed drive and peek-in slitter wheels. Speed is infinitely variable, 60-300 feet per minute, to handle everything from 14" long printout to the smallest forms-cards. Optional higher speed ranges are also available.

Dual stop buttons add extra safety. Carbon is automatically wound on a fork for easy disposal. Signature imprinting roll is easily removed and locked in the safe for security.

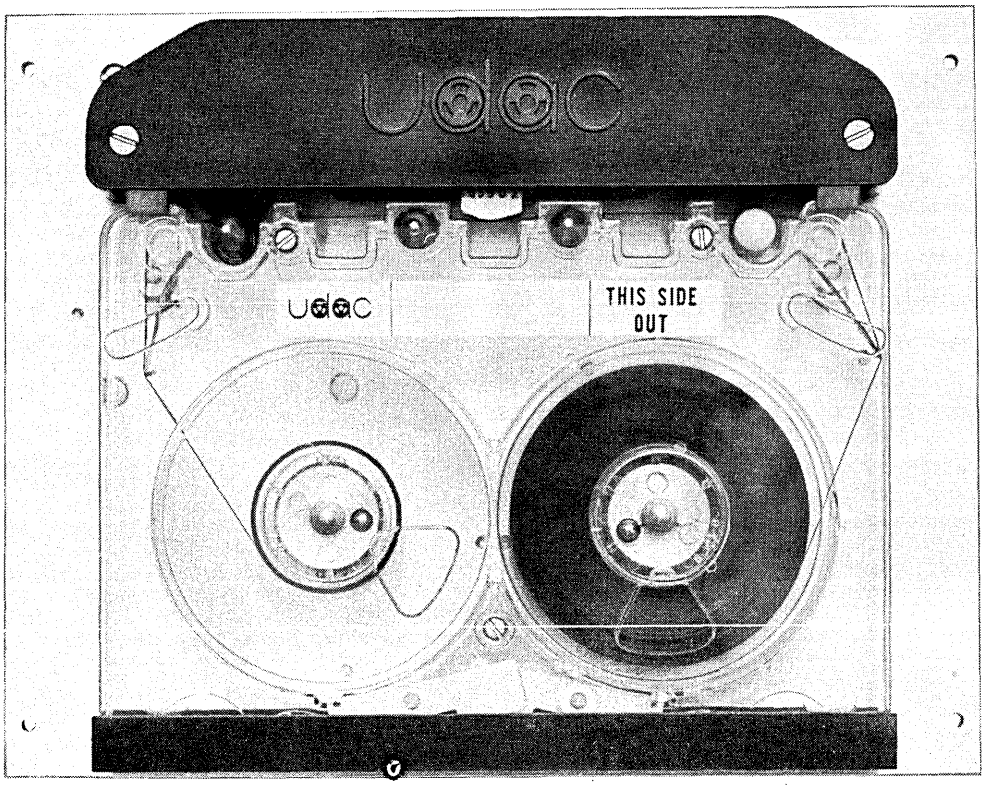
For all the Exciting / Eye-opening / Time-saving / Money-saving details, call your local Tab representative. Or write Tab Products Company, 2690 Hanover Street, Palo Alto, California 94304.

TAB PRODUCTS CO.

CALENDAR

DATE	EVENT/SPONSOR	LOCATION	CONTACT	COST
Oct. 19-21	Inst. Mgt. Sciences 11th National Meeting	Los Angeles	Gene Saxby SPB, P.O. Box 2097 Terminal Annex Los Angeles, Calif. 90054	$45, members $50, others $ 5, students
Oct. 19-21	IEEE Symposium, Automatic Support Systems	St. Louis	Allen Jants, IEEE P.O. Box 4124 St. Louis, Mo. 63136	$40, members $50, others
Oct. 20	ASM Western Systems Conference	Los Angeles	F. Tracy Wells, Jr. 3116 Claremore Ave. Long Beach, Calif. 90808	$35
Oct. 20	DPMA Division II Fall Conference	Pittsburgh	DPMA P.O. Box 2004 Pittsburgh, Pa. 15230	Unknown
Oct. 26-28	DP Supplies Assn. Input/Output Systems Seminar 70	New York City	DPSA 116 Summer St. Stamford, Conn. 06905	$150, non-members
Oct. 26-29	ISA Silver Jubilee Conference & Exhib.	Philadelphia	ISA 400 Stanwix St. Pittsburgh, Pa. 15222	$12, members $18, others Exhibits free
Oct. 26-30	BEMA 12th Annual Expo and Conference	New York City	BEMA 1828 L. St. Washington, D.C. 20036	Conference sessions, $30 each
Nov. 4-6	IEEE Northeast Electronics R&E Meeting (NEREM)	Boston	Val Laughner Assoc. 30 Boston Post Rd. Wayland, Mass. 01778	$4, members $5, others
Nov. 10-12	SEARCH Symposium, Criminal Justice Info & Statistics Systems	Dallas	Project SEARCH 1108 14th St. Sacramento, Calif. 95814	No fee
Nov. 12-13	AIIE Nat'l. Conf. Computer Applications & Systems Technology	Miami Beach	CAST '70 P.O. Box 1081 Miami, Fla. 33148	$65, members $75, others
Nov. 15-16	ACM Data Description & Access Workshop	Houston	Dr. E. F. Codd IBM Research Lab Monterey & Cottle Rds. San Jose, Calif.	$40, members $50, others
Nov. 16	ACM Computer Graphics Workshop	Houston	Jackie Potts Box 933, Blair Sta. Silver Spring, Md. 20910	Unknown
Nov. 17-19	Fall Joint Computer Conference	Houston	AFIPS 210 Summit Ave. Montvale, N.J. 07645	$20, members $40, others
Nov. 20-26	Biennial Int'l. Instr. & Automation Exhibition	Milan, Italy	U.S. Commerce Dept. BIC-932 Washington, D.C. 20230	Unknown
Nov. 30-Dec. 2	IBFI 3rd Int'l. Forum on Data Communications	Hollywood Beach, Fla.	IBFI/PIA Center 1730 N. Lynn St. Arlington, Va. 22209	$195
Dec. 7-9	NEC 26th Annual Conf. & Exhibition	Chicago	Nat'l. Electron. Conf. Oakbrook Exec Plaza #2 1121 W. 22nd St. Oak Brook, Ill. 60521	$3

Computer Expander



UDAC's Model 160 Tape Deck

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

USES CARTRIDGES —

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

OPERATES IN FOUR MODES —

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

REPLACES P/T PUNCH AND HI-SPEED READER —

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

GIVES OEM'S A COMPETITIVE EDGE —

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

For complete technical and application data, contact:
Marketing Manager,

udac

Universal Data Acquisition Company
An MCA Tech. Division
11822 W. Olympic Blvd.
Los Angeles, California 90064
(213) 478-0261

LETTERS

Add dictum

Sir:
I read with considerable interest the article entitled "The Gemini" in your August 15th issue (p. 39).

However, while it all sounds quite exciting, I seem to remember a dictum from one of the Kludge papers: "Announce it first, worry about producing it later."

G. CRAWFORD BRYANT
Annapolis, Maryland

Watch your language

Sir:
In the August 15th issue there is an article about "The Gemini." It mentions a "Gemini Program Language" (GPL).

This happens, however, to stand for my "General Purpose Language."

Let me remind the Gemini people that IBM's new programming language once was called NPL. The National Physical Laboratory in England then threatened to turn out a language called "Infernal Bloody Mess." NPL became PL/I. I will see what I can do for the Gemini people if it becomes necessary.

JAN V. GARWICK
Manhattan Beach, California

Argonne energy

Sir:
After reading Mr. McCusker's article on the NASA COSMIC program (Sept. 1, p. 41), I felt compelled to write documenting some of the activities of the U.S. Atomic Energy Commission in the area of computer program dissemination; in particular, those of our local center.

The Argonne Code Center was established in 1960 at the request of the membership of the Mathematics and Computation Div. of the American Nuclear Society. It was created as an information center for computer programs developed and used for the solution of problems in reactor design and operation, nuclear physics, and engineering analysis.

While the staff level and operational costs are low compared to the space program's COSMIC effort—a 2.5 personnel level versus 20 and somewhat under $400,000 for our decade of operation compared to their $750,000 for the past three years—we are proud of the fact that about 5,000 program packages have been disseminated to AEC contractors, universities, public utilities, and other companies engaged in nuclear projects. The center staff is augmented by a supporting network of representatives from cooperating installations.

The AEC also contributes significantly to the maintenance and distribution of the shielding code collection of the Radiation Shielding Information Center at Oak Ridge National Laboratory, which has been in operation since 1963.

MARGARET K. BUTLER
Argonne National Laboratory
Argonne, Illinois

Have fun

Sir:
What makes Entrex's "Dumb Blond" such a novel concept? Dumb Blond predates the computer by several centuries, and I've spoken it fluently for years! In addition, the term "Dumb Blond" is as outdated as the shade of lipstick so vividly displayed in the Entrex advertisement (July 15, p. 83).

To be consistent with equal employment opportunity legislation, perhaps the language should be entitled "Quick and Easy Input" rather than "Dumb Blond." Both a dumb blond and simplicity are frequently beautiful and exciting, but this doesn't imply compatibility or equivalence. In fact, a wise man once said that "most dumb blonds are really smart brunettes."

Although we blonds do have more fun, it isn't clear that an Entrex 480 qualifies as something a blond would want to have fun with. What operating or outputting plans does Entrex have for a dumb blond when she's not inputting? Hmmmmm??

BLOND BRUCE
Westminster, California

Amort kills

Sir:
Ever since the hexadecimal system first appeared (IBM 360), everyone who has nothing better to do has been trying to invent a different notation. The subject is so beaten to death that one would think computer people are still in the Dark Ages worrying about absolute trivia (Letters, Sept. 1, p. 11).

The A-F notation has proven itself to be excellent from all viewpoints:

1. It is easily written because no new symbols have to be learned.
2. Existing recording media can be used instead of having to resort to special fonts and codes.
3. It can be orally enunciated and understood.
4. A child can learn it.

With respect to (3) some programmers use the Army designation of the letters—able for A, baker for B, etc., which is very convenient over the phone (which is why the Army adopted these designations).

However, good programmers don't even bother with this; instead they read as they see and pronounce the same way. Furthermore, even dense programmers learn the symbols, and after a little practice they can perform addition and subtraction almost as fast as in decimal notation.

Let's bury this subject for good and let's get to work solving problems.

ANTHONY AMORT
Eaton Yale & Towne
Kenosha, Wisconsin

Output error

Sir:
Your article, "Keypunch Replacement Equipment," in the June issue (p. 79), was in error regarding Data Instruments' DATAPLEX equipment. Several of the comparisons made were incorrect and others would tend to be misleading to your readers. When comparing DATAPLEX with other data handling methods, a basic problem occurs in that DATAPLEX totally eliminates the need for keypunch equipment rather than simply replacing the function of this equipment. DATAPLEX could better be categorized as a true "source data automation system."

With DATAPLEX, information ultimately destined for computer input is captured when it is first typed and does not ever have to be manually typed, keyed, or handled again on its way to the computer. (The information also does not have to be manual-

ly batched, coded, verified, or pooled.)

When the information is typed on DATAPLEX recording typewriters, it is also captured on a magnetic-tape cassette (like a carbon copy). The recorded digital information is then taken from the cassettes and reformatted at the DATAPLEX processor in accordance with preprogrammed format instructions. The output of the processor is a computer-compatible magnetic tape completely formatted and in the desired language for input to the user's mainframe computer.

Thus, by capturing the data at its origin on cassettes as a part of normal business activity and then processing the information all by machine, DATAPLEX truly eliminates the need for all manual operations associated with keypunch, key-to-tape, key-to-crt, or key-to-disc.

Because of this totally automated data handling approach, it is difficult to compare DATAPLEX with the more traditional forms of data preparation. Hopefully, you will develop a new category or classification so that more accurate and useful comparisons can be made in the future.

ROBERT D. SLAGLE
Data Instruments Company
Sepulveda, California

Ethnocentric kick

Sir:
Your recent survey in the June issue of keypunch replacement equipment was extremely well done and I read it with great interest. However, with the ethnocentricity typical of a U.S. magazine, you ignored all such systems of non-American manufacture.

Elbit Computers, Ltd., has been building and delivering the Validata key-to-tape system since January 1969 with over 10 installations presently operating here in Israel and another two in Europe. The Validata system is of the shared-processor type and is based on the use of the Elbit 100 minicomputer. In one of the major banks here in Israel where Validata has been in use for over a year, the following costs savings have been achieved over the previous paper tape system used.

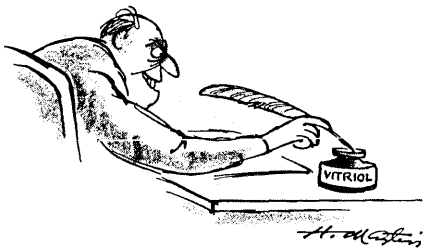
1. Monthly costs: Paper tape system I£ 115,000. Validata I£ 80,000.
2. Main computer savings: With the paper tape system, the bank was using 4½ hours/day of 360/40 time for data entry and editing. With Validata, this has been reduced to one hour a day. Based on a figure of I£ 750/hour for 360/40 time, savings of I£ 65,000 per month have been realized.

Recently Control Data acquired a controlling interest in Elbit and will use its wide network of sales and service organizations to market our products.

LEONARD DREYER
Elbit Computers, Ltd.
Haifa, Israel

Mod PL/I

Sir:
In his article "Can COBOL Cope?" (Sept. 1, p. 42), Peter Vaughn neatly describes the need for modular programming and the steps that



should be followed. He very aptly comments on "the fundamental hostility of the COBOL environment to modular design." But he fails to mention the hope of the future. Developed in a remote corner of the computer world, PL/I combines the excellent structure features of COBOL with extensions of the modular facilities provided by ALGOL.

The search for an adequate programming language should at least start with a language based on the COBOL experiences, rather than on COBOL itself. Certainly PL/I is a large language; that is because it provides many facilities to the user. Certainly PL/I has problems; I might mention the conversion rules. But PL/I was designed with modular programming in mind from the start.

WILFRED J. HANSEN
Argonne National Laboratory
Argonne, Illinois

Catalyst analyst

Sir:
Robert C. Maegerlein describes some of the attributes of a good systems analyst in his article "A Different Breed" in your Aug. 1 issue. A good systems man certainly must have creative ability, be critical—even rebellious—and might just be "some kind of a nut." It is completely ridiculous to suggest that he should decide his own projects and determine his own goals. With that sort of stipulation, what we have defined are the empire-building, systemization-for-its-own-sake prima donnas that the profession can well do without. These are the sort that consider management's, or the user department's, requests too trivial to concern themselves with, who move on once the "fun-part" is over, and who consider the problems of implementation, not to mention documentation, a bore.

Eric Hoffer's "The True Believer" seems to be the basis for this article and, I think, he would be quite surprised to see a difference noted between the Army's attempt at organizing a mass movement—unquestioning obedience—and the Green Beret approach, which seems to involve somewhat more esprit de corps. I would prefer an individual who was not as susceptible to mass movement psychology, but rather one who is intellectually independent, can communicate his ideas, lucidly, and understand ideas and problems of others with sensitivity.

J. N. PIKE
Vancouver, B.C.

Yes today

Sir:
I have just read Peter Vaughn's "Can COBOL Cope?" (with modular programming) in the Sept. 1 issue. It occurs to me that I answered the question his title poses in my DATAMATION article "Modular Programming in COBOL" (May '68, p. 50). The answer was affirmative.

HARRY T. HICKS, JR.
Information Management, Inc.
San Francisco, California

Maya doesn't ad up

Sir:
The more I see that ad "The Mayas made your computer possible . . . Katun can make it work" (Aug. 15, inside front cover), the more I am annoyed by its arrogant sophistry. To imply that the Mayas had anything to do with the development of electronic computers by western technological civilization is at best wishful thinking (perhaps future historians

(Continued on page 133)

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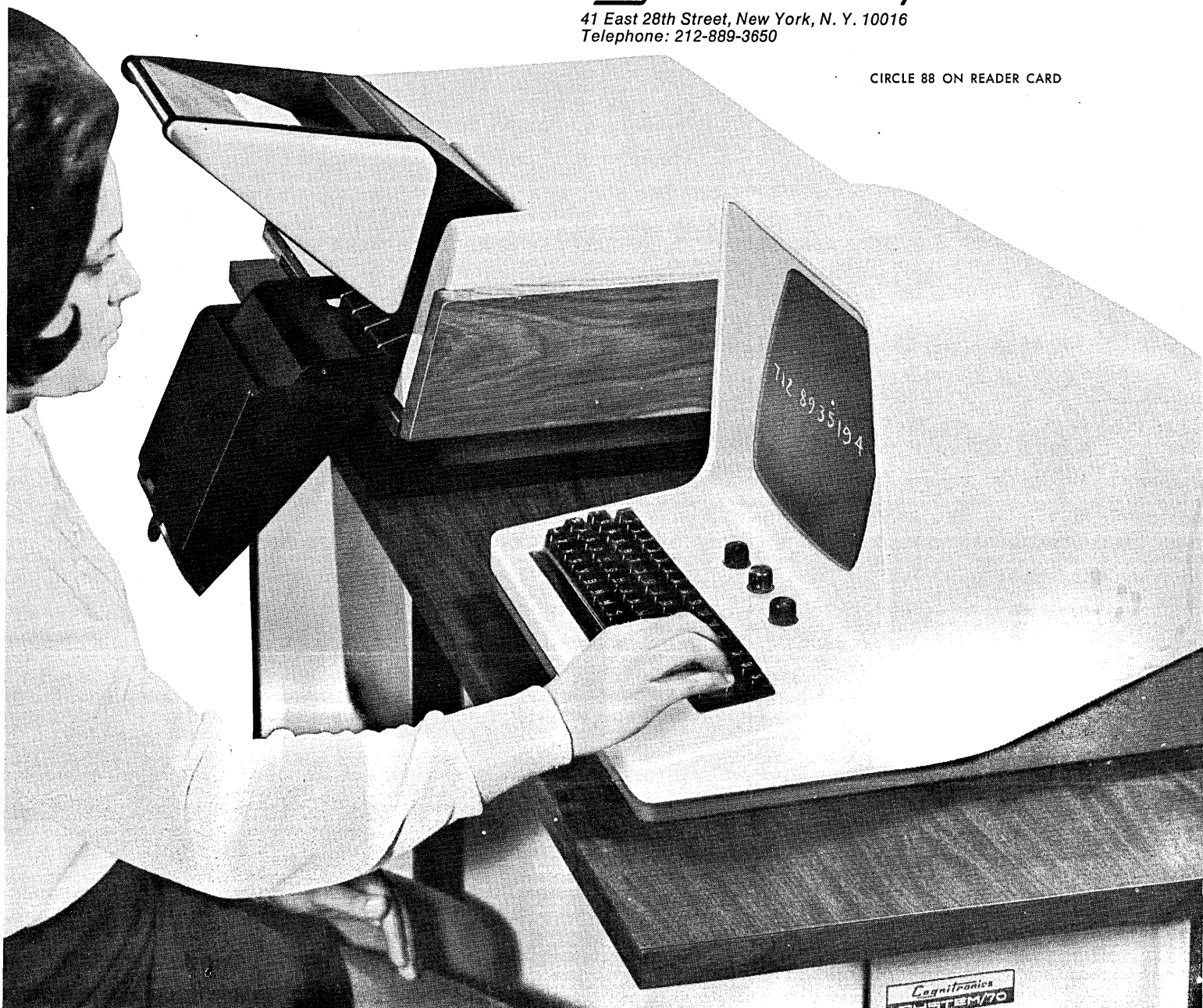

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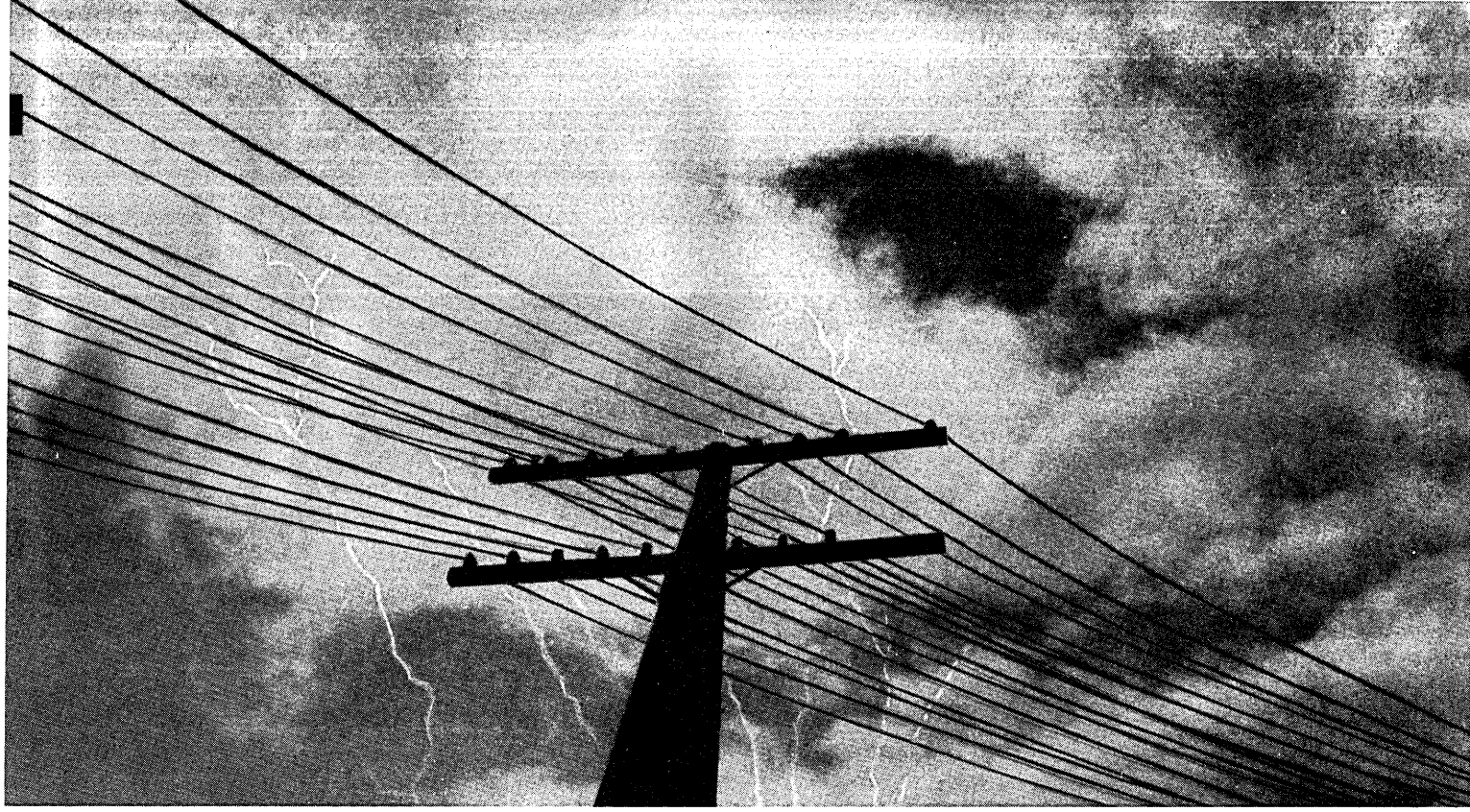

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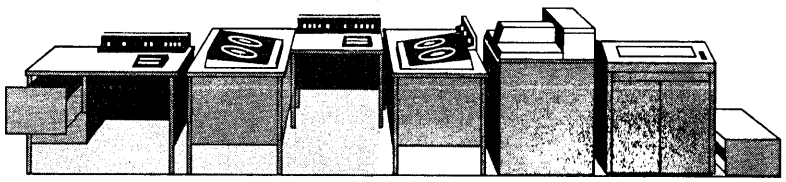

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LOOK AHEAD

HASN'T 1970 BEEN AWFUL!

Long-faced sources say IBM will reach only one-third of shipment quota for 1970 and tallies for other mainframers will start at "not bad" and end with "disastrous." Others disagree with IBM figures, claiming World Trade should make up for domestic failures. 1970 was a time when the Nix-onian economy and the end of a technical cycle crashed in a bad accident, they say, and '71 is supposed to be better.

TRW, THREE USERS FORMING CANADIAN DP FIRM

Abandoning their own computer centers are three Canadian outfits who, with TRW Inc., are forming what would become the largest dp firm north of the border. We hear each will be equal partners in the venture, which has a name like Canadian Systems Ltd., in Toronto, and the three users will throw their computing gear into the kitty.

The firm, with personnel contributed by all four, will provide dp and software services to outside customers and to the three: T. Eaton Co., leading Toronto department store; London Life Insurance Co.; and Steel Co. of Canada Ltd. Word is they'll also get into civil systems, like urban planning, but with TRW know-how they can be expected to get into development of medical systems, traffic and environmental control, and the like.

LEAR SIEGLER ACTIVE IN DP MERGER SEARCH

Giant Lear Siegler, Inc. (1970 sales: $566 million) has been looking into edp industry mergers "more intensely than ever before" in recent months, talks on the average with one prospect a day, and is especially interested in firms with products related to data communications. Sources say the recent agreement to manufacture some 12,000 20-pound portable terminals for Data Input Devices may grow into a merger. LSI naturally isn't commenting. But Philips W. Smith, corporate director of communications and information systems, says its acquisition of a controlling interest in Applied Computer Time Share, Inc. (ACTS) of Detroit provides LSI with a "vehicle for moves into the data communications field."

It also provides ACTS with a big potential customer. Lear Siegler operates some 20 companies in the midwestern area served by ACTS which could very well be hooked into the time-share company's five computers. LSI's total corporate bill for edp runs from $8-12 million a year, with 95% of it on remote batch.

SOME 67s RETURNED, OTHERS JUST COST MONEY

With 360/67s coming back to IBM from time-sharing firms (Computers Unlimited, Virtual Computer Services, both now defunct, and Mega Systems, still alive), it looks like that machine isn't easy to make money on. Despite an infusion of $1.5 million from Beneficial Finance early this year, VCS couldn't make it in the down economy and closed its doors last month. Mega unloaded its 67 and now services its customers on a 67 owned by Insco, a servicing subsidiary of Continental Insurance. Mega has a facilities management contract with Insco (which is planning two more 67s) and hopes to sign up more FM customers. It also is offering new fixed-price deals for its own

XDS 940 and GE 400 series systems on the basis of guarantee of usage or a percentage of the system. Not making money yet, Mega has at least achieved a positive cash flow.

Some big 67 troubles, besides financing, have stemmed from the system itself. Two firms that seem to be making it, Computer Software Systems, Inc., and Interactive Data Corp., have had the advantage of being run by members of the team that developed the Cambridge Monitoring System for the 67, and both have since put several hundred thousand dollars into improving it. CSSI, Stamford, Conn., has had some personnel cutbacks, but claims it'll be in the black with its three 67s this year. IDC, financial services specialist in Waltham, Mass., says it is "very close."

MINI MAKERS EYE END USER SALES

OEM-oriented mini makers are increasingly emphasizing end user sales. In the poor economy, firms have found many discount orders from small systems houses cancelled as the latter went under or had to pull back. Too, big orders were strung out over longer periods of time, wreaking some havoc on production schedules. We're told the turnaround has occurred, but it's still "mostly psychological."

DP FIRM STARTS WALL STREET BUZZ

For a change, Wall Street is hot on an edp firm: Inforex. It just went public so can't talk now, but we hear it's No. 2 behind Computer Machinery Corp. in number of shared-processor stations installed and hasn't been hurt by the economy because of its low per-station cost, $120/mo. On the same front, Systems Engineering Labs announced minicomputers late in September and may be able to use them in a more price-competitive Keytran system.

RUMORS AND RAW RANDOM DATA

While we await the Univac 1110 – to be announced around FJCC time – we learn that a stripped-down version of the 1110 that is still more powerful than the 1108 is in the works, as is the 1112 . . . Univac has been keeping a bright light under a bushel. More than 18,500 of its VP and VIP keypunches have been shipped, and though no figures are in, they have replaced many IBM counterparts. One big example, 50 at Royal Globe . . . After the Civil Aeronautics Board tabled a proposed contract between 11 big airlines and Atar Computer Systems, Inc., for a common automated reservations system (see p. 85) the airlines late last month withdrew from the agreement. Thus all parties are released to proceed individually . . . Maintenance firm, Comma Corp., has captured contracts with 12 peripherals vendors and with computer users owning about a hundred 360 systems . . . Computer Synectics, Inc., Santa Clara, will begin selling its computer monitoring equipment in Europe and Japan. It introduced its line at Computer '70 in London. Earlier it received $1 million in new financing and hired a new president, Philippe Yaconelli . . . We hear that George Forsythe of Stanford, former ACM president, is slated to give a paper at the Counter-Conference in Colorado next year . . . The heads on an IBM 3330, flying at a mere 40 micro-inches above the disc surface, can be damaged by cigarette smoke. Which prompts one wit to remark that maybe this hazard should be printed on the package.

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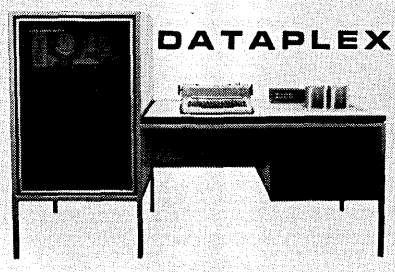
DATA INSTRUMENTS



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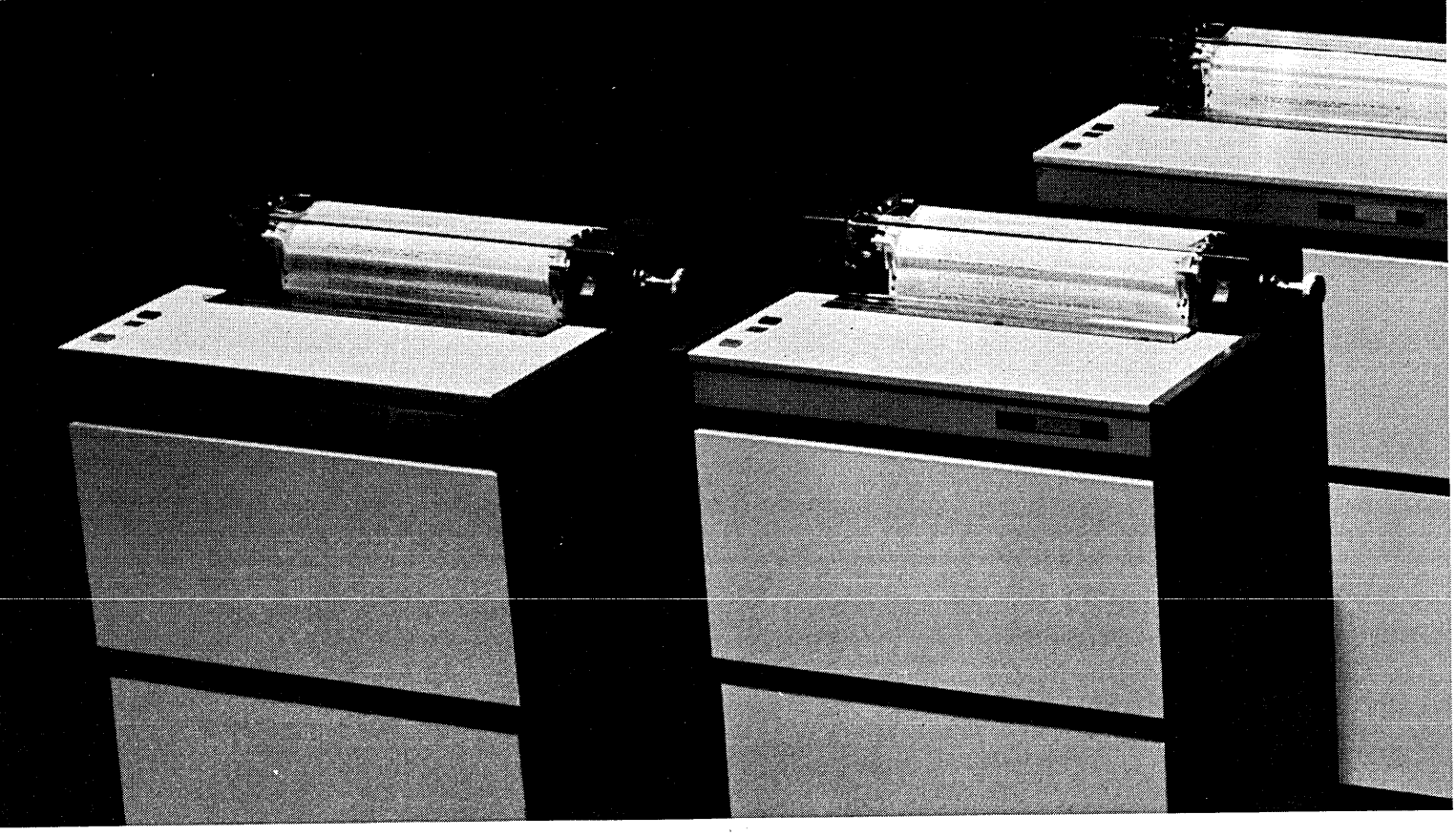

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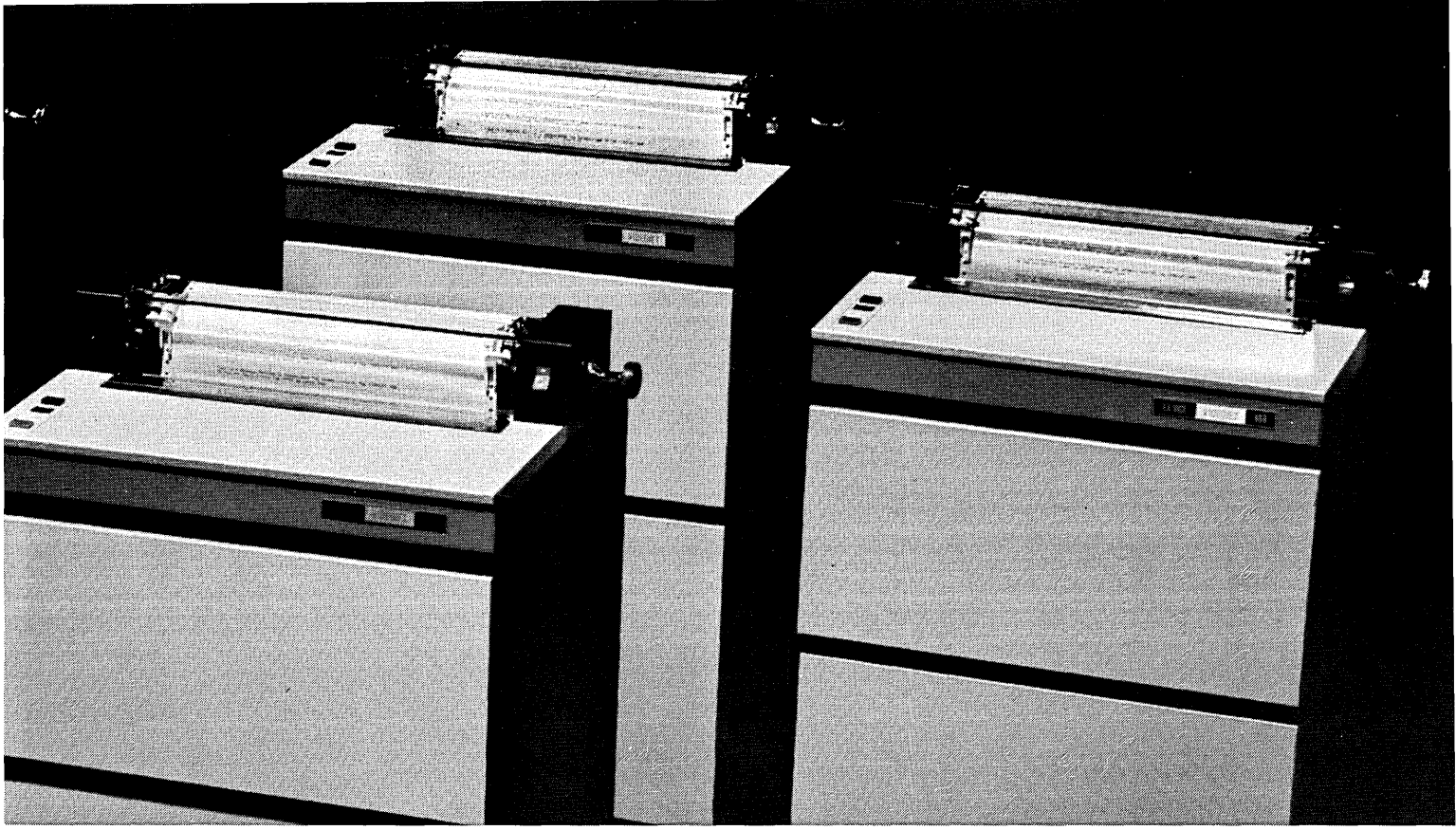

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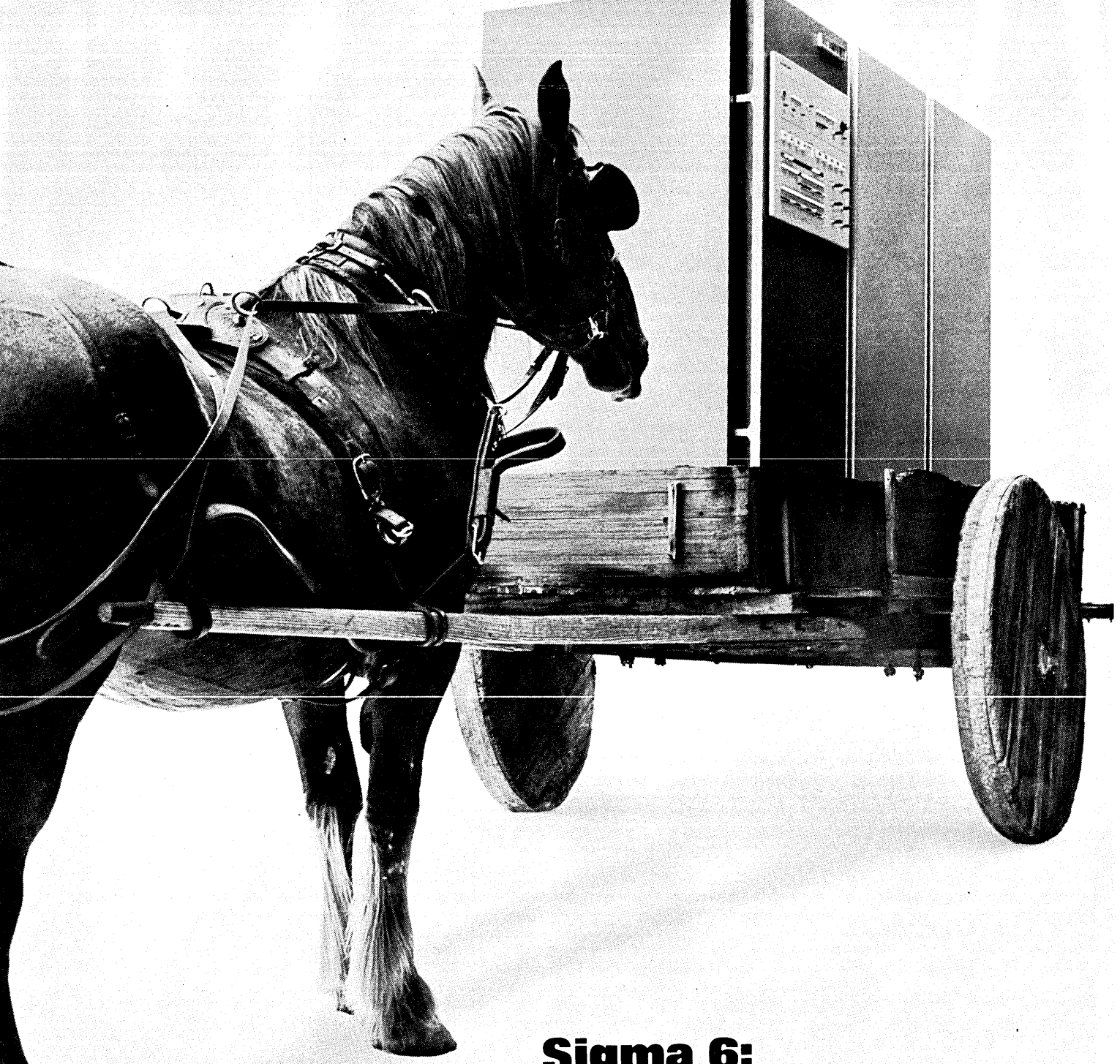

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XDS

Xerox Data System
El Segundo, Californi

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Flavors of Compatibility

A significant historic trend toward the greater availability of replacement components like core memories and units like tape drives is readily observable. No longer restricted to a single vendor for all elements of a system, the knowledgeable and cost-conscious user can get from other sources such units as disc drives, communications control units, and a variety of terminal-control unit combinations.

Each of these is more or less compatible with the unit it is replacing. In some cases, only the nameplate and price are different. In others, the same function is provided but programming and/or software changes may be necessary to exploit the substitute device.

None of these should be confused (but frequently are) with similar devices that require special engineering, special hardware, *and* special software prior to attachment.

This issue of *Datamation* contains a survey of plug-compatible discs, tape units, and core memories, illustrating just how far this trend has gone. To further help our industry be aware of what's offered by various vendors, *Datamation* is in the throes of publishing a *Datamation* Industry Directory (DID) with distribution scheduled for the second quarter of 1971.

In planning DID, we reviewed the trends now present in the field to determine how to arrange, catalog, and index the 30,000-or-so products, supplies, and services we plan to list. As we proceeded with this categorization, it became apparent that compatibility will be the dominant theme for the next few years. In probing further, we found that compatibility comes in several flavors. Two are important to the industry in general. Therefore, we offer two definitions that helped the layout of DID and may help you deal with vendors.

First, there's *electronically plug compatible*, which refers to the physical and electronic aspects of compatibility or equivalence. Here, we are concerned not only with the number of pins but also the signal levels. *Logically compatible*, on the other hand, refers to the functional equivalence. That is, does the device respond in the same way as another device to commands, instructions, or control signals? For example, a disc unit that is electronically compatible might require additional programming to make it logically compatible.

Although these two types of compatibility have been offered separately for some time, a recent trend has been toward both types being offered in one engineering design. Thus replacement units can be procured without the specter of extra hardware black boxes or special software modifications.

In a hesitant sort of way, the industry is moving toward this "real"—that is, complete "replacement equivalent"—compatibility. In the meantime, the user would be wise to recognize the difference between the two flavors of compatibility. And be aware of the hidden programming costs inherent in system components that are merely electronically compatible.

—R. L. Patrick

Compatible disc drives, tape units, and large core storage are emphasized in our survey of this new form of unbundling

IBM Plug-to-Plug

by Cecil R. Frost

A new form of unbundling is emerging; the user is now getting a choice of computer peripherals whose price and performance characteristics are not controlled by the computer manufacturer. These unbundled peripheral equipments appeared in 1969 in sufficient numbers to trigger a general industry and government reevaluation of how systems should be procured. From all appearances, the 1970s are going to be banner years for this new industry—that of plug-to-plug compatible peripherals.

This survey article on plug-to-plug compatibility places major emphasis on magnetic disc drives, magnetic tape units and large core storage units which are plug-to-plug compatible with corresponding IBM System/360 peripheral equipments.

During the survey, it was noted that some manufacturers did not attempt to improve the state of the art to any major extent. They provide peripheral devices similar to S/360 peripheral devices at a large price differential. Other manufacturers offer peripheral devices with newer technology at a more modest price savings. The devices with newer technology offer shorter access times which, if properly used, will provide a significant increase in overall system performance. The improvement in performance will probably more than offset the price differential between the newer technology units and those which replicate the older technology.

Managers of data centers or other installations who depend upon cost effectiveness, through the ability to rapidly load/swap programs, should derive significant benefits from the use of plug-to-plug compatible peripheral devices.

The changing technology

Many of the IBM System/360 peripherals were first delivered in 1965. If a two-year development lead-time is assumed to be the norm, the peripherals delivered in 1965 were based on the technology of 1963 and 1964. By extrapolation, the peripherals which are being delivered for the first time this year represent the state of the art of 1968 and 1969. Thus, the manufacturers are now delivering products which have a five-year improvement in the state of the art. The following paragraphs summarize the more significant changes which have occurred these five years.

Large core storage. Large backing core storage units are now available in 8.3-million-byte units which have a cycle time of 3.0 usec or less, and sell for approximately three cents per bit. This represents a factor of at least two improvement in performance over the IBM 2361 for essentially the same cost.

Disc memories. The major improvements relate to higher recording densities, faster access times, and greater reliability. The higher recording densities are primarily the result of improved magnetic recording surfaces and proximity of the read/write heads to the recording surface. The faster access time usually relates to the utilization of a voice-coil actuator rather than the older hydraulic actuator. The improvement in reliability usually refers to the replacement of a mechanical detent with an electronic detent and the replacement of electromechanical relays with solid state electronics.

Some noncompatible disc drives provide higher transfer rates by means of higher rotational speeds, a technique which frequently introduces reliability problems. Bearing wear is considered to vary approximately as a function of the square of the rotational velocity. The use of a voice coil actuator usually reduces the access time by 50%, for an average access time of about 30 msec compared to a typical access time of 50 to 65 msec for hydraulic actuators. Magnetic disc memories offer recording capacities above 10^8 bytes for about 0.01 cents per bit.

Magnetic tape units. The typical magnetic tape unit of 1965 featured seven or nine tracks, non-return-to-zero recording (NRZ), 200 and/or 556 and/or 800 bit-per-inch (bpi) recording densities, and dual-capstan pinch roller drive. During rewind, the tape was subjected to variable and high tape speeds, uneven tensions and uneven layering on the take-up

reel. Pinch rollers aided the degradation process by embossing wear particles and other dirt into the oxide surface of the tape. The modern tape unit (such as the IBM 2420) features 1600 bpi, nine tracks, phase encoding, single capstan, and vacuum-column control of the tape during rewind. The loops are controlled in the vacuum columns during rewind, thus assuring near-constant tension and edge guidance. Tape speed is controlled by a servo-type system. The oxide surface is in contact with only the read/write head of the transport mechanism. During the high speed rewind, the head is moved out of the way. Read/write speeds have increased to 200 inches per second compared to the traditional 37.5, 75.0 or 112.5 ips. Transfer rates are now up to 320,000 bytes per second. Soon-to-be-announced tape units will boost this rate. Storage cost is usually around 0.0004 cents per bit (price of one transport and one reel of tape). Average access time for a 2400-foot reel is on the order of 72 seconds. Storage capacities exceed 10^7 bits per reel of tape.

Plug-to-plug compatibility

The three principal aspects to be evaluated when discussing plug-to-plug compatibility are: hardware, software, and performance. For the purpose of this survey and brevity of text, the word "compatible" should be interpreted to mean plug-to-plug compatibility in accordance with the following definitions:

Hardware. A new peripheral device is compatible with another device if the new device is physically and electrically interchangeable with that device, and neither the peripheral nor the equipment to which it connects requires any modification in order to effect the replacement. This requirement usually includes the ability to read the same media without rerecording or other conversion.

Software. A new peripheral device is compatible with another device if the new device functions properly within the computer system without any modifications or changes to the operating system, utility and diagnostic programs, input/output driver programs, and user programs. This implies that the peripheral will accept all standard function codes and formats and respond with all standard control responses and formats at the appropriate logic levels and timing intervals.

Performance. A new peripheral device is compatible with another device if the new device has performance characteristics such that the computer system operating characteristics are not degraded in any manner. As defined, performance is probably the most flexible of the three definitions, but also one which offers the user an improvement over the computer manufacturer's peripherals. Compatibility does not mean that performance is identical. This aspect is further amplified in a following section.

Benefits of plug-to-plug

The benefits derived from the use of plug-to-plug peripheral devices include general differences in technology which affect performance factors such as: access time, reliability, maintainability, and price. Each of these factors will be discussed.

A 50% reduction in disc access time is probably the most significant contribution to overall system performance. Many large data processing systems are still dependent on roll-in and roll-out of many small non-core-resident load modules. In a time sharing system, the sequence of accesses is generally not predefined and an average access time can be up to two or three times the time required to roll-in and execute the next load module. The ability to increase the system throughput capability by 30-50% while reducing lease costs of the discs by 20% is attractive.

Reliability and maintainability are usually interrelated and dependent upon the technology employed in the peripheral devices. The most notable improvements in disc drives include the replacement of several items such as control relays and the mechanical detent mechanisms with electronic devices. Magnetic tape units have been significantly improved through the use of a single capstan and a tape rewind

which uses the vacuum columns to maintain a uniform tension and guide the magnetic tape. Several other features are indicated in the survey tables.

A review of the "Delivery Lead" entries in the tables will indicate that the user can achieve significant improvements in delivery time with the utilization of plug-to-plug compatible peripherals. Assuming the expansion of a system is carried out on a business-like basis, an earlier delivery can mean the ability to satisfy requirements sooner. Rapid data center expansion, for example, to satisfy customer requirements can mean more business which, in turn, means more system loading and more revenue.

At first thought, a mixed facility might appear to be a disadvantage. It is not difficult to envision situations where two maintenance engineers could wind up in a shouting contest about what or who is to blame for problems in a mixed facility. This survey necessitated discussions with many salesmen, including those from IBM, who cover mixed installations. The track record of these installations is good and getting better. Some installations had early problems, but the proven equipment appears not to be creating problems. It appears, further, that IBM is being very cooperative, even to the point of occasionally assisting the suppliers of compatible peripherals in the initial debugging of interfaces.

Summary

As a rule, plug-to-plug compatible peripherals provide the facility manager with faster response times, lower cost, shorter lead time, and often decreased down-time for adjustments and repair. If the facility manager is somehow dependent upon overall performance for promotions, raises, bonuses, or other compensation, the plug-to-plug compatible peripheral devices are certain to be a factor in his facility.

THE DEVICES

The following sections describe the various plug-to-plug compatible peripheral devices considered during the survey. The discussions and tables are organized into replacements for the following IBM equipments:

2311 Disc Storage Drive
2314 Direct Access Storage Facility
2400-series Magnetic Tape Equipment
2361 Core Storage

All tables follow on pages 28 through 33.

Model 2311 replacements

The Model 2311 IBM Disc Storage Drive had been used on IBM S/360 computers since 1965, essentially without competition and subject solely to the IBM pricing structure. In 1969, several manufacturers produced and installed plug-to-plug compatible units which connected to the Model 2841 Storage Control Unit. Ten manufacturers and three end-user distributors responded to the survey questionnaire. The analyses of the pricing and characteristics data indicates that disc storage drives with similar characteristics are available for approximately 50% of the sales price and 80% of the lease price. (The lease prices include prime-shift maintenance.) The manufacturers have been very careful to preserve specific 2311 characteristics, such as: IBM disc pack, storage capacity, cylinder capacity, transfer rate, and the two major and related considerations of total hardware and software compatibility. The most significant area of nonconformity is that of access times.

All the vendors indicated that their unit was compatible or interchangeable with the Model 2311, and that special control units, other interfacing, and hardware and/or software modifications are not required. All manufacturers specified the standard IBM operating range, or better. All stated that the disc drive would accept all standard I/O commands and formats from the Model 2841 control unit and would return all standard status information, command responses, and formats. Most indicated that a read-only switch was standard. IBM has this feature on a RPQ basis (Request for special Price Quotation).

Model 2311 table descriptions

The descriptions of the 2311 replacements are divided into five areas: drive characteristics, access timing, drive cost data, marketing summary, and comments. The distributor is the company which sells or leases the product to the end user, and is not necessarily the manufacturer. The drive model number identifies the device which replaces the IBM 2311 Disc Storage Drive. The following paragraphs describe the meaning of each of the items under the five areas.

Storage capacity. This is the usable storage capacity of the disc drive, in bytes. In the majority of cases, the number is the same as the IBM 2311-1; i.e., 7.25 million bytes. One manufacturer shows 5.4 million bytes, which is the capacity of the IBM 2311-2.

Cylinder capacity. This figure represents the number of bytes which can be accessed without moving the read/write heads. In most instances, it is 36,000 bytes, which is the cylinder capacity of the IBM 2311-1.

Transfer rate. This number indicates how fast data can be transferred to or from the disc drive once the read/write heads are positioned over the correct cylinder and addressed record. The number is usually 156,000 bytes per second. Note that most references are identical to the IBM Model 2311-1, the entry in the third column of the table.

Read-only protect. This entry indicates if there is a panel switch on the disc drive which disables the write-circuitry so that the disc becomes a read-only memory. Most drives also have the capability to disable the write mode if the power supply power is below specification. This latter capability is not considered the implementation of read-only protect for the table.

Cylinder-to-cylinder access time. This is the time (in milliseconds) required to move the read/write heads from one cylinder to an adjacent cylinder.

Average access time. This is the time (in milliseconds) required to move the read/write heads from one cylinder to any other cylinder at random.

Full stroke access time. This is the time (in milli-

seconds) to move the read/write heads from the innermost to the outermost cylinder.

Lease price. This is the monthly lease price, based on a one-year lease period, with single shift (eight hours) maintenance.

Purchase price. This is the single-unit purchase price without maintenance.

Maintenance. This is the monthly payment necessary to obtain single-shift (eight hours) maintenance of the purchased disc drive. This figure includes parts and labor.

Delivery lead. This is the time, in months, between the time the order is placed and the time the disc drive is delivered.

First delivery. This is the month and year that the first production unit was installed in the customer's facilities.

Manufacturer. This entry is the name of the original equipment manufacturer.

Comments. This category is a "catch all" for miscellaneous information and indicates contractual relationships with regard to the sale and maintenance of the disc drives.

Model 2314 replacements

The IBM 2314 Direct Access Storage Facility was designed primarily for S/360 installations which require larger amounts of disc storage. The disc drives for the 2314 have the following designations: The 2312 is a single-spindle drive, the 2318 is a dual-spindle drive, and the 2313 is a four-spindle drive. Each spindle utilizes the Model 2316 Disc Pack, consisting of eleven discs mounted one-half inch apart on a vertical shift, and removable as an integral assembly. Two read/write heads approximate each of 20 oxide-coated recording surfaces, thereby providing 40 tracks which can be written onto or read from without repositioning the read/write heads. The 40-track (cylinder) capacity is 145,880 eight-bit bytes. The data transfer rate is 312,000 bytes per second. Each 2314 disc drive has about a four-times greater recording capacity and a two-times faster transfer rate than the Model 2311 disc drive.

As a general rule, most systems which require more than 36 million bytes of storage (five 2311s) will usually find it more cost effective to use a dual-spindle 2314 (2314 controller and 2318 dual-spindle drive) which has a capacity of 58 million bytes. Other factors to consider include the determination if the 2841 Storage Control Unit (for the 2311s) should or will also have 2303 Drum Storage Units or 2321 Data Cell Drives. The evaluation should also include an analysis of the sizes of the various files and effect of higher transfer rates on system performance. Systems close to the trade-off factor should be configured, priced, and analyzed for throughput several ways before the hardware is ordered.

Unlike the 2841 Storage Control Unit, the 2314 Storage Control Unit does not provide control for drum or data cell drives. The manufacturers of compatible peripheral devices did not attempt to replace the 2841 controller, whereas the manufacturers of 2314 plug-to-plug compatible disc drives also offer their own disc drive controller. Every manufacturer who responded to the survey questionnaire offered a controller which, according to the manufacturer, connects to a standard S/360 channel, accepts all S/360 I/O commands and data formats, and returns standard S/360 responses and data formats.

The Data Products disc system does not have operator-removable disc packs, but is included in the survey because it does offer hardware and software compatibility, and other interesting features, at a significant price differential.

The article did not address the considerations of start-up time (time to read first record after loading of a disc pack) and simultaneous head motion on one drive while reading or writing from another drive.

Model 2314 table descriptions

The Model 2311 table descriptions are also applicable to the Model 2314 table descriptions. Several additional entries are in the 2314 tables, however, and these entries are discussed in the following paragraphs.

Controller model number. For all but one manufacturer, a non-IBM controller is required as indicated.

Drives/controller. This is the maximum number of drives which can be connected to the controller identified in the previous line in the corresponding column. The number is assumed to be the quantity that can be addressed on-line unless otherwise indicated.

Controller cost data. Cost factors are self-explanatory and generally follow the same definitions as the corresponding cost factors for disc drives. A blank space indicates the cost data was not disclosed.

2400-series tape replacements

The IBM 2400 magnetic tape units come in Models 1 through 6, all of which employ a half-inch tape. Models 1, 2 and 3 record nine tracks at a single density of 800 bytes per inch. Models 4, 5 and 6 normally record at 1600 bytes per inch but with the dual density feature (option) they can also read or write at 800 bytes per inch NRZI. Each byte consists of 8 bits plus a parity bit. Models 1, 2 and 3 can be equipped with a seven-track compatibility feature (option). Tape densities of 200, 556, or 800 bytes per inch with odd or even parity check are provided by the option. A data converter option can be added to the seven-track compatibility feature to allow the reading or writing of seven-track binary data. Table 1 (above) summarizes the 2400-Series magnetic

Model No.	Recording Density (bytes/inch)	Transfer Rate (bytes/sec)	Tape Speed (inches/sec)	Encoding
2401-1	800	30,000	37.5	NRZ
2401-2	800	60,000	75	NRZ
2401-3	800	90,000	112.5	NRZ
2401-4	1600	60,000	37.5	Phase
2401-5	1600	120,000	75	Phase
2401-6	1600	180,000	112.5	Phase
2420-5	1600	160,000	100	Phase
2420-7	1600	320,000	200	Phase

Table 1.

(Continued on page 33)

IBM 2311 REPLACEMENTS

	DISTRIBUTOR	Bryant, Div. Ex-Cell-O Corp.	Calif. Computer Products, Inc.	IBM Corporation	Marshall Data Systems
	DRIVE MODEL NO.	1100	CD1	2311-1	M2500
DRIVE CHARACTERISTICS	STORAGE CAPACITY	7.25M	7.25M	7.25M	7.25M
	CYLINDER CAPACITY	38K	36K	36K	72.5K
	TRANSFER RATE	156K	156K	156K	156K
	READ-ONLY PROTECT	Yes	No	RPQ	Yes
ACCESS TIMING	CYLINDER-TO-CYLINDER	25	10	25	18
	AVERAGE ACCESS	75	30	75	48
	FULL-STROKE	135	60	135	65
DRIVE COST DATA	LEASE	460		570	495
	PURCHASE	15,000		24,745	13,000
	MAINTENANCE	50		55	66
MARKETING SUMMARY	DELIVERY LEAD	1	1	4	1
	FIRST DELIVERY	Sep. 1969	Aug. 1969	Approx. 1964	July 1968
	MANUFACTURER	Bryant	Century Data Sys.	IBM	Marshall Data Sys.
	COMMENTS	Part-for-part parallel design to 2311	Electromagnetic positioning and electronic detent	Hydraulic actuator and mechanical detent	Top and front access for maintenance

	DISTRIBUTOR	Memorex	Memorex	Peripherals General, Inc.	Potter Instrument Company, Inc.
	DRIVE MODEL NO.	620	630	711	DD4311
DRIVE CHARACTERISTICS	STORAGE CAPACITY	5.4M	7.25M	7.25M	7.25M
	CYLINDER CAPACITY	27K	36K	36K	36K
	TRANSFER RATE	156K	156K	156K	156K
	READ-ONLY PROTECT	Yes	Yes	Yes	Yes
ACCESS TIMING	CYLINDER-TO-CYLINDER	20	20	25	19
	AVERAGE ACCESS	50	50	75	55
	FULL-STROKE	80	80	135	110
DRIVE COST DATA	LEASE	415	475		450
	PURCHASE	11,500	12,000	17,000	18,100
	MAINTENANCE	125	125	55	50
MARKETING SUMMARY	DELIVERY LEAD	1	4	2	6
	FIRST DELIVERY	Feb. 1969	Apr. 1970	Apr. 1970	Dec. 1969
	MANUFACTURER	Memorex	Memorex	Peripherals Gen.	Potter Instrument
	COMMENTS	Three-moving-part actuator	Three-moving-part actuator	On-line and off-line test monitor unit	Eddy current brake, off-line test

	DISTRIBUTOR	Talcott Computer Leasing	Telex Computer Products Div.		
	DRIVE MODEL NO.	9311	5311		
DRIVE CHARACTERISTICS	STORAGE CAPACITY	7.25M	7.25M		
	CYLINDER CAPACITY	36K	36K		
	TRANSFER RATE	156K	156K		
	READ-ONLY PROTECT		No		
ACCESS TIMING	CYLINDER-TO-CYLINDER	15	10		
	AVERAGE ACCESS	73	30		
	FULL-STROKE	135	60		
DRIVE COST DATA	LEASE	400	525		
	PURCHASE	12,000	19,400		
	MAINTENANCE	54	55		
MARKETING SUMMARY	DELIVERY LEAD	1	1		
	FIRST DELIVERY	Apr. 1970	Aug. 1969		
	MANUFACTURER	Friden Div., Singer	Information Storage Systems		
	COMMENTS	Servo mechanism actuator-positioner	Electromagnetic actuator, one electronic adjustment		

IBM 2314 REPLACEMENTS

	DISTRIBUTOR	California Computer Products, Inc.	Data Products	IBM Corporation	Marshall Data Systems
GENERAL	DRIVE MODEL NO.	CD 12/CD 22	314	2312/2318/2313	M2700
	CONTROLLER MODEL NO.	CD 14	7361	2314	M2800
	DRIVES/CONTROLLER	8 + Spare	8	8 + Spare	8 + Spare
DRIVE CHARACTERISTICS	STORAGE CAPACITY	29M/58M	232M	29M	29M
	CYLINDER CAPACITY	145K	312K	145K	145K
	TRANSFER RATE	312K	234K	312K	312K
	READ-ONLY PROTECT	No	Yes	RPQ	Yes
ACCESS TIMING	CYLINDER-TO-CYLINDER	12	10	25	10
	AVERAGE ACCESS	33	55	60	30
	FULL-STROKE	65	100	130	60
DRIVE COST DATA	LEASE		2530	535/920/1745	430
	PURCHASE		98,000	24,105/41,640/78,885	18,000
	MAINTENANCE		400	75/135/240	
CONTROLLER COST DATA	LEASE		1470	1480	1300
	PURCHASE		60,000	66,835	52,000
	MAINTENANCE		150	60	
MARKETING	DELIVERY LEAD	3 to 6	12	9	8
	FIRST DELIVERY	March 1970	July 1970	Approx. 1965	Oct. 1970
	MANUFACTURER	Century Data Sys.	Data Products	IBM	Marshall Data Sys.
	COMMENTS	CD-12 single unit CD-22 dual unit.	Non-removable disks, up to 1.8 billion bytes.	2312–single unit 2318–dual unit 2313–quad unit	Top and front gives total access for maintenance

	DISTRIBUTOR	Memorex	Peripherals General	Potter Instrument Company, Inc.	Telex Corp.
GENERAL	DRIVE MODEL NO.	660	733	DD 4314	5312
	CONTROLLER MODEL NO.	661	IBM 2314	DC 5314	5328
	DRIVES/CONTROLLER	8 + Spare	8 + Spare		8 + Spare
DRIVE CHAR-ACTERISTICS	STORAGE CAPACITY	29M	29M	29M	29M
	CYLINDER CAPACITY	145K	145K	145K	145K
	TRANSFER RATE	312K	312K	312K	312K
	READ-ONLY PROTECT	Yes	Yes	Yes	No
ACCESS TIMING	CYLINDER-TO-CYLINDER	20	25	19	10
	AVERAGE ACCESS	50	60	55	32
	FULL-STROKE	80	130	110	60
DRIVE COST DATA	LEASE	430		380	435
	PURCHASE	18,000	18,000	20,000	17,400
	MAINTENANCE	72	60	50	60
CONTROLLER COST DATA	LEASE	1315		1200	1305
	PURCHASE	54,450		55,000	53,600
	MAINTENANCE	75		55	75
MARKETING	DELIVERY LEAD	4 to 6	3	1	5
	FIRST DELIVERY	June 1970	May 1970	May 1970	April 1970
	MANUFACTURER	MEMOREX	Peripherals General	Potter Instr.	Information Storage Systems
COMMENTS		Total floor space less than IBM 2314	Cannot mix 733s and IBM 2312s	Eddy current brake	Electronic positioning and detect

MAGNETIC TAPE UNIT REPLACEMENTS

	MANUFACTURER	Ampex Corporation				Bucode (OEM)
GENERAL	MODEL NO.	TM-1624 II	TM-1624 III	TM-1624 V	TM-1624 VI	20247
	REPLACES IBM MODEL	2401-2	2401-3	2401-5	2401-6	2420-7
FEATURES	NO. OF TRACKS	9*	9*	9	9	9
	RECORDING MODE	NRZ	NRZ	Phase	Phase	Phase
	AUTOMATIC THREADING	No	No	No	No	Yes
	READ BACKWARDS	Yes	Yes	Yes	Yes	Yes
PERFORMANCE DATA	TAPE SPEED	75	112.5	75	112.5	200
	RECORDING DENSITIES	800	800	800/1600	800/1600	1600
	DATA TRANSFER RATE	60	90	60/120	90/180	320
	REWIND TIME	90	90	90	90	60
COST DATA	LEASE RATE	400	520	435	530	
	PURCHASE PRICE	14,400	17,900	16,400	21,600	
	MAINTENANCE	70	86	82	98	
MARKETING SUMMARY	DELIVERY LEAD	3	3	3	3	3
	FIRST DELIVERY	Oct. 1968	Oct. 1968	Oct. 1968	Oct. 1968	Mar. 1970
REMARKS		*Seven track version available, GSA Contract, Auto-load feature, single capstan drive, vacuum-column rewind, servo control of tape speed.				See Text

	MANUFACTURER	Potter Instrument Company				
GEN-ERAL	MODEL NO.	SC 2402	SC 2403	SC 2405	SC 2406	AT 2425
	REPLACES IBM MODEL	2401-2	2401-3	2401-5	2401-6	2420-5
FEATURES	NO. OF TRACKS	9	9	9	9	9
	RECORDING MODE	NRZ	NRZ	Phase	Phase	Phase
	AUTOMATIC THREADING	No	No	No	No	Yes
	READ BACKWARDS	Yes	Yes	Yes	Yes	Yes
PERFORMANCE DATA	TAPE SPEED	75	112.5	75	112.5	100
	RECORDING DENSITIES	800	800	1600	1600	1600
	DATA TRANSFER RATE	60	90	120	180	160
	REWIND TIME	130	100	130	100	100
COST DATA	LEASE RATE	400	530	440	550	500
	PURCHASE PRICE	18,200	21,100	20,800	25,000	–
	MAINTENANCE	85	90	95	100	105
MARKETING SUMMARY	DELIVERY LEAD	1 or 2	1 or 2	1 or 2	1 or 2	1 or 2
	FIRST DELIVERY	1968	1968	1968	1968	Aug. 1970
REMARKS		Single capstan drives, vacuum-column rewind-automatic threading versions available. Potter TC5803 Controller replaces IBM 2803-1, 2.				See Text

	MANUFACTURER	Potter	Storage Technology Corporation			
GEN-ERAL	MODEL NO.	AT 2427	ST 2430	ST 2450	ST 2460	ST 2470
	REPLACES IBM MODEL	2420-7	2401-3	2420-5	2401-6	2420-7
FEATURES	NO. OF TRACKS	9	9	9	9	9
	RECORDING MODE	Phase	NRZ	Phaze	NRZ/Phase	Phase
	AUTOMATIC THREADING	Yes	Yes	Yes	Yes	Yes
	READ BACKWARDS	Yes	Yes	Yes	Yes	Yes
PERFORMANCE DATA	TAPE SPEED	200	112.5	100	112.5	200
	RECORDING DENSITIES	1600	800	1600	800/1600	1600
	DATA TRANSFER RATE	320	90	160	90/180	320
	REWIND TIME	75	60	60	60	60
COST DATA	LEASE RATE	885	545	515	555	820
	PURCHASE PRICE		25,000	24,000	27,000	37,000
	MAINTENANCE	115	105	100	110	110
MARKETING SUMMARY	DELIVERY LEAD	1 or 2	2	2	2	2
	FIRST DELIVERY	Oct. 1970	Nov. 1970	Jan. 1970	Sept. 1970	Oct. 1970
REMARKS		See Text	Cartridge loading, automatic threading, single capstan drive, 24-hour maintenance, many other technical features.			

	MANUFACTURER	Telex, Computer Products Division				
GEN-ERAL	MODEL NO.	4812	4822	4832	4852	4862
	REPLACES IBM MODEL	2401-1	2401-2	2401-3	2401-5	2401-6
FEATURES	NO. OF TRACKS	9*	9*	9*	9	9
	RECORDING MODE	Phase	Phase	Phase	Phase	Phase
	AUTOMATIC THREADING	No	No	No	No	No
	READ BACKWARDS	No	No	No	No	No
PERFORMANCE DATA	TAPE SPEED	37.5	75	112.5	75	112.5
	RECORDING DENSITIES	800	800	800	800/1600	800/1600
	DATA TRANSFER RATE	30	60	90	60/120	90/180
	REWIND TIME	80	80	80	60	60
COST DATA	LEASE RATE	310	435	530	480	540
	PURCHASE PRICE	15,740	17,020	19,340	19,900	25,170
	MAINTENANCE	62	70	86	82	98
MARKETING SUMMARY	DELIVERY LEAD	1	1	1	1	1
	FIRST DELIVERY	1969	1969	1969	1969	1969
REMARKS		*Seven-track version available, automatic loading.				

	MANUFACTURER	Telex	Texas Instruments			
GEN-ERAL	MODEL NO.	5420-7	924-2	924-3	924-5	924-6
	REPLACES IBM MODEL	2420-7	2401-2	2401-3	2401-5	2401-6
FEATURES	NO. OF TRACKS	9	9*	9*	9	9
	RECORDING MODE	Phase	NRZ/Ph	NRZ/Ph	NRZ/Ph	NRZ/Ph
	AUTOMATIC THREADING	Yes	No	No	No	No
	READ BACKWARDS	No	Yes	Yes	Yes	Yes
PERFORMANCE DATA	TAPE SPEED	200	75	112.5	75	112.5
	RECORDING DENSITIES	1600	800	800	1600	1600
	DATA TRANSFER RATE	320	60	90	120	180
	REWIND TIME	60	100	100	100	100
COST DATA	LEASE RATE	890	426	489	470	499
	PURCHASE PRICE	~45,000	11,400	11,900	11,700	12,500
	MAINTENANCE	120	109	138	131	160
MARKETING SUMMARY	DELIVERY LEAD	1	2 or 3	2 or 3	2 or 3	2 or 3
	FIRST DELIVERY	1969	Nov. 1969	Nov. 1969	Nov. 1969	Nov. 1969
REMARKS			*Seven-track version available, single capstan drive, vacuum-column rewind, 16-hour maintenance.			

IBM COMPATIBLE LARGE CORE STORAGE

GENERAL	MANUFACTURER	Ampex Corp.	Data Products	Fabri-Tek
	MODEL NUMBER	ECM-1/ECM-2	CM1720-1/CM1720-2	LCM207-10/LCM207-20
	REPLACES	2361-1/2361-2	2361-1/2361-2	2361-1/2361-2
PERFORMANCE	CYCLE TIME (S/360-50)	4.0	4.0	4.0
	CYCLE TIME (S/360-65)	2.8	3.0	2.8
	DUAL ACCESS	Yes	Option	Option
	ACCESS CAPACITY	8.3M	8.3M	8.3M
MARKETING	LEASE	6695/11,330	5425/9065	7655/13,277
	PURCHASE	289K/489K	244,150/407,400	235,000/423,000
	MAINTENANCE	375/575	375/575	375/575
	LEAD TIME	2	4 to 6	6 to 7
	FIRST S/360 DELIVERY	May 1969	July 1970	July 1970
COMMENTS			Faster versions available.	

GENERAL	MANUFACTURER	IBM	Lockheed Electronics	
	MODEL NUMBER	2361-1/2361-2	CM300-1/CM300-2	
	REPLACES		2361-1/2361-2	
PERFORMANCE	CYCLE TIME (S/360-50)	8.0	3.5	
	CYCLE TIME (S/360-65)	4.0	3.2	
	DUAL ACCESS	Option	Option	
	ACCESS CAPACITY	8.3M	8.3M	
MARKETING	LEASE	6495/10,990	–/–	
	PURCHASE	296,385/493,970	240,500/377,500	
	MAINTENANCE	375/575	375/575	
	LEAD TIME	individual schedule	6 to 9	
	FIRST S/360 DELIVERY	1968	Feb. 1971	
COMMENTS			Also 0.5M-byte version for S/360-50.	

Plug-to-plug . . .

tape transports.

The primary manufacturers of compatible peripherals are Ampex, Potter, Storage Technology, Telex, and Texas Instruments.

The remarks section in the tables contained enough space for all but the following comments. The Bucode 20247 is marketed to end users by Data Processing Financial and General Corporation. Potter offers the AT2424 (150 ips NRZ) and the AT2426 (150 ips phase). These two units are IBM compatible but don't directly replace any existing IBM model.

Mag tape table headings

The descriptions are broken into the categories of: General Features, Performance Data, Cost Data, Marketing Summary, and Remarks. The definitions of the items under these categories are given below. If the descriptions mean the same as those in the previous tables, the explanation is omitted.

Manufacturer. This is the name of the original equipment manufacturer. With one previously mentioned exception, these are also the companies which market the units to the end users and service the leased or purchased units.

Number of tracks. This number includes the number of bits that are recorded simultaneously across the width of the magnetic tape. The number includes a parity bit which is checked when read.

Recording. The entry means either nonreturn to zero (NRZ) or phase encoding or both.

Automatic threading. This indicates the capability to automatically thread the tape on the take-up reel, load the vacuum columns, move the tape to the load point (reflector), lower the read/write head and indicate ready to the operator and return ready status to the controller. Some units also include a power window which is automatically raised during the load process.

Read backwards. This feature is not usually con-

sidered critical but it does increase the efficiency of data sorts and merges, and other data processing applications. It might be a deciding factor when competitively comparing two otherwise equal contenders.

Tape speed. This number indicates the magnetic tape speed, in inches per second (ips), during read/write operations.

Recording densities. The recording density is usually expressed as bits per inch (bpi) but it really indicates bytes per inch as all bits of each byte are recorded simultaneously across the width of the tape. Many models offer seven tracks per inch as options, and this option normally indicates the ability to write or read tapes, compatible with the IBM 729 Series, at 200, 556, and/or 800 bpi.

Data transfer rate. The transfer rate is given in thousands of bytes per second.

Rewind time. This number indicates the time, in seconds, required to return the tape to the load point from the end-of-tape. Some of the numbers may indicate average rewind time and thus half of the maximum rewind time.

Lease rate. The lease rate is the cost of monthly rental including at least one shift of maintenance. The rate is according to the shortest term available, usually one year.

Purchase Price, Maintenance, Delivery Lead, First Delivery, and Comments have definitions similar to those specified for magnetic discs.

2361 core storage replacements

The S/360 2361 large core storage unit provides auxiliary fast access storage for the Model 50, 65, 67, and 75 computers. The 2361 may be used as an extension of main memory, as buffer storage between two computers, or intermediate storage between main memory and I/O devices, such as the 2314 disc system. Efficient use of the 2361 can minimize the wait-light syndrome in time sharing systems which are heavily dependent upon the random swapping of program load modules.

The manufacturers of plug-to-plug replacements for the 2361 are just starting to make deliveries. Ampex is the one notable exception. The first Ampex unit was delivered in May 1969. In general, the compatible equipments offer a factor of two, or better, access time and an improved delivery schedule for approximately equal price. The technology is not significantly different. Manufacturers have had less than two to four years for the development of new techniques.

There are some interesting aspects of the compatible large core memory units which the potential customer should be aware of prior to negotiations. Some of the manufacturers indicate that their core memories have access or cycle times far better than a S/360-50 can utilize. The effective access time is dependent upon the characteristics of the Model 8080 large storage attachment which must be added to the S/360 series to permit attachment of the 2361 or equivalent. The lower limit for access time appears to be between 3.0 and 4.0 usec for the S/360-50, and between 2.0 and 3.0 usec for the S/360-65, 67 or 75. The local sales representatives had different answers, but the highest probability numbers appear to be 4.0 and 3.0 usec for the S/360-50 and S/360-65 respectively. These figures relate to the hardware and software capabilities of the computers.

In addition to the above cautionary note, the addition of large core storage does not automatically improve the efficiency of the system. The efficiency of the system with bulk core is very dependent upon the data management techniques implemented on the computer system. As of this date, the manufacturers of compatible peripherals do not appear ready to take on the responsibility of assisting in or performing the appropriate modifications to the operating system and data management support software. There are installations which properly use plug-to-plug compatible large core storage. In general, however, the data processing manager is advised to investigate the above aspects prior to selection and implementation.

Because the Model 50 has a four byte data path and the Models 65, 67 and 75 have an eight byte data path, the data processing manager should study, determine and specify, prior to signing a contract, whether he will need the dual access (two computer) feature and whether or not the computers will require the different data-path widths. Factory installed options are straightforward. Later field modifications may be impossible or very expensive.

Large core table headings

The table headings are in agreement with the headings of the previous tables with the exception of the following:

Cycle time. The cycle times for the S/360-50 and S/360-65 are given in microseconds. The Model 65 is also representative of the Models 67 and 75. The timings include the consideration for the two different data path widths.

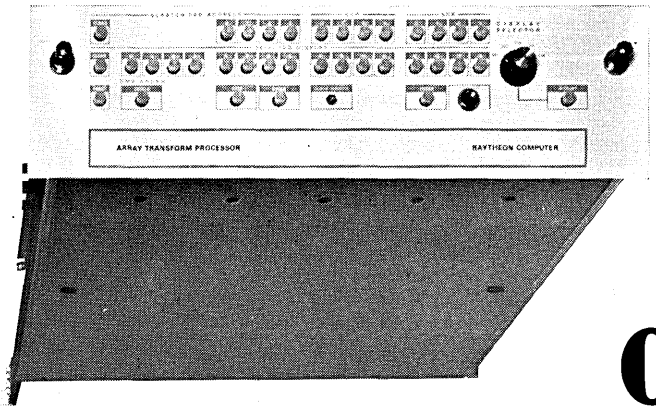
Dual access. This item refers to the capability to permit two computers to access bulk memory, including consideration for the two data-path widths.

Access capacity. This is the number of bytes of storage which can be connected and addressed. The number is usually 8.3 million bytes.

The 2361-1 is a one-million byte storage unit and the 2361-2 is a two-million byte storage unit. Up to four 2361-2s can be connected and addressed.

The other table entries have the same meanings as those used in the previous tables. ■

Mr. Frost is a senior computer systems consultant with Compata, Inc., Tarzana, California. He has had 14 years' experience in edp, including positions at Computer Sciences Corp., Control Data Corp., and RCA. He is also a part-time instructor at UCLA and has a BSEE from New York University.



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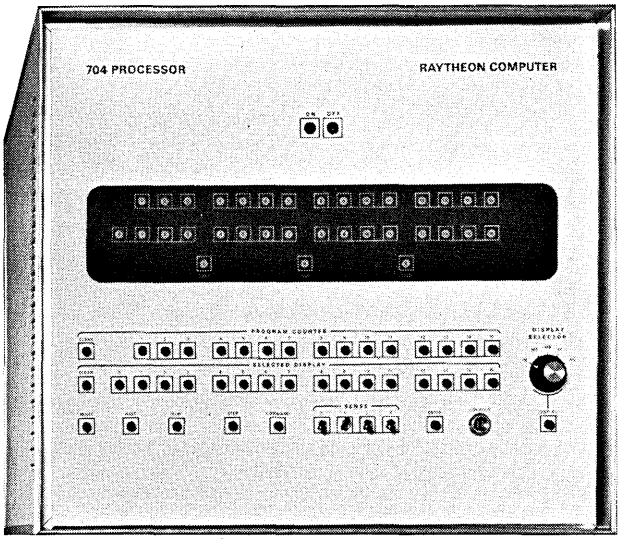

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PERSPECTIVE

an interpretive review of significant developments

Leasing Firms May Get a New Lease as Tight Money Forestalls Purchases

Money is tight, so how do you stretch it? One way is to get your computer from a leasing company.

In talking to the older leasing firms — Randolph, Boothe, Greyhound, Levin-Townsend, Leasco, and DPF&G — it is apparent that computer users are doing just that. Third-party leasing is treated very matter of factly these days, not at all as in 1967-68 when the "to lease or not to lease" question was cause for anxiety.

Of course there will still be some anxious moments when lessors get into binds through tight money and/or ill-judged and ill-managed acquisitions. Also, IBM has not stopped considering the lessors its competition; and although it no longer writes letters to that effect, it has priced new systems and maintenance to deter leasing companies from buying them as they did the 360.

The current lease market report has 360/40 and 50 machines in a sellers' market, with Model 30 and 65 systems moving at the whim of buyers. Cornelius T. Ryan, Randolph president, said Model 50s were in the super sellers' market category before the 370 announcement. Now prices are still firm but terms have softened. The contracts are being written for one to two years, not three or four as previously. The customer wants to keep his options open.

Model 65 was also hit by the 370, but Ryan feels that the 370/165 is directed at overloaded installations. He said Randolph's "good number" of 65s were, for the most part, secure in business installations that are not capacity bound. Randolph does keep busy though, selling the Model 30.

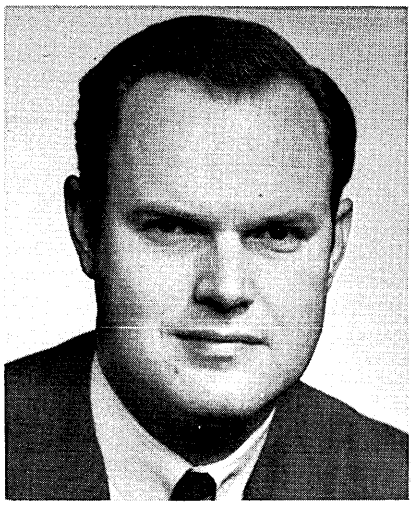
Levin-Townsend's James Townsend claims the "shortest terms and highest prices of any lessor" and says that his equipment is 99% committed when it is turned back. L-T, which had losses of $28.7 million in 1969, recently reported a profit of $713,510 for first quarter 1970.

This is an indicator of the market and also how badly a company can suffer by making ill-advised acquisitions. L-T staggered through the first part of this year ousting its president, writing off a losing gambling casino hotel and almost nonexistent restaurant franchises, and trying to find a merger partner that had a cash flow and could handle its debt to IBM. Its existence now is due to a rewrite of its deal for the IBM equipment, which pledges most of its equipment and assets to the computer giant as collateral.

Fluid situation

Liquidity has bothered some leasing companies as much as it has their customers. DPF&G, in a loss position because of runaway cost for its now sold-off service bureaus, recently decided increased cash flow was more important than its antitrust suit against IBM. The settlement was a rewrite of terms with IBM for the equipment that will reportedly pump $30 million more through the company in the next two years.

Today's tight money is also one of the reasons for lessors not showing a great interest in the 370. However, this is overshadowed by increased rental-to-price ratio and maintenance costs of the 370s.



Ryal R. Poppa

The pricing of new systems is, according to Ryal Poppa, ex-president of Greyhound, current president of DPF&G, and head of the lessors' association, IBM's most obvious means to limit leasing company growth.

The ratio is established by deducting maintenance charges from rental and dividing the remainder into the purchase price. The rent-to-purchase ratio for a Model 360/50 is 48.35 to 1. Maintenance costs add 2.90% to the total price. A 370/155 has a 53 to 1 ratio and 11.43% maintenance overhead.

Poppa doesn't consider these figures as bad as those for the Model 25 — 56.50 to 1 with 8.98% maintenance — or the 85 — 57 to 1 with 8.68%, which no lessor bought to any extent. But there is the opinion that despite user interest, the IBM 370 pricing policy will discourage the leasing companies. To date the firms haven't ordered the new systems for leasing. Leasco has ordered some for its overseas time-share network, but the general attitude is epitomized by Boothe Computer Corp.'s statement: "The ratio of rental to purchase price, including maintenance cost, of the 370 series, negates serious consideration on the part of either a user or a lessor to purchase the new line."

Paul Williams, Jr., Boothe president, said the company did not intend to acquire any 370 equipment. He noted that its cost is 160% of the rates lessors are now charging for 360s.

Ryan at Randolph isn't writing off the 370 so completely. He questions whether 360/50 users would find the move to 370/155 advantageous. Those moving from lease to rent would get a hefty cost increase due in large part to charges for second- and third-shift use of the computer. Lessors as a rule charge on the basis of a single shift. Ryan believes there will be selective buys of 370s by leasing companies. He said that although the profit probably won't be as good as with most 360s, it shouldn't be as bad as with the Model 25. Randolph has no 25s.

Lease on life

The future for the diversified companies seems brighter than that of the firms specializing in computer leasing. Except for L-T and DPF&G, who after attempts to broaden their corporate bases have reverted to being primarily leasing companies, all are

part of larger organizations. Randolph is a subsidiary of The Travelers Corp.; Greyhound has always been part of the bus company; and Leasco has been the only company to parlay itself into a corporation of which leasing is now a minor part.

None of the three has had the extreme troubles of L-T, although there were times when Leasco seemed shaky. Reliance Insurance does much to stabilize the company, but its main interest at present is to establish national and overseas time-share operations, which may cause some uneasy moments in the future.

Greyhound has had lower profits for the first half of 1970 — $1.7 million compared to $2.6 million in early 1969 — due to slow turnaround of systems and possibly an abiding inventory of 2311 disc drive replacements. But there is no cash-flow problem. It has a European operation built around MPL, a London-based dp service.

Randolph claims a $20 million annual cash flow. The company has taken advantage of this to set up a general leasing company in Luxembourg with the First National Bank of Boston and a joint company with Sanders Associates, to lease that company's displays. It has also established a "special-purpose partnership" with Century Data Systems to acquire and lease its disc drives.

Some of the new influences in leasing can be seen in the Randolph developments. Banks are taking a greater interest in the business. They prefer full payout (financial leases) rather than term (operational) contracts, and they are interested in general, not specialized, leasing.

DPF&G and Randolph indicate they are interested in general leasing. This could be the direction for DPF&G, which now has an interest in ACTS, a Detroit time-share operation, and the Berkeley Computer Corp., currently preparing a 500-channel t-s system. It also has a marketing agreement for Bucode's 2420 replacement tape drives.

Keep it busy

While the lessors are looking for opportunities for future expansion, they're still aware of the present necessity. "We've bought the equipment and must keep it earning revenue," said Townsend. "I don't care what announcements or market changes come along, they just make it easy or difficult to keep our stuff busy."

Levin-Townsend paid $158.5 million for its equipment, Randolph $175 million, Leasco $250 million, DPF&G $220 million, and Greyhound $217.6 million. Most of the equipment was bought in 1968, and the standard depreciation is for 10 years with 10% residual value. This means the final assessment of computer leasing won't be made until 1978. But one indication might be the statement made recently by a customer: "We've written our contracts and they're to our advantage. If the leasing companies have handled their accounting right, they'll be OK."

—John Wessler

Campus Computers: Target for Militants and Almost Anyone Else

As student disorders escalate, the militants are becoming more sophisticated in the ways of sabotage, and are increasingly turning toward campus computers as an easy — and highly effective — target. If the goal is not destruction and disruption, then perhaps a computer can be held for ransom. At any rate, it's evidently gotten through to the students that computers cost infinitely more and are much harder to replace than files and furniture in a dean's office.

The colleges themselves have been slow to react to this new threat. While bullet-proof glass and bars on windows have appeared at some campus computer centers, most are still among the most vulnerable facilities at the colleges. The CDC 3150 that was destroyed by two Molotov cocktails at Fresno State College in May was located only a few feet from ground-floor windows through which the firebombs were tossed by two students on foot. Only glass and venetian blinds stood between the hardware and the street. Curiously, at Queens College of the City Univ. of New York, the data processing personnel have been instructed to keep blinds down as "protection" from firebombs.

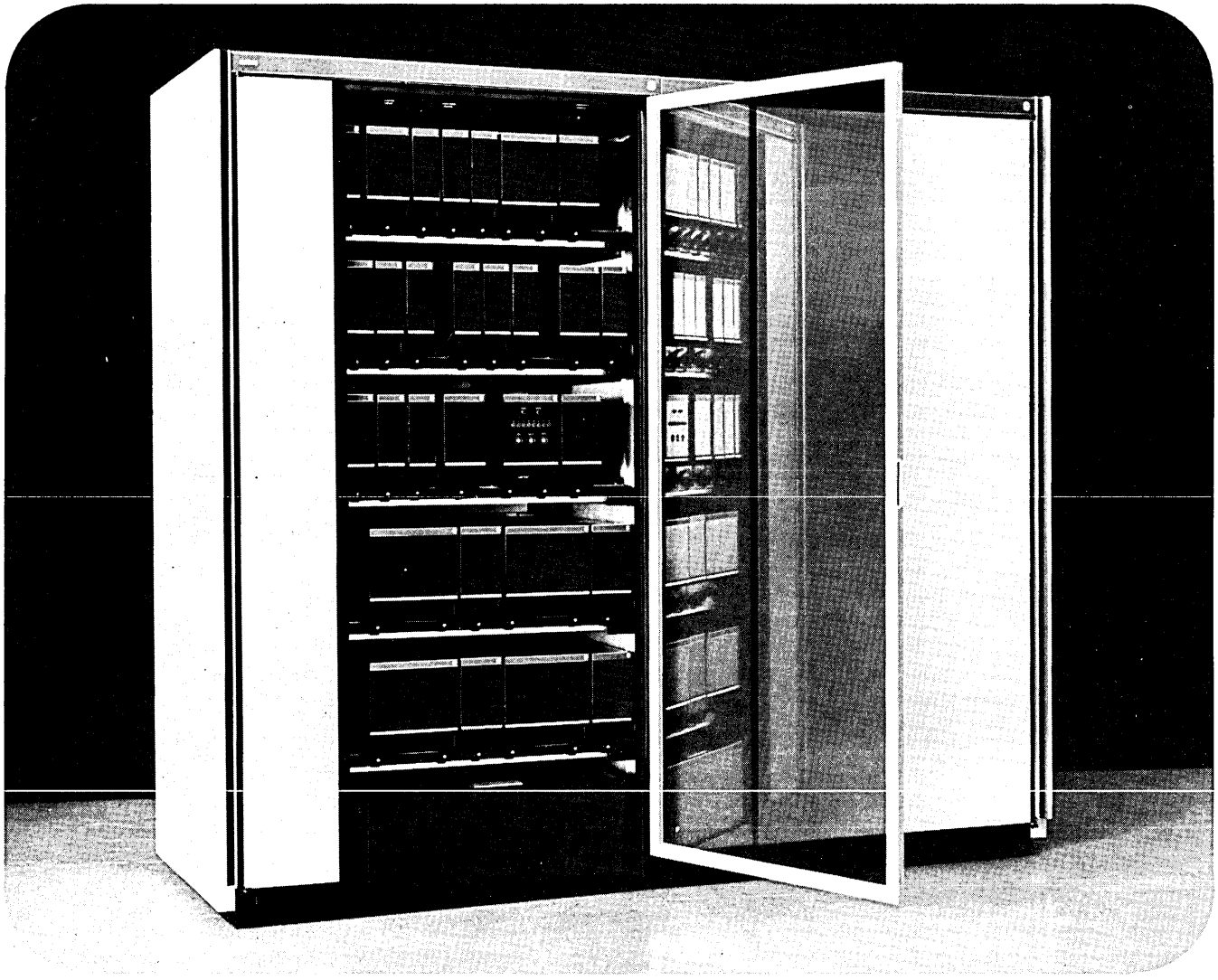
The problem of spurring college administrators into action is pointed up by efforts recently undertaken by the Stanford Univ. Computation Center to compile a survey of computers destroyed and their value. The information would be used in an effort to motivate the administration to provide more security.

Protection impetus

Perhaps the destruction of the Army Mathematics Research Center at the Univ. of Wisconsin in August will provide impetus to protecting computers. Four machines were destroyed in that blast, ranging in size from a CDC 3600 to a Honeywell DDP 124. And, of course, there was one fatality and three persons injured. The Fresno State incident would also have resulted in casualties except that of the two operators normally on duty at the time of the attack, one was out sick and the other had stepped out briefly to phone a programmer about a bug at the moment the Molotov cocktails struck.

It's doubtful if much could have been done to prevent the destruction of the Mathematics Research Center, which was apparently a well-conceived crime. Bullet-proof glass, which would have stopped the casually tossed Molotov cocktails at Fresno, would have offered slight resistance to the panel truck filled with dynamite that was planted at the Research Center. Still, more strict campus security measures possibly could have prevented entry or parking of the truck. Notably, the Univ. of Wisconsin has now added five additional campus policemen and is obtaining 24 more patrolmen from the Madison city police force. Only two weeks after the explosion, the state of Wisconsin provided $720,500 to enhance security at the university and other state buildings.

Most destruction is probably much more random than the Wisconsin incident, so a logical defense is to locate computers away from campuses. The trend toward increased use of remote access makes the physical location of



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ANOTHER REASON TO THINK COLLINS WHEN YOU THINK COMPUTER SYSTEMS

computers less important, whether they are used for academic or administrative purposes. A few computers have been relocated, notably at one college of the City Univ. of New York. This solution to avoidance of casual attacks on computers is easiest to accomplish in an urban environment, however. In New York, a computer center that is only a few blocks from its college may be well concealed by the anonymity of the great city. In Madison, Wis., it would be a lot harder to hide a computer center, even if it were miles away.

Evacuate Illiac

A conspicuous example of a planned off-campus location is the Illiac IV project at the Univ. of Illinois. This mammoth endeavor, originally commissioned by the Dept. of Defense as an $8 million job in 1966, is now running to $24 million in development costs. And, since DOD will have options for two-thirds of the available computer time, Illiac IV will be an obvious target for radicals who dislike the military.

Anti-Illiac protest marches early this year were followed by a request from the university that DOD locate the computer at an alternate site, away from the campus. The feeling is that by having the hardware off campus, the university would be able to isolate itself from the defense-related computation, yet still utilize Illiac capabilities through remote access. The Illiac IV itself is under construction at the Burroughs plant in Paoli, Pa., and is expected to be delivered early in 1972.

Computers are not always *destroyed* by radicals, however. In an incident at New York Univ. in July, more than 150 students held a computer center for ransom, saying they would take "appropriate action" if $100K bail was not raised by the university to free a Black Panther. The money wasn't delivered, and, fortunately, the computer center was not damaged when police moved in.

Save our computer

In some instances, computers seem to have lived a charmed life amid campus disorders. This has been attributed to such causes as students from lower economic levels depending upon aid programs that would be disrupted without computers to assist in their administration. And on some West Coast campuses, according to a high official, computers are often spared because many of the computer personnel are themselves involved in radical activities and wouldn't do anything to harm their livelihoods.

In one respect, colleges are fortunate: Most of them have located their computers wherever space was available, often in basements. Such facilities are easier to protect than the typical "fishbowl" installations that commercial organizations proudly build for their marvelous computers. But action must be taken to protect campus computers. The student revolt shows little sign of decline, and the sort of violence marked by the destruction of computers is apparently increasing. As of now, computers are a soft touch.

—F. Barry Nelson

Ma Bell to Consider Certifying Some Foreign Attachments, Sometime

AT&T last month agreed to consider certifying foreign attachments, an idea that independent terminal equipment manufacturers and many users of the switched telephone network have been promoting for some time.

Shortly before AT&T's offer surfaced, Dittberner Associates, a Bethesda consulting firm hired by FCC's Common Carrier Bureau, proposed a certification scheme that would lift present interconnection restrictions immediately. Under this plan, independent terminal manufacturers could provide network central signaling units and any data/voice access arrangements needed. Current tariffs require this coupling equipment to be supplied, owned, and maintained exclusively by the carriers.

Dittberner's report also suggested that some network protective features users now pay for aren't really necessary in every case. It questioned whether there is any need at all for data access arrangements in view of Bell's protracted delay in requiring them for private line service. "Leased lines present essentially the same personnel safety hazards and potential network harm as dialed circuits," the report said.

It estimates that lifting present interconnection restrictions would cause telephone common carriers to lose, over the next decade, some $3 billion in potential revenue just from network protective device rentals. "The total telecommunications equipment and services market will increase as a result of expanded interconnection, with the major short-term benefits accruing to computer and telecommunications equipment manufacturers in the form of an increased market share — largely at the expense of the Bell System."

NAS inspiration

Both the Dittberner report and the AT&T commentary were inspired by an earlier National Academy of Sciences study of the interconnection problem. That problem, basically, revolves around tariff provisions that: a) specify the signal levels that can be generated by independently made terminals connected to the switched telephone network; b) require the use of network central signaling units and data/voice access arrangements; and c) make the carriers exclusive suppliers of these devices. The carriers say the provisions are needed to safeguard the telephone network; their opponents argue that independently made equipment can be tested and certified safe before it goes into service, so the only reason for the carriers' monopoly over interconnection devices is to freeze out competitors. NAS, basically, concluded that the network can be adequately safeguarded either by relying on the tariff or by establishing a rather elaborate certification program and adding some new tariff provisions to control the design and manufacture, installation and maintenance of independently manufactured terminals and coupling devices.

Dittberner thought the NAS proposals were "technically sound" but difficult to implement because of

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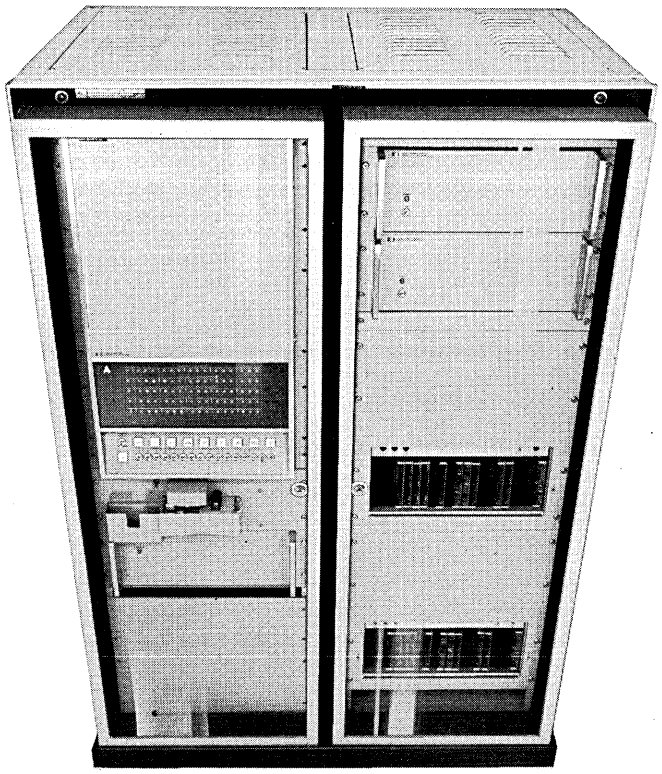

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the people and money required. The report makes it clear that if FCC implements the NAS certification plan, it will preserve the carriers' dominant position as suppliers of telecommunications equipment to users of the switched telephone system.

Ma Bell, in analyzing the NAS report, talked about services rather than markets. Basically, the company contended the NAS report vindicates AT&T's often-stated argument that service will be dangerously degraded if existing tariff regulations are monkeyed with. This contention isn't quite true, though.

The NAS report makes a significant distinction between the need for the signal level limits currently specified in the tariff, and the need for continuing the carrier's present monopoly over coupling units. Signal level limits, says the NAS, are essential; but independents could supply the connecting arrangements under "a properly authorized and enforced program of standards development, equipment certification, and controlled installation and maintenance."

The Dittberner report carries this idea even further.

The protection provided by carrier-supplied network access devices "is at least comparable to that of several other 'protection providing' alternatives that can result in greater economic benefits, increased competition, a more rapid pace of telecommunications innovation, and improved quality of service," Dittberner said.

The alternative preferred in the report is a standards/certification program "which is simple, effective, and inexpensive," covering equipment, installation, and maintenance personnel. Such a program is "necessary if the potential benefits of extended interconnection are to be realized."

Interconnect now

The public interest will be best served, adds the report, "by immediately extending interconnection privileges to leased line and nationwide public dialed telephone networks of U.S. common carriers." Tariff provisions requiring the use of carrier-supplied coupling devices should be removed. New provisions should be inserted at the same time, saying that customer-owned equipment can be directly connected "if the appropriate standards of network protection and personnel safety are met."

Dittberner proposes a "Joint Council of Telecommunications" composed of manufacturers, telecommunications users, and common carriers to develop standards and recommend them to the FCC for possible inclusion in the tariff.

Under Dittberner's proposed certification scheme, a telecommunications user who wanted to interconnect independently made equipment would have to let the carrier test it first. If the carrier rejected the installation, and the user felt victimized, he could appeal to FCC, which would operate, or contract for, testing facilities. The user would be liable for network damage if he failed to abide by these rules. Installation/maintenance of foreign attachments would be provided by either the carrier or an FCC-certified installation/maintenance specialist.

AT&T for one

When this plan is compared to the one favored by AT&T in its recent statement to FCC, it becomes clear that a Grand Canyon-sized gulf still separates the carriers from independent telecommunications makers and many users.

Certification, as AT&T envisions it, includes control over the manufacture of terminals and coupling equipment. Also, the certification program wouldn't begin until after all the needed standards were developed. (The Dittberner plan, by comparison, proposes immediate implementation.) And AT&T would let federal and state regulatory agencies jointly run the program.

The NAS report largely supports AT&T's certification plan, as the company's commentary to the FCC repeatedly points out. By emphasizing this point, Ma Bell's lawyers apparently are trying to make their plan seem unbiased and risk free. The corollary, of course, is that the other camp's solution is radical and dangerous.

AT&T's strategy could pay off. The commission majority seldom ventures very far out on a limb. ■

—Phil Hirsch

"And yet, all this is less complex than the brain of a chicken."

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Health agencies in the Buffalo area are discovering how dp can improve their services through a health data network

Medical Network

by E. R. Gabrieli

Twenty years ago the total outlay for the entire health field in our national budget was around $13 billion. By 1960 this amount increased to $27 billion and by 1968 to $63 billion. Predictions are (*Fortune*, Jan., 1970) that by 1980 this figure may reach $200 billion, so that medical care will become the largest "industry" in our national economy. This spectacular growth reflects not only progress in all fields of medicine, but also increased awareness of the importance of health matters in our affluent society, and our changed cultural attitude toward the community's responsibility in providing health services. These attitudes culminated in Public Law 89-749, the Comprehensive Health Planning and Public Service Act of 1966, which specifies the right to "the highest level of health attainable for every person." The law guaranteed the right to health for every citizen and made the delivery of the best attainable health services a major national concern and a major economic risk.

Four years after the declaration of war against illness and the definition of our responsibilities toward the sick, some of the emerging problems are definable. All parties concerned entered this new era of health care with the anticipation that additional funds through various assistance programs would eliminate disparity in the health system: every patient would be treated like a private patient. Experience has shown that the cost of health services has climbed much faster than the cost of living indices. The private practice approach, excellent on a limited scale, seems to fail on a larger scale. Not only are our economists concerned about costs, but some social scientists warn us that the trend is disaster-prone, that it may upset our precarious socio-economic equilibrium. Despite the vast funds allocated for health (something like 6.8% of the gross national product), presently "for many millions of people the frustrating, unsuccessful struggle to obtain health care is as American as apple pie." (Assistant Secretary for Health, Dr. Roger O. Egeberg, *Hospital Tribune*, Feb. 9, 1970, p. 1.) Legislation declared war on illness, but our health industry failed to expand to a "war economy" when more funds were poured into the system.

Traditionally, medical practice is operationally fragmented. Each practitioner is a separate subunit with his own goals and associations. His functions are patient-oriented rather than concerned with institutional efficiency. This assures continuity of care in home, office, and hospital. The pregnant woman "learns" her obstetrician during the prenatal period and finds him a great source of comfort when labor begins. Admittedly, efficiency could be increased if clinics would provide the obstetrical services and a few obstetricians could supervise a large labor wing. This could, however, destroy the precious human element that is so important to the patient.

When the student of systems-thinking considers

other aspects of health services, he finds it amazing that physicians can tolerate the burden placed on them by the fiscal agencies, hospitals, and the "industry." The health insurance offered to the public was designed to relieve the insured from all red tape when illness struck. This benefit was appreciated by the patient, but the clerical burdens of the physician's office began to mount. Actually, the physician had to act as if he were the insured; to collect his fees he had to write more and more certificates and reports, fill out claim forms, and bargain for his fee. This was perhaps a wise fiscal policy at the time the system was designed, but slowly it increased the clerical overhead of the physician and placed a growing demand on his time to formulate the acceptable phrase for each insurance company.

Other insurance policies had an even more profound impact on clinical medicine: inadvertently they shaped some fundamental medical habits. When multiple laboratory studies, X-ray examination, or several consultations were needed, the best course of action was hospitalization. By formulating policies so that hospitalization is "covered" while office visits are not (or are covered only to a limited degree), the insurance companies *de facto* encouraged hospitalization. In many cases the same diagnostic study could have been done equally well in the office. Currently, the American practitioner is accustomed to hospitalize when extensive studies are needed, private office practice being geared to handle only lighter cases. Since the cost of hospitalization now approaches $100 per day, much could be done to control rising costs by encouraging office visits rather than hospitalization.

Add to this already complex problem the shortage of skilled physicians and the fund raising rivalry among hospitals. All these factors aggravate the internal frictions of the system. Subgoals geared to institutions lead to waste of resources and low levels of efficiency. It is understandable that this fragmented industry could not step up efficiency simply by pouring in funds. Instead the inefficiencies led to more bottlenecks, frustrations, and disappointments.

Can dp fill the need?

Perhaps the greatest problem in the health industry is the unavailability of primary data. The physician maintains medical records in his office and in the hospital. These records, created only for the immediate use of the recorder, are informal, *ad hoc,* inaccessible, and often illegible. Because they often contain confidential data, such records are kept under lock and key in the office and in a special area of the hospital guarded by specially trained medical record librarians.

Health departments fight valiantly to report contagious diseases and other important data, but their efforts are greatly limited by the inherent informality of medical recording and the reluctance of the individual physician to release data. The doctor feels that once he has given out data he cannot assure his patient's privacy, which he rightly regards as a major ethical responsibility.

Without adequate hard data, health planners have become accustomed to gather "population samples" and expert opinions for background information, and then design "programs" for national use. Considering the sophistication of market analysis in all other industries, the outsider may wonder how the health industry, lacking the minimal needed facts, can operate. The dedicated public health leaders design their programs, care plans, and even the largest health service assistance programs on personal opinions, intuition, and broad assumption—all the available substitutes for hard facts.

As computers began to absorb more and more of our nation's data handling, medical computing was proposed by the hardware manufacturers. Actually, several major manufacturers invested substantial efforts to "give" medicine a data system. These attempts were generally ignored by the medical profession, and, at a recent small AMA planning meeting on medical computing, a prominent member of the funding team of the federal government, personally responsible for the establishment of many large computer installations, raised the question of whether computers have anything to offer to medicine.

Apathy and action

Retrospectively, it is not difficult to diagnose some of the reasons for the apathy of medicine toward electronic data processing. The physician has grown wary of external pressures. During the last two decades many self-appointed prophets have criticized medicine and offered simple solutions to the profession whose members have the longest educational training and are generally characterized by dedication and high intellectual standards. When a representative of computer manufacturers applies marketing pressure to introduce "turnkey total medical information systems," the physician soon notices that there is often only an incidental overlap with his practice of medicine. An automated inventory program of the pharmacy, or preparing payrolls in the hospital, cannot "turn on" the medical community. It becomes obvious that since the objectives of computerization cannot exceed the level of competence of the designer of the system, progress in medical computing necessarily remains low. The only successful applications of computers are in limited areas where the project leader has the highest level of medical competence, e.g., electrocardiogram interpretation, diagnosis of thyroid status, congenital heart disease, etc. The very few larger scope programs, like the Permanente project and the problem-oriented data recording of L. Weed, also reflect eminent clinicians behind the planning. The gap between bedside medicine and information technology is substantial. The true, full-scale medical objectives have not been formulated, and the majority of the pedestrian applications offered by the commercial systems have provided little assistance to the practitioner.

The Medical Society of the County of Erie in New York State made an enterprising decision when, in 1968, its president, Dr. G. Alfano, formed a Committee on Computers in Clinical Practice. This committee regarded the future partnership between physician and automated data handling technology as a challenge and enlisted the best medical brains of the area to begin to sort out the essential elements of the private practice of medicine.

Their first concern was the problem of confidentiality-privacy-privileged information. Jointly with the State University of Buffalo's Medical School and the Western New York Hospital Association, a con-

ference of experts was organized to draft a proposal for the Legislature of New York State to protect computer-stored health data. This meeting resulted in a bill now in the hands of the Senate, sponsored by Senator Caemmerer, proposing full immunity to health data stored in a computer.

The committee also concluded that medical computing should become a part of medical practice, to serve the health needs of the sick. Since physicians record data of the most private nature, they must be able to assure their patients that they can enforce the same ethical rules that medicine has honored over the centuries. Unless physicians receive and accept this controlling role in the formulation of the policies concerning data accessibility coupled with the related responsibility, an intimate symbiosis between medicine and computer technology is unthinkable.

The committee also recognized the need for regionalization: practitioners, in general, must personally know the policy-makers formulating rules for data security. It is a matter of personal faith, confidence in our colleagues—a system involving all participating physicians as committed partners.

Clinical Assistance

In order to place such a new, heavy burden on the medical profession, the planners of the data system must clearly identify the benefits to the patient and/or to the physician. As mentioned previously, such operations as sophisticated pharmacy inventory programs cannot turn medicine on. A well-designed health data network must offer services that were inaccessible before, which will assist clinical functions. The committee singled out a few of these:

Medical histories. A synopsis of every patient's longitudinal past medical history should be available. Not only is it time-consuming to collect these data during a medical examination, but often the patient is a poor carrier of his own health data. "The doctor gave me blue pills" or "I had surgery" is sometimes the only information extractable. The hard facts are scattered in various doctors' offices, hospital records, school health reports, military files, etc. Physicians are constantly frustrated by the inadequacy of a past history given by the patient or his family.

Genetic cross-referencing. This is a new concept feasible only in a well-planned, automated data system. Hereditary factors are responsible for a substantial part of our health pattern, and the physician's diagnosis and prognosis would often be quite different if the findings could be matched against the patient's hereditary history. This should comprise all diseases with hereditary meaning which occurred in blood relatives of the patient. A report stating that there are several members in the family with an established bleeding defect would alert the surgeon or obstetrician to search for a genetically controlled clotting factor deficiency; multiple occurrence of one type of malignancy, or coronary heart disease, diabetes, and mental illness would all be meaningful data for the decision making of the physician. Again, it is a routine part of every medical examination to ask for illnesses in the family, but the reply is often irritatingly inadequate. Patients able to give a good family history are exceptional and, although we know how important genetics is in medicine, gathering of hereditary history from the patient is a continuous compromise, leading to suboptimal diagnostic or therapeutic decision.

Shared community experience. Characteristics of each region are quite different in terms of climate, ethnic groupings, socio-economic composition, occurrence of certain diseases, and effectiveness of certain therapeutic measures. Nongeographic generalizations in medicine are often undesirable. A particular treatment approach when selected by the physician is often a complex decision, involving not only medical considerations but availability of services, social, nutritional, economic, and other factors. Results described in California may not be reproduced in Connecticut. Further, medicine is changing so rapidly that a single physician cannot accumulate the experience needed for optimized decisions.

The avalanche of potent new drugs often reaches the physician without adequate background data and needed comparisons. Drug manufacturers promote new drugs, patients often ask for drugs in vogue, and the physician faces the dilemma of either assuming therapeutic conservativism due to lack of adequate data, or risking ruthless "progressiveness." He knows he is unprepared to face inadequately known side effects of drugs or the embarrassment of finding some of the new drugs inferior to the well-tested drugs. For instance, in the case of the constantly growing number of antibiotics, supporting data as to risk of side effects is scattered in the jungle of literature, while personal experience accumulates slowly. Yet the choice of the "best" antibiotic should be empirical, based on a large number of similar cases. Shared drug experience in a community, via a data bank, would rapidly show the effectiveness and risks of new drugs, thus enabling the clinician to optimize his choice of treatment.

Planning a network

After these and many other merits of medical computing were carefully examined, and the committee recognized the real values of such a data system, the development of an areawide health data network was proposed. On February 28, 1970, a communitywide meeting was held, jointly sponsored by the Department of Preventive and Social Medicine of the School of Medicine, the Western New York Hospital Association, and the Medical Society. The objective of this meeting was to explore the feasibility of an areawide health information network. The meeting was attended by some 80 individuals representing more than 30 health-related agencies. Dr. James R. Nunn, president of the Medical Society, opened the meeting, stating that, "Obviously, the Medical Society is in favor of a health information network, but will be on the alert to see that criteria for safety, accuracy and confidentiality are met. Clearly, a community decision is needed." Dr. R. M. Bannerman, a prominent medical geneticist, emphasized the great value of a well-planned, readily retrievable health data system.

The interest of hospital administrators was stated by the executive director of the Western New York Hospital Association. The Commissioner of Health of the County of Erie, Dr. W. E. Mosher, said, "The necessity of acquiring technical and administrative

expertise for developing and maintaining a health information system cannot be overstated. The sophistication of the disciplines and the complexity of the relationships among these disciplines involved in medical and health fields are obvious." The point made by Commissioner Mosher is important. Medical computing is a difficult, multidisciplinary task. There is no place for dilettantes in any of the fields involved.

Dr. Harry A. Sultz, of the Department of Social and Preventive Medicine, discussed the academic aspects and stressed the importance of team approach. "The establishment of a community data bank does not merely await the employment of the appropriate technical experts, who, with an available computer can produce a data bank. Were this the case, community data systems would spring up all over the country. The fact that nowhere in the United States is there a working example of a comprehensive communitywide health information network attests to the complexity of the problems of establishing such a system. . . . The academic aspects of a community health information system are related to three basic functions of a university: teaching, research, and service to the community. The value as a teaching tool of actual data defining realistic situations as they relate to the interests and concerns of the various disciplines in a university cannot be overemphasized. It is imperative that graduates in the health and social sciences have the most understanding of the facts of their profession and community which is only made possible by means of a good health information system. . . . "

Areawide network endorsed

A similar strong endorsement of the concept of an areawide health data network was presented by Mr. J. F. Hickey, executive director of the Community Welfare Council. "It is with great enthusiasm that we lend our full support and cooperation to the concept and implementation of an areawide computerized health information network, particularly because it will not be strictly limited to health data. . . . The Community Welfare Council with its 108 member agencies, both public and private, is in an ideal position to generate interest with appropriate agencies in supplying input data for the system. This, of course, will require a massive and highly structured educational program to develop the interest and willingness to participate. . . . It is refreshing to find that there is recognition that localities' needs vary from area to area and that the 'stamping plant' concept for the delivery of services is totally unrealistic. Unfortunately, this is a message that many, if not most of us, have been unable to communicate successfully to the officials of our various levels of government. We are faced today with increasing population growth, health and social services needs, e.g., longevity with attending health needs, drug use and abuse, and out-of-wedlock births, in dimensions we have never experienced before. We are presently woefully unprepared because of our archaic data systems, to cope intelligently with these problems. Ironically, we are spending and wasting more tax and voluntary dollars than ever because of our data inadequacies. Unfortunately, this waste has been the result of the 'something is better than nothing' philosophy. . . . "

The New York State Health Department was represented by Dr. L. Campbell, who said: "It is my opinion that a strong community orientation presently exists for the establishment of a Health Information Network. One highly feasible vehicle for such cooperation is the Comprehensive Health Planning Council of Western New York. Keeping in mind that regional networks must remain compatible with each other, I envision the State Health Planning Commission as playing a coordinating role throughout the State to insure that compatibility exists among the various areawide Health Planning Agencies' health information systems. . . . "

The subsequent discussions urged those present to implement the network as soon as possible. The local Association of Record Librarians emphasized the availability and willingness of hospital record librarians to learn the role of data security administrator. It was also stressed that without good planning the mushrooming medical computing efforts would not have the capability of establishing a network to connect related records.

The meeting ended with a motion to "approve the concept of an areawide health data network and establish an organization of leadership in Western New York of those who are vitally interested in this network, in order to proceed from this point and to form the nucleus for the development of this program." The motion was passed unanimously.

A steering committee with six members was immediately established, the self-organizational activities picked up further momentum, and the planning of the network is now well under way.

Conclusion

Many others have proposed medical data banks and health data systems. This is, however, the first case we are aware of where the medical community has committed medical data as the beginning of the networking growth. We recognize that many details of the design and operation of the network are still unclear and would welcome suggestions and comments, since we believe the total design of the network is stored in the form of expert knowledge, fragmented in many brains. To put the mosaic together is our local and national challenge. ■

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Reasons are given for selecting the matrix form of management of dp operations

Matrix Management

by Gerald R. DeMaagd

The impact of third-generation computers on the field of data processing has not only been a revolution in the technical sense but, perhaps more than many of us realized at first, it has transformed our view of how the computer professional should go about his work. There have been many changes in the "functions" or sets of tasks performed by an individual, and in the way they are structured in a data processing organization. These functional changes have led to requirements for new ways of organizing the data processing function itself.

As a response to what was basically a technological change, many companies began to modify their dp departments, often in experimental ways. These variations have taken several forms. Sometimes, a whole new computer-based organization would be formed, accompanied by major reassignment of company personnel to newly created positions, increased outside recruiting of professional specialists, and a new charter of responsibility relationships to upper corporate management. Frequently, a recentralization to company headquarters of computer systems design and operation also took place, in anticipation of the increase in capabilities of the new equipment and as major investment costs in systems design and programming forced upper management attention and approval. Other firms' responses ranged from "beefing up" their existing dp department with a few new programmers, or retraining their present ones, to complete reorganization on a project basis.

From our accumulated experience with these reorganizations we can now generalize and draw tentative conclusions about the variables pertinent to the structuring of a dp organization, the task relationships within these structures, and the appropriate management roles implied for each.

Three structural models

Let's first examine three types of organizational structures—functional, project, and matrix.

A functionally organized data processing installation is based upon task specialization with a manager for each specialized group. These generally take the form of functional groups for programming, systems analysis, and computer operation, each of which is responsible for any and all tasks that may require performance of its specialty. Fig. 1 presents a typical functional arrangement.

A second type, which has gained some ardent adherents but which can claim fewer permanent successes,[1] is the project organization. Under this method, project teams are formed, combining a mix of skills, under a project leader who is given responsibility for accomplishing all the various types of tasks required for a given systems area. This combination of duties may show up in modifications to functional titles such as programmer/analyst. Fig. 2 (page 48), presents an example of the project arrangement.

This type of organizational structure comes in both extreme and modified versions. The extreme version encompasses all skill classes on a team, including keypunching and operations; the modified version usually limits the project grouping to systems and programming only, leaving keypunching and operations under functional administration.

A third, and the newest conceptual model in the area of organization theory, is known as the matrix form or matrix organization.[2] The characteristics of this type are illustrated in Fig. 3 (page 49).

As represented in Fig. 3, the functional divisions might be programming, systems analysis, computer operation, user coordinators, etc. To complete the matrix, temporary project assignments are superimposed upon the functional form. The new structure is one of overlapping, task-oriented friendship groups composed of persons with complementary specializa-

1. Walter J. Stuart, Jr., "An Experiment in DP Management—Revisited," **Datamation**, Vol. 15 No. 11 (November 1969), pp. 149-157.

2. For definitive discussion of matrix organization see John F. Mee, "Matrix Organization," **Business Horizons** (Summer 1964), pp. 70-72, and Robert A. Smith, III, "The Matrix Approach to Management and Organization: Making Leadership Democratic and Effective," unpublished Marshall Space Flight Center paper, National Aeronautics and Space Administration (November 1966).

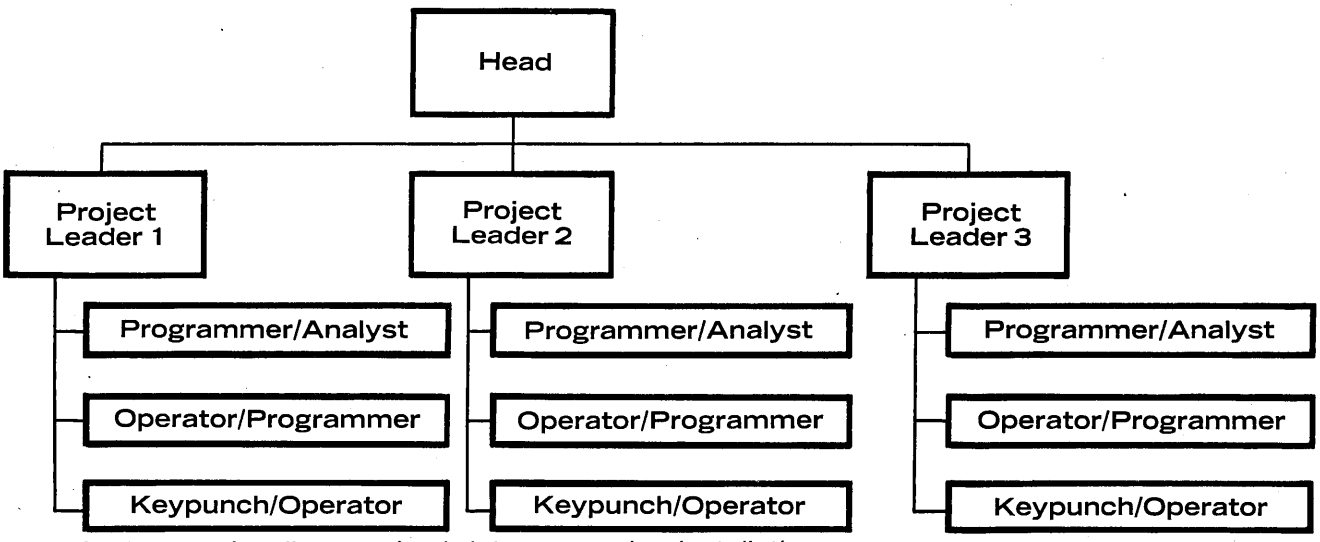

Fig. 1. Functionally organized data processing installation.

tions.[3] The formation of these task teams for temporary and specific purposes provides a flexible and adaptive way for coping with change.

It should be noted that some team members may remain administratively attached to their functional area, or may join and withdraw from the team assignment as they are needed. This organic adaptive feature is one of the primary differences between the matrix approach and the autonomous project group. The project organization draws primarily on its own internal resources; a team working under a matrix structure "borrows" resources from the functional divisions, which then assume a supporting relationship.

The matrix approach is a flexible and adaptive way to achieve a series of project objectives which uses the knowledge and skills of participating specialists without relying on a one-way flow of work or a rigid functional allocation of authority. The task team in the matrix approach responds in an organic functioning sense to feedback pertaining to its own performance on team (not functional) objectives, corrects itself in a loosely structured way, and achieves positive internal interactions for the resolution of conflict.

Since this structure is not a mechanistic one, how much authority the team director will have, vis-a-vis the functional supervisor, is a variable, dependent upon the kind of job to be done and the relationships existing under the usual organizational structure. Therefore its exact form cannot be uniformly defined; it depends on the case.

Limitations and advantages

The advantage of the matrix organizational concept is that it allows some attributes of both functional specialization and project orientation to operate, while minimizing other dysfunctional aspects and disadvantages. As used in one aerospace-defense firm, projects are organized along the lines of the matrix concept "to take best advantage of the resource utilization efficiencies of the company's functional organization and at the same time have the focused attention of project organization."[4]

Unfortunately, the view of most managers is there has to be an either/or decision between the functional and project types of organizational structure. Using the new concept, the question becomes one of "balance" in the selective use of the matrix form.

For example, there is a definite time limitation on project organization which has not always been recognized. R. A. Smith notes that, "In its early stages project management tended toward complete autonomy as if a project were a permanent fixture. This proved to be self-defeating to the institution housing it. For in reality, projects are mortal and have a definitized closed system life span."[5]

Likewise, major criticisms of functional organization are that it spreads responsibility, contributing to "dropping the ball" between functions, and that the rivalries between specialists cause dysfunctional function conflict.[6] The fact that dysfunctional results can be expected from specialization has now been widely recognized in management literature.

Early human relations researchers discovered how division of labor led to the formation of small work groups, with norms and goals often at odds with those of management and with enough real power over their members to invalidate management's output expectations.[7] One remedy for this is "job enrichment" or "job enlargement," in which work is made more interesting and varied.

One way to accomplish job enlargement is to form larger combinations of work packages that can be referred to as whole tasks. This is easier to do in a matrix structure because the shared responsibility relationships of this form can more easily cross any barriers in the traditional division of work processes.

(Continued on page 48)

3. William H. Reynolds, "The Executive Synecdoche," **MSU Business Topics**, Vol. 17 No. 4 (Autumn 1969), p. 26.

4. Lear Siegler, Inc. Instrument Division internal publication, Volume IIA Management (April 1969), p. 2-1.

5. Robert A. Smith, III, "Social Systems Analysis and Industrial Humanism: Awareness Without Revelation," **General Systems, Yearbook of the Society for General Systems Research**, Vol. XIV (1969), p. 104.

6. Stuart, **Op. Cit.**, p. 150.

7. Fritz J. Roethlisberger, **Management and Morale** (Cambridge: Harvard University Press, 1941), quoted In Edmund P. Learned and Audrey T. Sproat, **Organization Theory and Policy** (Homewood: Richard D. Irwin, 1966), p. 8.

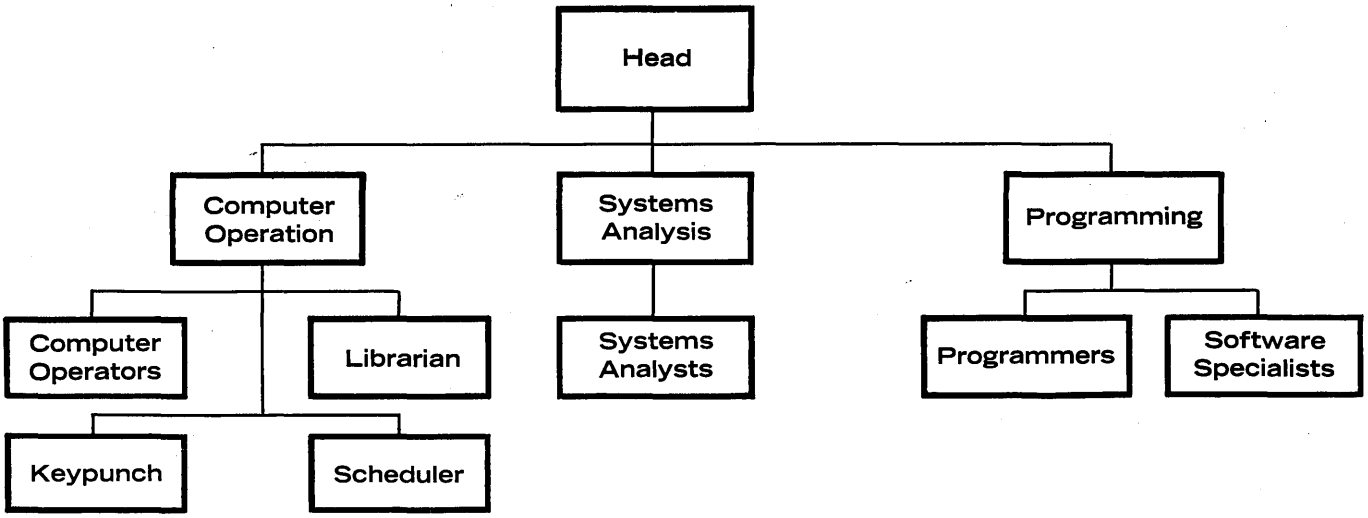

Fig. 2. Project organization of data processing installation.

The matrix organization can be designed to increase the congruence between work group and organizational goals by assigning work in terms of meaningful end products to a "task team" (including members with all the skills needed to accomplish the job) and routing to the team all the control information needed to engage in self-regulation.[8]

It works because it tends to minimize external determinants which shape behavior and performance and motivates internal responses to meet the corporate objectives.

It utilizes the emergent elements of behavior in the group's internal social system to assist in the effective performance of the assigned objective. When this occurs, the external influences affecting job performance over which the members of the group have little or no control (such as their personal characteristics and backgrounds, physical working conditions, external economic and social influences, general company policies and practices, and technology) are all reduced in importance.

It provides a maximum opportunity for consensus—that is, feedback which is translated, heard, and understood. It enables the leader to move his organization closer to the resources of human potential residing in the enterprise.[9] "It goes beyond the autonomous project management organization, which did indeed overcome the impasse of lateral authority invested in functional departments, by treating organization in an organic rather than a . . . mechanistic sense."[10]

Management of the task team

Being a team manager in a matrix organizational structure is a markedly different experience than in either the functional or autonomous project types. Lacking strict organizational lines, the matrix utilization of shared responsibility and mutual interdependence to get the job done requires a special set of leadership responses.

Some of the implications for team management under these conditions are:

1. *Emphasize the processes involved in getting the job done.* "The actions performed by a group are less important than are the processes they perform, the other processes they are related to, and the directions of those relationships."[11] Since the matrix form is designed to operate in an interactive environment, the total task may not be in any one functional state of development at a time. Therefore, what is to be done on a project by a particular person at a particular time may be less important than maintaining momentum in the form of a continuing set of interactive relationships. For the team leader, creating and maintaining these relationships is the work of organizing, and the ways in which these processes are continuously executed are the organization.[12]

2. *Anticipate changes in team focus.* Even though the team works in an interactive situation, there will be a shifting of reliance from one member's skills to another's, as the project progresses. Something like this has been experienced by Standard Oil Co. (Ind.).

> **Early in the process, it was recognized that the technical task of designing and implementing the types of information to be defined by our various "users" would require a fusion of talents previously located in several departments. Each company then began combining these diverse activities into a new department, usually called "Information Services". . .**
>
> **In the early stages, we found that the "users" have to lead, with Information Services personnel acting as consultants. In the final stages, the reverse is true, and this fact is now generally recognized by all the participants.**[13]

Similarly, in the aerospace manufacturing matrix type organization,

> **. . . we find that the individuals on the project team should be more descriptively referred to as participants. They are there for a purpose—their individual capability to contribute to the goals of the project. There are no unproductive members of the team. In a hierarchical organization, there**

8. Learned and Sproat, **Op. Cit.**, p. 9.
9. Smith, "The Matrix Approach to Management and Organization: Making Leadership Democratic and Effective," **Op. Cit.**, p. 7.
10. Smith, "Social Systems Analysis and Industrial Humanism: Awareness Without Revelation," **Op. Cit.**, p. 105.
11. Karl E. Weick, **The Social Psychology of Organizing**, (Reading, Mass.: Addison-Wesley Publishing Co., 1969), p. 108.
12. Weick, **Op. Cit.**, p. 1.
13. John E. Swearingen, Chairman of the Board, Standard Oil Company (Indiana), remarks at the Decision-Maker of the Year Award Luncheon, 16th Annual Midwest Conference on Statistics for Decision co-sponsored by the American Statistical Association, Chicago Chapter and the Chicago Association of Commerce and Industry, March 28, 1969.

can be members who fill a position and contribute to the stability of the structure. Because of its total goal orientation and the functional expectations of its participants, there are no positions in the project, organization, or hierarchy of positions. All members of the team are essentially on an equal level and status is determined by the relative importance of their individual contribution at any particular time. This concept implies a change in focus in the project organization with time—a change in emphasis as the importance of tasks change in progress toward the goal.[14]

The team manager's role, then, is to overlay these interactions and assure that the emphasis is placed properly with regard to time and the circumstances.

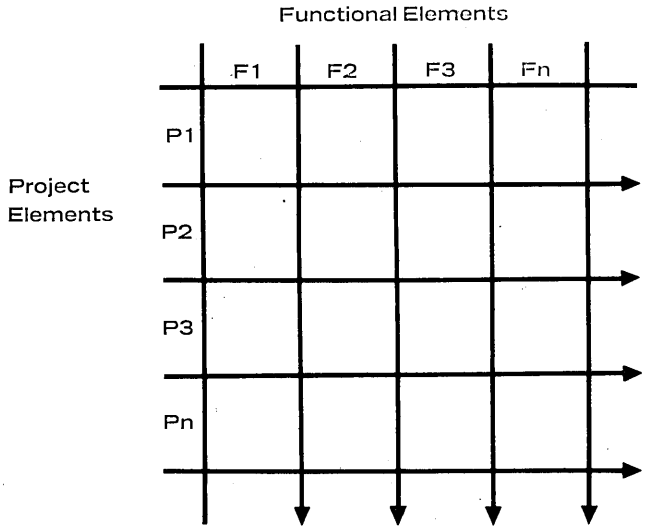

Fig. 3. Matrix form of organization.

3. *Take steps to handle the ambiguity reaction of computer professionals.* Sometimes technically competent programmers, trained in a functional organization, will react negatively to the vagueness of specific task responsibilities in the interactive process. Dr. Fred Massarik argues that ambiguity should be optimized. He believes that too much ambiguity severely impedes organizational effectiveness by creating overwhelming anxiety for the individuals and by obscuring guidelines for organizational survival, but that joint support for an ambiguity state makes it possible for the managers involved to establish appropriate compromises in areas such as task definitions and assumption of responsibility.[15]

Thus, organizations of the matrix structure require individuals with a high tolerance for ambiguity. At times this may mean the professional finds less satisfaction in his job—that is, higher than average involvement on an intense, elusive problem-solving relationship may lead to higher than average frustration. "As a consequence of this involvement, professionals' work is a greater potential source of both satisfaction and frustration. Although this highly motivated state is very desirable, a price is paid for its intensity. Obstacles that are viewed by an outsider as relatively insignificant are seen . . . as major blocks to successful performance."[16]

One way to reduce the individual's anxiety is to provide recognition of the person's accomplishments on the job, particularly higher management's cognizance of the person and his work. How this is done does make a difference. For example,

This type of recognition desired is recognition of the individual and his work; this link of the man to his work is essential. For example, calling a man by his first name, asking how the family is, and otherwise passing the time of day may be satisfactory for many employees; but it is not the type of recognition desired by many technical employees. . . . An acknowledgement of the individual's accomplishments, contributions and problems as they are related to a current project is generally more favorably received and appreciated.[17]

Conclusion

The type of structural arrangement you will find best for your dp organization will probably depend upon what kinds of problems you are trying to solve. If, after your third-generation computer has been installed, the only anticipation for new systems is of a routine or maintenance nature, then the functional structure with its one-way flow of work and hierarchical controls may work perfectly well. If a major conversion, companywide reconcepting of major application programs, or major installation of new equipment is anticipated, perhaps reorganization on the basis of autonomous project groups would serve. Once these projects were completed, however, expect to be confronted with another reorganization—project groups are mortal.

Considering the dynamic nature of data processing and its continuing requirements for change, the matrix concept of organizational structure has the features of flexibility and adaptability that make it a natural for the field. It permits the combination of a high degree of specialization with maximum efficiency of operations, as well as the focused attention of project organization. In a rapidly changing world, selective use of task teams to accomplish specific objectives offers the data processing manager a modern way of organizing to get the job done. ■

14. Lear Siegler, Inc./Instrument Division internal publication, **Op. Cit.**, p. 2-4.
15. Fred Massarik, **Functional Ambiguity and the Cushioning of Organizational Stress**, NASA Research Grant Paper at UCLA, (1965) quoted in Smith, "The Matrix Approach to Management and Organization: Making Leadership Democratic and Effective," **Op. Cit.**, p. 10.
16. Lee E. Danielson, **Characteristics of Engineers and Scientists Significant For Their Utilization and Motivation**, (Ann Arbor: Bureau of Industrial Relations, The University of Michigan, 1960), p. 12.
17. Danielson, **Op. Cit.**, p. 16.

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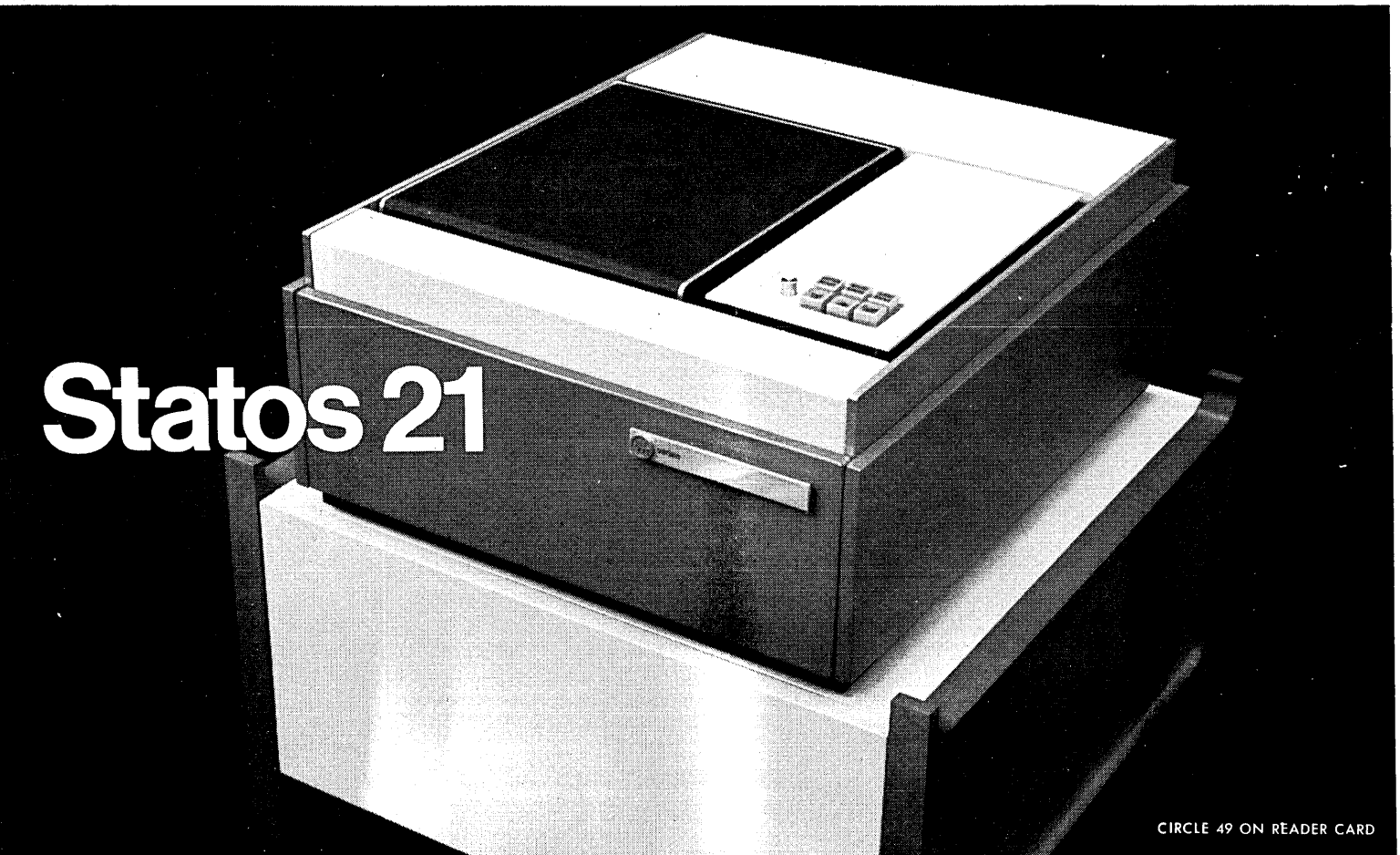

CIRCLE 49 ON READER CARD

Intelligent terminals for OCR may be the way to go in the future. Here are some definitions and aids to selection

Smart Terminals

by Arthur W. Holt

Good communications are essential to getting the most out of any computer system since the communications method provides that important link between man and machine.

Because terminals bring the use of the computer to the place where the data originates, such as with people at a remote location, a terminal that can read information directly and transmit it to a central computer is obviously an important entry into the entire field of computer terminals and communications.

Technology is now progressing to the point where this is becoming a practical, useful way of communicating with a computer. The major input to this type of terminal will be through improved optical character recognition (OCR) techniques.

Remote OCR IT's

Ideally, and even somewhat practically, this OCR terminal should read hand-printed numerics and machine-printed alphanumerics. There should also be a means of correcting mistakes on the spot, perhaps by a keyboard. Such a terminal could be used on-line or off-line to a central computer system and could include many different options, such as tapes, discs, displays, and printers. A store-and-forward capability might be valuable.

An essential feature of an "intelligent" terminal, or one that can read information exactly the way it is prepared, is that it must be comparatively inexpensive—at least when compared to the types of OCR systems now in use. This is mainly because the amount of data transmitted each day is quite small as compared to that used in the large batch-processing OCR machines. The fact that only a low volume of data is to be processed can be used as a cost-saving factor in designing and building the machine. Therefore, the OCR portion of such a terminal will be relatively slow.

Such remote OCR machinery can take two forms: one accomplishes the character recognition task at the remote location; the other contains only the "scanning" or the image pick-up at the remote site, and the video is sent by wire to a central location where the recognition is completed. The first form is referred to as an OCRIT (optical character recognizing intelligent terminal), and the second form will be referred to as a SCANIT (scan-only intelligent terminal).

This article will contrast systems using intelligent terminals with systems using other forms of data entry; it will discuss comparisons of intelligent terminals with the classical use of OCR; it will compare OCRIT's with SCANIT's; and it will present the major advantages of intelligent terminals over systems using other terminals, including keypunch terminals, key-to-tape terminals, crt's and others.

Terminals vs batch processing

The classical use of optical character recognition is, of course, the batch-processing method, and there are a great number of applications where this will continue to be the most effective and efficient way of entering data into business systems. Batch processing often involves physically transporting documents from the site at which they are generated to the reading machine. In systems where the documents are generated at many far-flung points, there is usually a long lapse between the time documents are generated and the time they are entered into the business system in digital form.

Batch processing is used in three basic methods:

Type and Read. The most straightforward use of OCR, this is a highly valued method because all parameters of the system are amenable to tight control. It is primarily used for the conversion of large masses of non-machine-readable data which are physically carried to a central location. This data is generally prepared by a typing pool using fairly standard typewriters, particularly those equipped with the OCR-A font. A typical application is the conversion of mailing lists.

The type-and-read mode normally uses a "page reader" transport rather than a "document reading" transport. (A page reader scans lines of print parallel to the short edge of the sheet. A document reader scans lines of print parallel to the long edge and is limited to three or fewer lines per document.)

Turnaround Document. A good example of this application is a utility company system which prints out bills on a high-speed printer once a month in a machine-readable font. These bills are sent to distant places by the post office and are, hopefully, returned to the sending source by the same untiring method. Clerks open the envelopes, examine the payments, and the original bill is then sent through the OCR machine.

A machine feature particularly useful here is the ability to read handprinted numerals, which may be added to the document if the amount of the check differs from the amount on the bill. A document reading transport is often used in this application rather than a page reading transport.

Remote Genesis. A third application of OCR to business data entry is when data is actually created at many places distant from the central OCR machine. A typical example is the gasoline credit card system,

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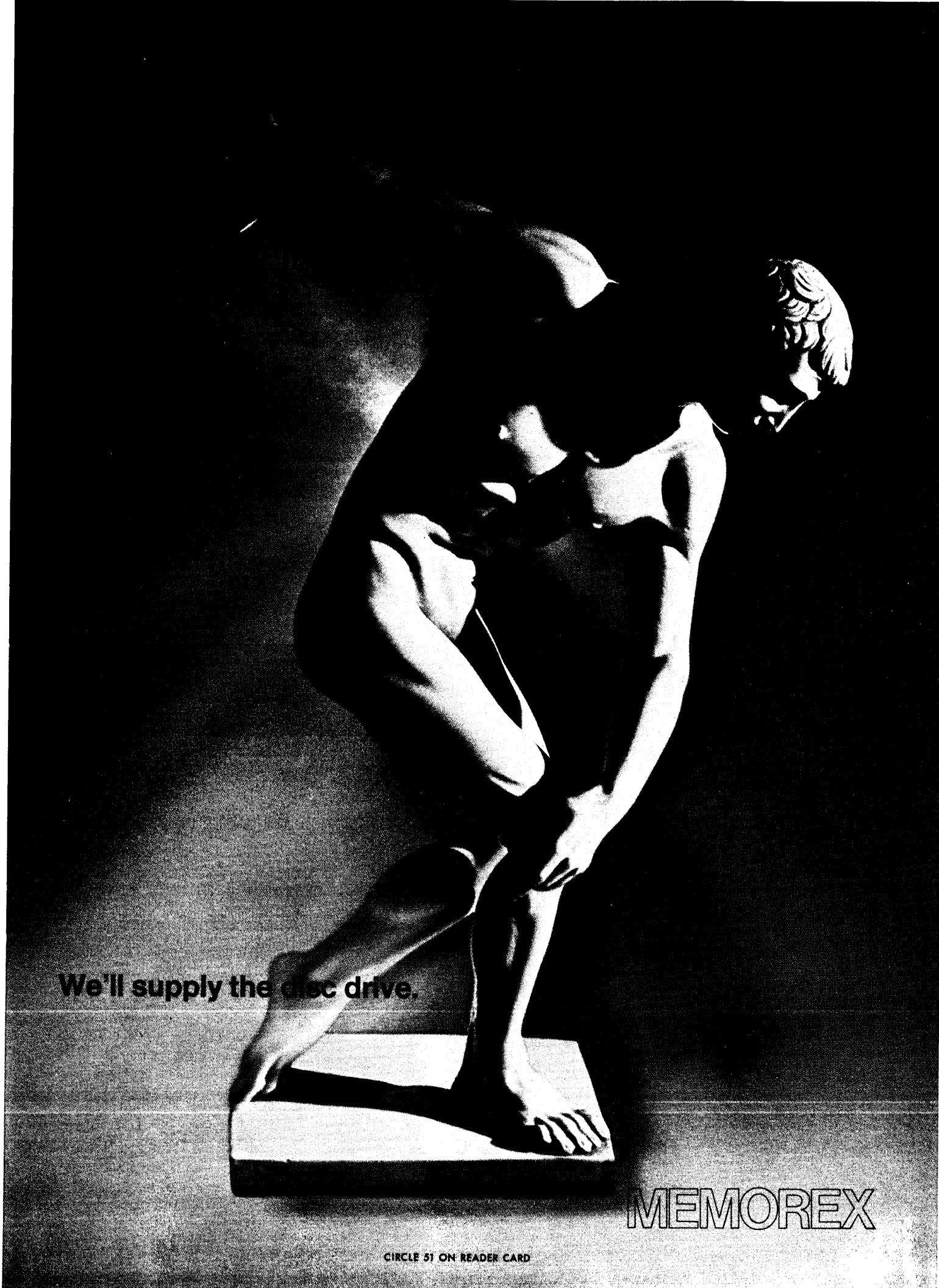


CIRCLE 51 ON READER CARD

where machine-readable tickets are created at the gas pump and shipped to a central location for processing. This was the first known successful commercial use for OCR.

Applications requiring combinations of turnaround documents and remote genesis are likely candidates for the initial use of large numbers of intelligent terminals, such as a large food or beverage distributer. (A network of OCR terminals is illustrated in Fig. 1.) The national company may have several hundred individual distribution centers where routemen pick up their orders early in the day, deliver them, and later in the day enter their sales and sales projections for the next day into the data processing system. In such a system, an intelligent terminal will include a high-speed printer which serves several purposes. Each evening it prints out directions for the next day's production, and each morning it spews out information printed in machine-readable font for each routeman.

While on the route, the routeman uses a pencil to record with numerics the dollar amount of deliveries made to each customer and the amount of the receipts. When he returns to the plant, he feeds his stack of slips into the intelligent terminal. The IT can read the original machine-printed data and the hand-printed numerals, convert these to digital codes, and send this data immediately to central headquarters. Any characters the machine considers undecipherable can be corrected on the spot.

Intelligent terminals have the following advantages over OCR batch processing.

1. Real-time communication is available, meaning that a near-zero time lag system can be implemented.
2. Interaction between the source of the data and the home office is possible.
3. Correcting rejects on the spot trains personnel faster.
4. Original records can be retained at the originating site.

Intelligent terminals cannot and should not replace all OCR equipment used in batch processing. In fact, there are many economic and practical factors which favor centralization. For those operations in which a time lag is inherent, such as use of mail in the turnaround document example, batch processing is an excellent method.

The operation of each terminal can be considered a miniature batch-processing operation in itself. In fact, if the price/performance ratio of an OCRIT is right, there is no reason why it shouldn't be connected to its own cpu.

OCRIT vs SCANIT

An OCRIT is defined as a machine which makes decisions on the spot; the SCANIT merely accepts data. One example of a scan-only terminal is a facsimile-type scanner which sends video data at slow rates over a dial-up phone line to a central location where the actual character recognition is performed. Other scan-only terminals operate at much higher speeds over multiple dedicated lines.

From a functional standpoint, the SCANIT system behaves like an intelligent terminal—that is, the system does read human language and makes decisions which translate it into binary code. Also, rejects can be immediately identified and corrected. Interestingly enough, most SCANIT rejects can be corrected at either the terminal or at the central processor, where a video copy can be made available. It is also practical to use a store-and-forward mode so transmission can be performed during low-cost hours. In this case, the video is stored on a magnetic tape.

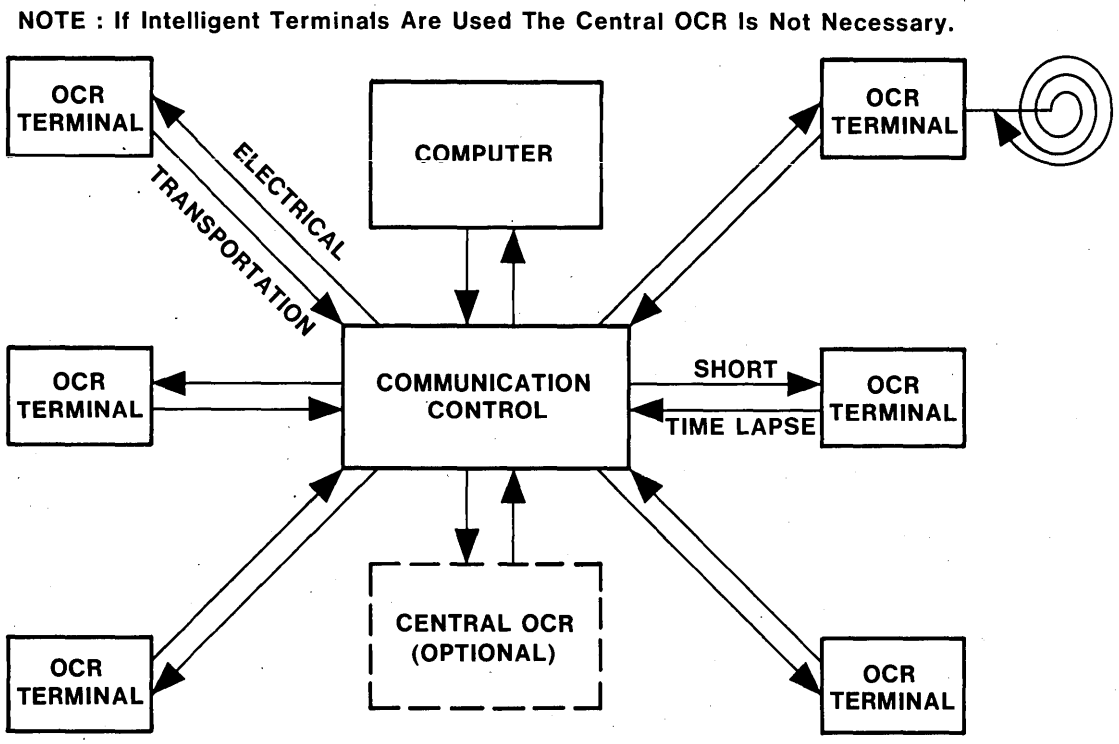


Fig. 1. Network of OCR terminals.

The main distinction between OCRIT's and SCANIT's is in the economics of transmitting video over communications lines. A typical character and the space around it requires some 500 to 1,000 bits of information to describe in terms of a video image. If a sophisticated system for transmitting white areas is used, these figures can be halved in transmission. In contrast, a 64-character alphanumeric set can be transmitted with only six bits, representing a saving of at least 50 to 1 in transmission costs.

The main attraction of a slow-speed SCANIT system is its extremely low capital investment. Although the cost per thousand characters may be poor, its ability to collect and transmit widely scattered data into a computer system without translation by human beings can be of great value to a data processing manager.

One of the elusive advantages of using OCR terminals is that they may enable the data processing system to get fast reporting from sources never before possible to reach except by mail.

An example might be a manufacturer of replacement parts with 500 outlets. He needs inventory and re-ordering information daily. Each individual source is tiny, but taken together the total may be huge. The central computer can generate a new parts list as often as necessary, and these lists can be mailed to the outlets. Once a day the outlet can fill in variable numbers using handprinting. The IT will read the machine-print and handprint numbers directly and transmit the data directly. This is a form of the turnaround document application; it saves a lot of data entry. In such a system, a very low hardware cost may be more desirable than a low cost per thousand characters reading performance.

In a system where the terminal is off-line from the cpu, either OCRIT's or SCANIT's can be used with the same constraints described in the on-line system. The SCANIT must still be connected to its central recognition unit, however, or no recognition can occur. Interaction between the data source and central unit is limited in both systems to correcting rejects. In the store-and-forward mode, rejects can be corrected immediately for the OCRIT, while SCANIT rejects must be handled later, after transmission.

The main distinctions between the two systems are:

1. An OCRIT system will have significantly lower communication charges than a SCANIT system.
2. A SCANIT system will have significantly lower hardware costs than an OCRIT system.

Using a few arbitrary definitions of traffic volume, a few simple generalizations can be made about when to use an OCRIT system and when to use a SCANIT system. Low volume is considered to be less than 50 messages per day per terminal. Moderate volume is between 50 and 5,000 messages per day per terminal.

First, in widely scattered, moderate-volume systems, OCRIT terminals will be economically superior to SCANIT terminals. Second, if the recognition unit is nearby, the communications cost may be only a small percentage of the total systems cost, and SCANIT terminals used in a moderate-volume situation may be superior to OCRIT terminals. Third, in widely scattered, low-volume situations, the SCANIT may be valuable simply because of its very low initial price.

For high-volume situations, a high-speed conventional OCR machine becomes economically feasible.

Throughout this paper some words have been endowed with a lifelike gift; thus, the OCRIT and SCANIT have had "intelligence" bestowed upon them. On the other side, devices such as keypunches, paper-tape readers, crt terminals, etc., were quickly consigned to the limbo of "nonintelligence" and called NONIT's (nonintelligent terminals). The distinction between IT's and NONIT's is illustrated in Fig. 2.

Intelligent vs nonintelligent

Why is a character-reading machine intelligent and a punched paper-tape reader nonintelligent? One definition of physical intelligence is as follows: "The number of bits discarded by each decision is a rough measure of the intelligence of the act." With the paper-tape reader, the number of bits discarded is very close to the number of possible locations for each hole, times the number of holes. A good generous guess on the possible locations (each location being a hole diameter away from the next) is nine. For a six-hole reader, then, the number of bits discarded is nine times six, or 54. The output decision is represented by six bits.

Contrast this with the character reader. A typical machine reading OCR-A will search an area 50 units high by 15 units wide. (This figure includes a vertical uncertainty of three character heights.) These 750 bits are thrown away, and the output decision can be represented by six bits.

The relative intelligence of the character reader to the paper-tape reader is roughly in the ratio of 750 to 54, or 14 to 1. That's an order of magnitude difference, and that distinction between intelligent terminals and nonintelligent terminals will be artibrarily used. Readers then can also decide that keyboard devices are even less intelligent than a paper-tape reader.

OCR is appreciated by those who use it, independent of terminal considerations, for some of the following basic reasons.

The major attractiveness of character recognition as a method of input to computers is its compatibility with the way humans communicate among themselves. Why is compatibility good? Because humans produce better accuracy, better verification, better correction, and better flexibility using their single language than they can using with a double language. Humans also seem to maintain a greater feeling of personal security out of using a familiar set of marks.

Character recognition can save money over methods using human converters in a number of ways. Source documents are prepared so that they can also be used by humans for their nonmachine purposes before being sent to the information-collecting station for machine reading. The best example of this is the preprinted account number on bank checks.

Even when the machine-readable document does not enter the flow of general business commerce, very important savings can be realized compared to the traditional method of keypunching. These include:

1. Greater accuracy, partially due to the fact that people are more familiar with a typewriter keyboard than with a keypunch keyboard, and the fact that a typewriter allows instant verification.
2. Wages and training time is less for typists than for keypunch operators.

(Continued on page 56)

3. Format flexibility of an OCR document is almost infinite.

4. The document or page is completely correctable in any part without disrupting the entire document.

5. Handprint-reading ability moves the data interface one level closer to the data source.

Mark sensing has the potential ability to acquire information from noncaptive humans. Certainly it has some good uses like exam-answering; but it is still a double language and suffers from all the attendant problems. Tab cards can also be visualized as a special case of mark sensing. The advantages of optical character recognition machines over various forms of mark sensing are: more redundancy is built into a character than can be built into a mark system; space saving is considerable; OCR also allows human compatibility, instantaneous verification, and correctability. In fact, almost all of the advantages stated for OCR over punched cards also apply to OCR over mark sensing.

On the negative side of the ledger, one would expect to learn that the cost of a character recognition machine is greater than for a mark sensing machine. True, in comparison with card readers, present-day character readers are more expensive. In comparison with readers for less rigidly controlled mark sensing documents, however, the character reader is very nearly the same price.

This is because the majority of the machinery for the two jobs is identical—namely, there must be an input hopper, a paper pickoff, a paper transport, and at least two output sorting bins, as well as a complex array of photocells. There must also be a data recording device, or at least a computer interface. Only in the area of recognition circuitry itself does the character reader have a more expensive component.

Are the advantages of OCR as demonstrated by past general experience still valid at the remote terminal? The answer is an unqualified yes, because the closer the interface is moved to the source of data, the more accurate that data becomes, and the more displacement occurs of human converters.

Conclusion

In examining these arguments, it's important to point out that OCR capability can be added to any terminal, whether it is on-line or off-line, interactive or noninteractive. OCR can even be added as a field change to existing installations. What then has prevented the extensive use of OCR terminals? The answer is simple: present OCR machines are too expensive, primarily because they are not well matched to the needs of low-volume, remote data sources. In other words, they are too fast, too big, and too hard to service.

In the year 2525, or sooner, some well-meaning writer with a social conscience may complain about the inhuman use of OCRIT's and SCANIT's. Conversely, there may be a sentimental ballad called, "The Old Oaken Keypunch in the Corner." In the meantime, to summarize the most important relationships between batch processing OCR's, OCRIT's, SCANIT's, and NONIT's:

1. OCR can be an important means of entry at both central and remote locations. Material of poor printing quality, or that which contains unusual font styles, can best be read at a central location with a sophicated reading machine. Likewise, if the highest efficiency is required, batch processing systems should be used.

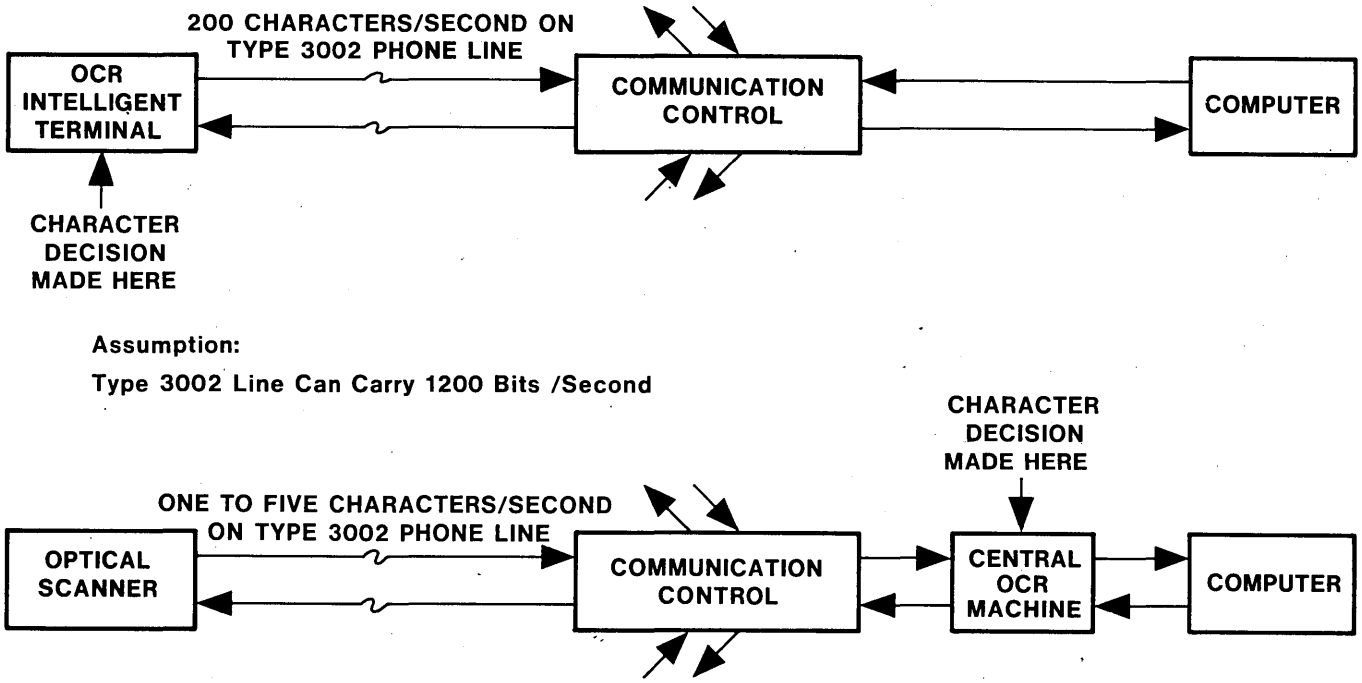


Fig. 2. IT's versus NONIT's.

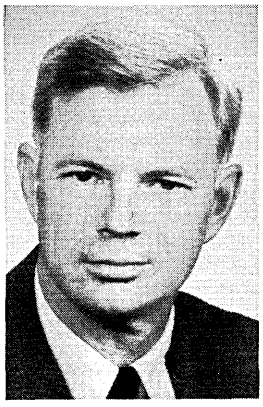
2. A type-and-read operation should be used wherever the best cost/performance ratio can be obtained. Where a short reporting cycle is valuable, however, OCR terminals should be useful. Combination systems using turnaround documents with handprint entry by personnel at a remote location provide a powerful method of upgrading the quality of data entry as well as maintaining its time value.

3. Within the two classes of OCR terminals, the OCRIT is a better choice than the SCANIT for widely scattered terminals handling moderate volume (50 to 5,000 messages/day). This is because the OCRIT reduces the information content of the material transmitted to a digital code while the SCANIT operates as a scanning device only and must transmit video images. The initial equipment cost of the SCANIT may be substantially lower than the OCRIT, however, particularly for very slow systems. The two areas of substantial use for the SCANIT, therefore, would seem to lie in moderate volume, closely spaced terminals (such as within one city), and in very low volume (less than 50 messages/day, widely scattered terminals. For volumes greater than 5,000 messages per day, any of several OCR machines now on the market should be satisfactory.

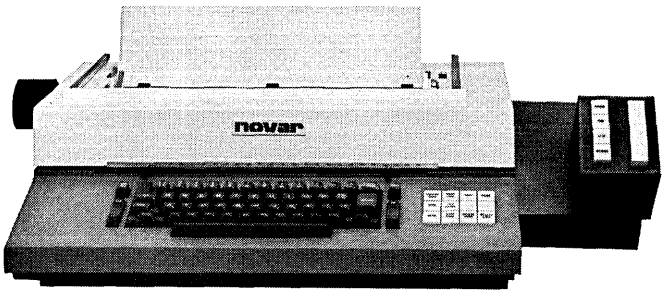
4. Comparisons of OCR terminals to non-OCR terminals must be made in two stages, the functional and the economic. A well-conceived OCR terminal system, making maximum use of preprinted and handprinted information, will require fewer operators than a system using NONIT's. At the same time, the accuracy will be improved and time lags will be shortened. Economically, present OCR devices are not marketed with appropriate sizes, speeds, and interfaces for moderate-volume terminal work. Worst of all, the prices are too high.

It is very well for an author to say that OCR is wonderful, that performance-matching is bad, and that prices are too high; but it would be much more useful if he would add some specifics to these nebulous benefits that OCR is supposed to confer. How *many* bucks per bit is a two-day time-saving worth? How expensive is an error? Can Norbert Wiener's classic book *The Human Use of Human Beings* help an engineer measure the actual value of a keystroke?

Unfortunately, most of these answers cannot be obtained by engineers or philosophers. Most of the answers must come from users of OCR systems. ■



Mr. Holt is vice president of Recognition Terminals, Inc., a subsidiary of Recognition Equipment, Inc. Before this, he was chief electronics engineer with Rainbow Electronics and also with the National Bureau of Standards. He has had many patents issued and several technical articles published. He holds a BA and an MA in physics from Williams College.



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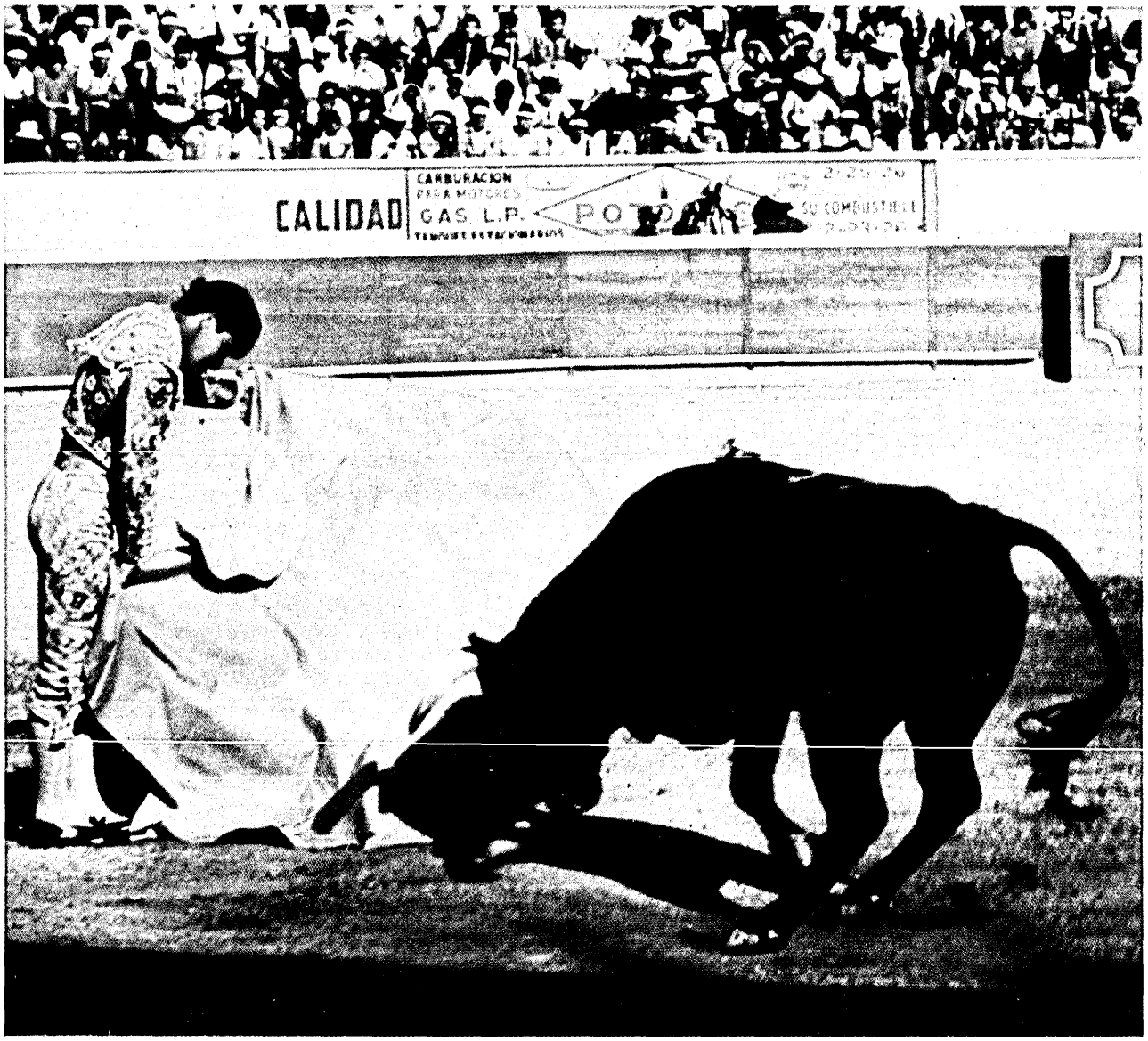

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Programming management is not fundamentally different from other management jobs, if the manager has a full understanding of the nature of the project.

Program Control

by Carl H. Reynolds

A common complaint among those who are charged with the responsibility of planning and managing computer program systems is that despite their best efforts the product is completed behind schedule, over budget, and below promised performance. I would like to suggest that this unhappy state of affairs is not necessary, and to explore certain relatively simple precepts which, in my experience, go a long way towards avoiding these difficulties—if managers will only become convinced of their usefulness and adhere to them.

As our experience in computer programming continues to broaden and mature, two basic considerations become more and more evident:

One, that there is no *fundamental* difference between the process of managing the development of computer programming systems and the process of managing comparable developments in any other technology.

Two, that the managers who are loudest in complaining about the difficulties imposed by what they call the uniqueness of computer programming are the ones who have failed to comprehend the technical environment in which they must work.

The basic problem in programming with which the manager must contend is that the product is essentially invisible—no more than an idea, not capable at first of articulation—which can be made visible only at completion and then only with the greatest difficulty. I will refer to this again later, but this fundamental quality gives rise to the second and equally important consideration, which is that even though the product itself is invisible it does, in fact, have a technology of its own which is more difficult to perceive than the product itself.[1]

Webster says that a technology is a method of achieving a practical purpose. The programming techniques used to implement computer-based systems satisfy this definition. But we must remember that a purpose is practical if it serves any useful function. The steps by which an end result is achieved become as practical as the result itself. Any particular technical method, whether it be the use of prestressed concrete in buildings, the use of transistors in electronics, or the use of syntax-directed methods in compiler writing, goes through stages of relative practicality.

For example when a technical method is still in the "research" stage, the practicality of the work performed is measured by the knowledge gained, which then may or may not be used to achieve a desired purpose.

If research determines that a technical method is fundamentally sound, the method then progresses to a second stage which we may call the "developmental." Here practicality implies not only that the desired

This paper is one chapter of a book being published by Brandon/Systems Press, Inc., on the Management of Computer Programming, edited by George F. Weinwurm.

1. The concept that programming has a technology was first presented to me by George H. Mealy, formerly of Bell Labs and IBM and now a consultant in Boston. Because I believe this is a key idea in learning to manage programming, I want to be sure to give him credit for it.

purpose can be achieved—at least in some instances—but that the purpose can be achieved within acceptable limitations. A technical method might prove uneconomic for general use but would be acceptable for use in a special situation which demanded that results be obtained at any cost. Thus, the tremendous development costs of SABRE were justified and a practical purpose was achieved in that it was demonstrated long before the general use of real-time systems that on-line inventory control systems could be developed and used economically.

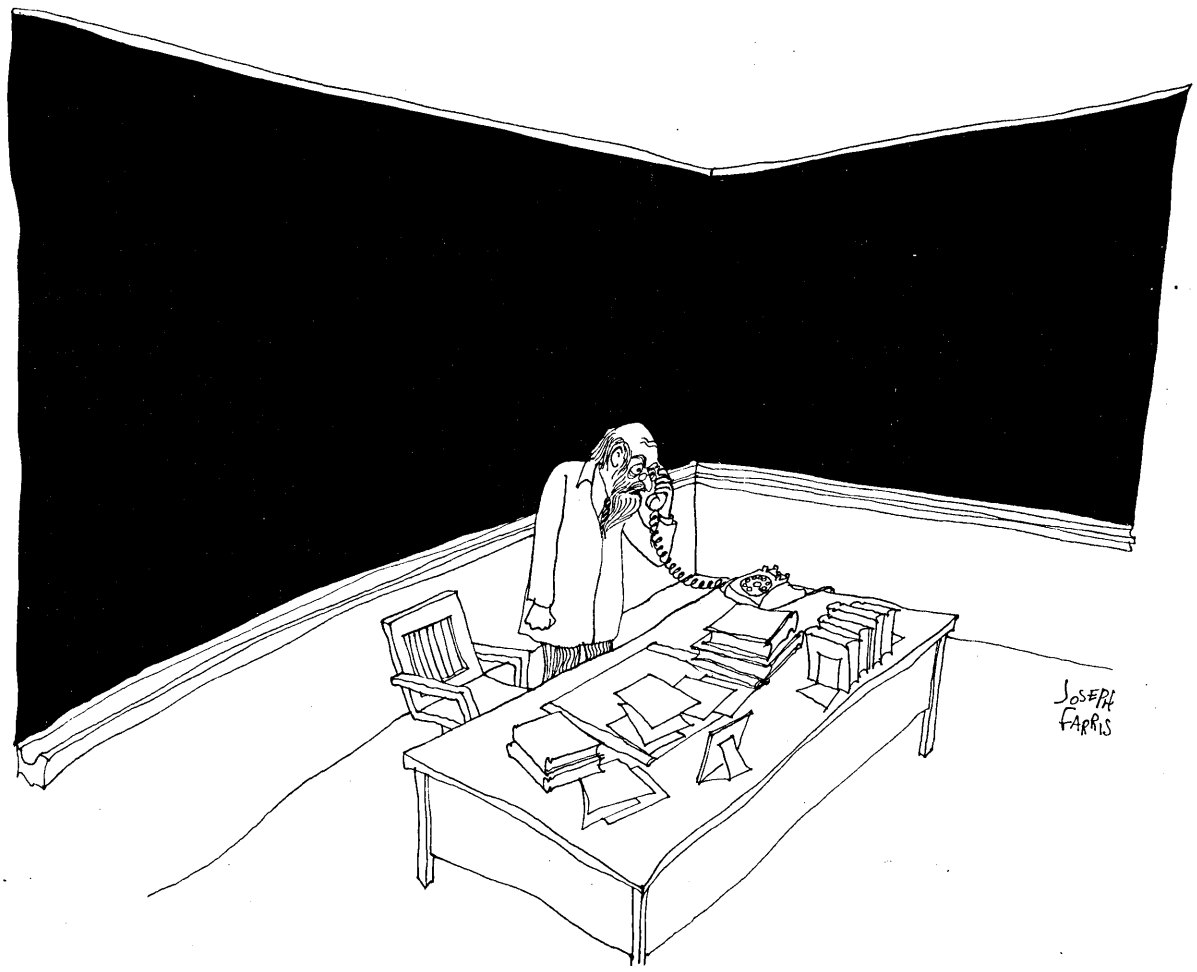
Finally, a technology or a technical method progresses to a stage which may be called "operational." By this is meant that the method has proved capable of achieving a practical, economic purpose in a wide range of situations and has become a relatively common tool for achieving the results for which it was designed.

Accordingly, then, programming has a technology. The technology consists of the technical methods used by the programmer to achieve the practical purpose of making machines do useful things. The technical methods pass through three stages of development: from research to developmental to operational. These distinctions are important because it is my basic premise that success in the management of programming depends more on an understanding of how to manage technologies in their various stages than on the particular technical aspects of programming.

The successful programming manager must first learn to recognize the different technological stages of programming and then realize that each stage requires its own discipline. The demands each makes upon the manager are entirely different. The failure to make the proper distinction will mean a failure to understand just what it is that is being managed. If this happens, the manager courts disaster from two possible fronts.

The most serious pitfall stems from the inability of the manager, who does not recognize the stage of the technology into which the project being managed falls, to predict the capabilities of the system for which he is responsible. It is rare that his expectations will be realistic. Being human and under pressure, he may be willing to accept estimates of high performance which have little hope of being attained. The result is always disappointment and heartache, because even a good job will then be judged by a false standard. As an example, it is clear to me that the time-sharing expectations of two or three years ago were far beyond the capability of the technology to produce.

Just as dangerous, however, is the case where an "operational" technology is discounted. In this case, much less is demanded of the system than is possible



"Somebody stole my chalk!"

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and the opportunity for accomplishment is lost. But we are usually so happy when a project comes in under budget and ahead of schedule that no thought is given to the potential waste or our own lack of professionalism.

What, then, should the manager give particular consideration to in the three stages of technological development which I have discussed?

Major r&d concerns

In both the "research" and "developmental" stages, a manager's principal concern should be whether he has available, either in himself or through his associates, the detailed technical knowledge and experience to make the necessary technical decisions. Because the objectives of the project have not yet been sufficiently defined, it may be necessary to choose between alternate paths, or to change objectives if new capabilities are discovered along the way. These are the same kinds of problems that confront managers of all research programs. Judgments must be made which are independent of past performance, which require skills higher than those sufficient to manage the well-developed, familiar technical tasks encountered in the "operational" stage. Also, the funds available in the "research" and "developmental" stages are considered risk funds and should be managed accordingly so that the greatest possible experience can be gained. Also, keep the salesmen away. At this point, the sales approach can only corrupt the purpose to be achieved. The best program in the world and the one easiest to sell is the one that hasn't yet been written. It is even better if nobody even knows whether it can be written, because then the only limitation on performance is the imagination of the seller.

The skill in managing a project where the programming requirements coincide with a technical method which has become "operational" is the art of matching the technology with the precise needs of the user. This requires the manager to understand fully the technology and to push it to meet every legitimate requirement. And in this stage, the approach of the salesman is not only valid, but necessary, to ensure responsiveness to the desired result.

Just as the manager in more mature industries, the programming manager must understand the full capability of the current technology so as to be prepared to make commitments in terms of dollars commensurate with the risks involved in achieving the desired systems results. Unlike some managers—but not all—he is dealing with intellectual concepts which may be harder to control than those involved in the production of tangible goods. He must differentiate between the technologies which he may use to accomplish a given purpose; and he will find each technology will demand its own emphasis. But I contend that the demand for a different emphasis for separate technologies has been applied in such fields as engineering for many years, with notable successes as well as notable failures. The same will be true in programming.

Programming can be simple or it can be unendingly complex. To get the job done it is necessary to understand the capabilities of the stage of the technology within which one's work must be accomplished and to make one's management decisions and commitments within that framework.

I would like to return to the invisibility of programming. Many people have said the familiar techniques of management cannot apply to programming. I contend that this is itself an illusion and that the reality is that the application of familiar techniques requires only imagination. In other activities which have significant management attention, control is achieved by the tangible presence of things to count, things to cost, times to be measured; progress or the lack of progress can be determined by physical measurements and counts, whether they be dollars or numbers, buttons punched out of a machine per day, item count in an inventory, or other things which can be touched or comprehended visually. The counterparts of such numbers are harder to come by in programming and the proposition becomes that, since you can't have such numbers, you can't manage. I concede the difficulty, but I insist that those physical counts or numbers which are useful to the manager can be produced in programming if:

One, you are convinced you can produce them.

Two, you learn to turn a deaf ear to those who say this is unreasonable or impossible.

Let me give you a few examples of the kinds of physical counts and numbers which can be produced in programming and then used by the manager to achieve control by the old, familiar techniques. But first let us define the familiar techniques:

Old and familiar

1. Establish a plan of action to achieve a goal within a given time period using given funds and resources.
2. As the work progresses, measure performance against the plan.
3. If progress does not match the plan, make a judgment with respect to the cause of the mismatch.
4. Take appropriate action by way of changing people or the plan in order to achieve the goal under the altered circumstances.
5. Continue the process until the job is done.

This is the fundamental plan, whether you are erecting a building, manufacturing an ice box or writing a compiler.

If the programming manager is to work within the framework of familiar management techniques, he must reduce at least some portion of the production process into physical events capable of being counted or measured. In order to accomplish this, he must establish that paper work will be produced. If the plan is to be effective and useful, it is absolutely essential that the content of this paper work be precisely determined beforehand. The beginning can be a one-page system description. This can then be expanded to include several simple subsystem descriptions. Then a document we may call the External Specifications will have to be prepared. Detailed programming and subroutine specifications will have to be produced, as well as coding, flow charts, and the documentation of internal specifications.

It is these pieces of paper which become the physical events to be counted and measured to control the management of the production of programming systems. Their usefulness to the manager will depend on

the completeness with which they were conceived beforehand, because they should be counted and measured only in binary ways—either they conform to the plan or they do not. Effective management cannot be based on the acceptance of a percentage of completion as satisfactory. If this is allowed, control is lost for it is assumed that the plan comprehends the best possible estimate of the expenditure of time, money and manpower needed to produce the work to be counted and measured by reference to each piece of paper. Any failure to conform to content or to the predetermined schedule must be the signal to the manager to stop and gain a thorough understanding of the exact status of the project, ignoring completely that step of the work which may be only partially complete and the reasons given for such partial completion. The manager must be intellectually committed at all times to the actual status of completion of the project.

Objective measurement

It is vital to the management of programming to make this intellectual commitment to the actual status of the project, that is to say, an objective measurement of progress, before one attempts to evaluate the reasons for the failure to meet the plan. A status report which discloses that the project is late, or over budget, or is not performing, may also bring with it a harrowing, heart-rending, albeit true, story of the reasons for disaster which is hardly conducive to that objectivity necessary for control, and which is apt to force a manager to make decisions and take action before having the necessary information.

There are many other counts and measures which can be used in programming but which require an even firmer management hand than those recited. As an example, numerical, measurable speed criteria must be established for every system to be produced. The precise numbers will vary from system to system, but they should be understood at the beginning of the project and the manager should be required to estimate these speed numbers beforehand.

These numbers will then be used to measure performance as the work progresses. He should be allowed the freedom of putting down percentages of uncertainty of numbers, which should then be re-estimated at every major checkpoint in the development of the system. Finally, they should be measured on the system itself.

Realistic estimates of performance will mean good customer relations. Programming has been a sort of "gee whiz" business and I can well remember when the untutored field force at IBM first heard about FORTRAN and, boy, was that "gee whiz." The mere fact that something like FORTRAN was possible was very exciting. That it ran slowly was not significant until people started to use it and then it became a tremendous problem. Many projects we are called upon to manage have the same characteristics. We hear, "Gee whiz, can I really get a computer system that will control my inventory? Wonderful!" We finish the project and suddenly it turns out that it will take five weeks to plan a one-month inventory and "gee whiz" becomes something else.

There are other numbers which can be useful. Everyone should be required to estimate the number of lines of code necessary to accomplish those parts of the system for which he is responsible. This should be done beforehand, be incorporated into the plan, and be used as a measure of performance.

I do not believe that what I have said is unreasonable or unrealistic and I have had some measure of success in using the techniques that I have outlined. What is unreasonable is to think that programming is incapable of being managed using those techniques which have withstood the tests of time. We are professionals and we must set professional standards. This means that we must develop our own skills to be able to assess, as experts, what is possible, what is probable, and what cannot be attained in programming. With these skills we will be able to recognize and deal with the technology which will determine the limitations within which we must operate on a particular task, and we will base our commitments to ourselves and to those for whom we work on reasonable assumptions and not on pipe dreams. If we can do this, and then insist that we derive the utmost from the technology at hand—without letting laziness and incompetence interfere with our goals—and insist upon schedules based on physical events and numerical descriptions of the products we produce, and if we commit ourselves to the objective assessment of the status of our projects at all times and before taking decisions to get back on the track, then, I submit, we will find ourselves in the company of other successful managers of other equally perplexing jobs.

If we can allow ourselves a little latitude, it would be because programming has developed, in less than 10 years, from an interesting and sometimes useful intellectual activity to the status of a profession upon the practice of which the economy of the country quite literally depends. The nation's defenses and the lives of our countrymen, in ways not always known to them, are irreversibly committed to considerations made in programming development activities. The survival of huge industrial complexes and the life savings of multitudes of people hinge upon the art of the programmer. In brief, the responsibility which falls upon the shoulders of a complex programming system is out of all proportion to the maturity of the field and quite often to the maturity of the people who produce the work. It is our job to encourage and elicit that maturity. ■

Mr. Reynolds is president of The John D. Kettelle Corp. He was previously president of Computer Usage Development Corp. and has held several positions at IBM, including that of manager, programming systems, data systems division. He has been in the computer field since 1951 and has a BA from Harvard University and an MS from Brown University, both in physics.

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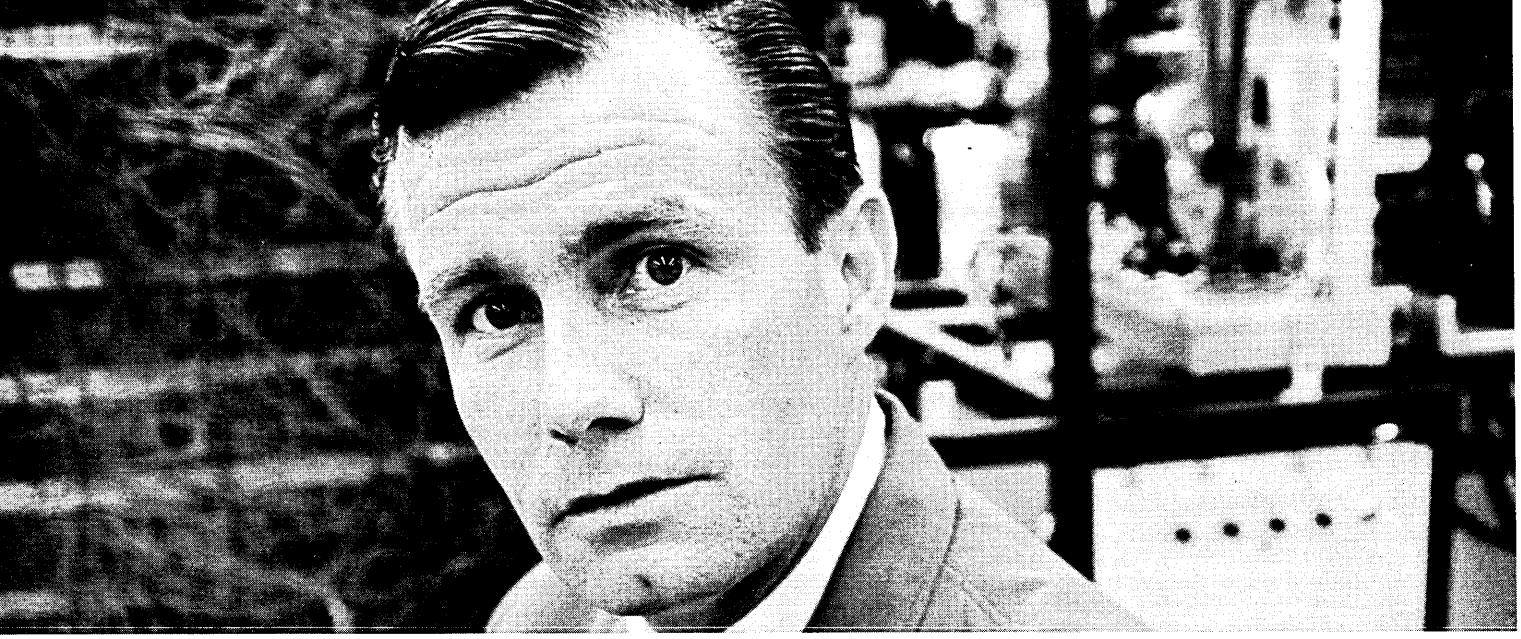
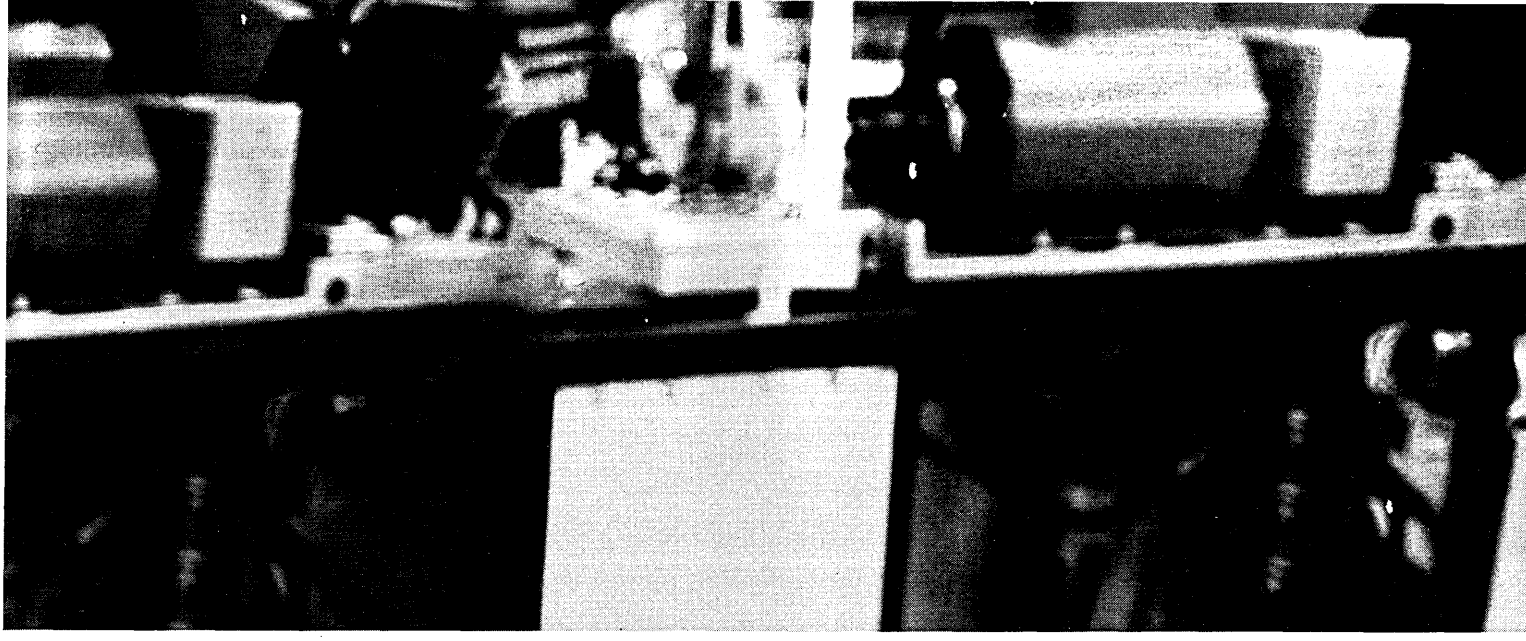


"Now Mohawk's got a programmable printer–and we've programmed it to release EDP dollars."

Northeast Regional Manager John McManus details a new MDS product.



"A very healthy share of all the computers in the country is right here in my bailiwick. And some of my clients run very hefty operations, using more than one computer—even computers of different makes.

"With these firms—I guess with most, really—the EDP workload keeps increasing but the budget doesn't. So the hot button today is releasing EDP dollars. We'd already moved in this direction with off-line printers that took some of the load off the computer, but it looked like we could go further. I suggested that our product planning people come up with an answer.

"They sure did. We call it the 2501. It's an off-line printer that's not hard-wired. It's programmable—and we supply the programs—to read the output tape from *any* computer, 7 or 9 channel, 800 or 1600 BPI, even a card reader. You name it.

"What's more, it will accumulate, re-format, edit and expand without taking the time of your computers or your programmers.

"And we know it's reliable. Because this new 2501 is based on tried-and-tested components: our proven 1250-line-per-minute drum printer, plus a programmable controller, tape handlers and card readers we've been delivering for years.

"This is important budget relief for a big installation. Or for any company—large or small—that just has to open up some computer time. Or for an EDP center that wants to feed a variety of inputs to a single printer.

"And right behind it we've got a few more surprises. How do you react to a programmable printer you can program yourself?"

Mohawk Data Sciences Corp.
Herkimer, New York

MDS

Clearly an extension of Spectra philosophy, the RCA-2, -3, -6, and -7, are added to the slate of IBM System/370 opponents

Extended Spectra

by Michael William Cashman, Assistant Editor

Sufficiently satisfied with their Spectra product line, RCA's Sept. 15 announcement clearly brought more of them. Only the names have been changed—the RCA-2, -3, -6, and -7. Although the same circuitry technology (monolithic) has been applied to the same basic Spectra architecture, there are some significant differences.

Aside from improved communications capability, probably the most significant change stems from RCA's belief that IBM has historically been stingy when it came to putting memory on their small to medium-scale products. So the small-scale RCA-2 is allotted up to 256K, and its virtual memory version, the -3, also has up to 256K of on-line core, plus 2 megabytes of virtual memory. The medium to large-scale model -6 (which appears to fall just short of the computing power of an IBM 360/65) has up to 2 megabytes of core memory, and the virtual version -7 the same 2 megabytes, plus 8 megabytes of drum-based virtual memory.

Since the hardware in the adjacent-numbered models is so similar, the Models -2 and -3 can be treated as one machine, as can the -6 and -7. In the RCA-2 and RCA-3, memory is meted out in 64K chunks (starting with 64K on the -2, and 128K on the -3) until 256K is reached.

A 2K 480 nsec ROM is used to implement the actual instructions, of which there are 145 on the model -2 and 151 on the model -3.

With a capacity of 2 megabytes of 4K virtual memory pages, the model 8567 drum, with its 8.6 msec average access time, is the Virtual Memory Storage System. Its transfer rate is 333KB/sec.

A block multiplexor channel will be along next year to support the Model 8590 disc pack. RCA obtains this unit from a vendor named IBM who also markets it under the number 3330 disc unit. This might be a temporary arrangement, however, as RCA says they'll have something bigger and faster along shortly.

The larger two systems are laid out the same as the -2 and -3, but things work faster. Up to 2 megabytes of main core can be attached to these two systems, and they access four bytes each 765 nsec. The scratchpad memory (128 words) cycles at 255 nsec, as does 3K of 72-bit ROM. A different cpu is used on the RCA-6 and RCA-7 systems, is rated at 765 nsec, and knows 153 or 163 commands depending on whether it's attached to a -6 or -7. Add time for a full floating-point word is given as 2.04 usec for the RCA-6, and 2.25 on the -7.

File management, batch, remote batch, t-s and other capabilities, as well as FORTRAN, BASIC, COBOL, and other common languages are provided for in the new Operating System and VMOS (Virtual Memory Operating System). The new monitors can handle 14 concurrent jobs just as OS/70 does, and microcoding facilitates emulation of IBM 360, 370 and 1401 series equipment, along with some 7000 series hardware, the Honeywell 200 line, and the GE 400 products. The virtual memory machines have interactive COBOL and FORTRAN features, and pre-compiler checks in both languages.

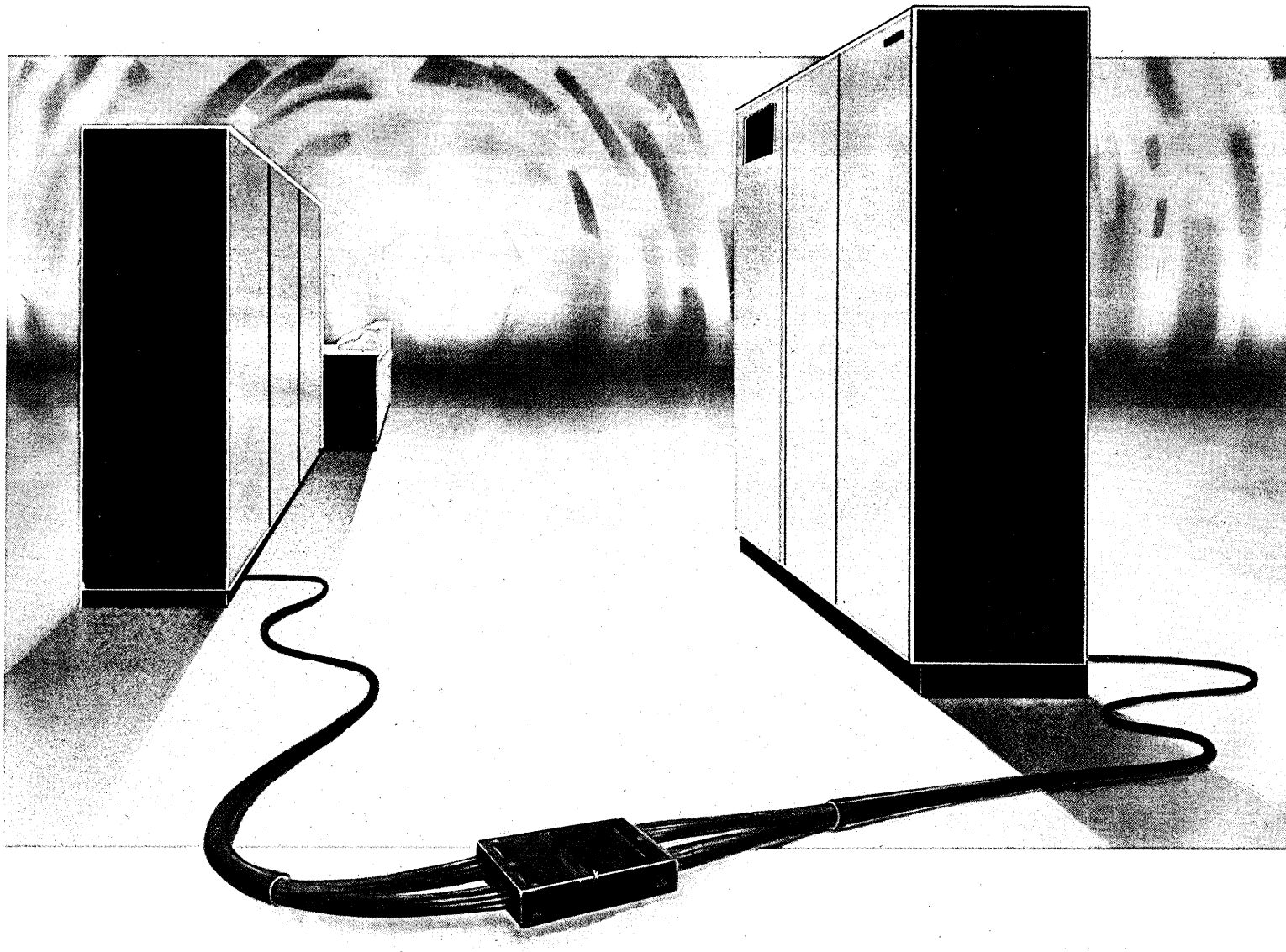
The RCA 8660 front-end will have interface capability for IBM 2074, 1130, 2780 and 2701/2703 data transmission devices, as well as Burroughs TC 500 data terminals.

Pricing and marketing strategies for the new family were covered last issue (p. 30) but at this point in time the price sheet says the RCA-2 sells for $710K, the -3 goes for $890K, the -6 for $1,380K, and the -7 flagship for $1,680K in typical configurations. A price/lease ratio of 46:1 works out to $15.4K/month for the -2, $18.9K for the -3, $29.3K on the -6, and $36.3K per month on the -7.

Once its customers are safely into the -2, -3, -6 and -7, RCA will also provide another, bigger machine to grow up to and love. This model is reportedly just as ready as the -2, -3, -6, and -7 are, so we are seeing more "iceberg marketing"—always have something else to show on short notice. ■

CPU	RCA-2 (RCA-3)	RCA-6 (RCA-7)
cycle time	1.44 usec	765 nsec
word size	32 bits = 4 bytes	32 bits = 4 bytes
index registers	total of 43, 16 for user	total of 43, 16 for user
arithmetic	fixed and floating binary and decimal	fixed and floating binary and decimal
MEMORY		
Main core:		
cycle time	1.44 usec	765 nsec
size	64-256 KB (128-256 KB)	128-2,048 KB
access	2 bytes	4 bytes
Scratchpad:		
cycle time	300 nsec	255 nsec
size	128 words	128 words
Read-only:		
cycle time	480 nsec	255 nsec
size	2K 54-bit words	3K 72-bit words
Virtual:		
size	(2 Megabytes)	(8 Megabytes)
access time	(8.6 msec average)	(8.6 msec average)
transfer rate	(333 KB/sec)	(333 KB/sec)
I/O		
Selector channels:	0-4 (1-4)	2-6
rate/channel	694 KB/sec	900 KB/sec
rate/system	1.38 MB/sec	5.24 MB/sec
trunks/channel	2	3
Multiplexor channel:	1	1
transfer rate	72 KB/sec	216 KB/sec
trunks	9	16
addressable devices	256	248

SUPERTHINK



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When the Goddard Space Flight Center wrote their specs for a hardcopy printer, they wound up with a choice of one.

They didn't mean to. It just turned out that way. Because of all the printers around, the Gould 4800 was the only printer which could give the Goddard people all they asked for. **Speed** Goddard asked for 1000 lines per minute. The 4800 will whip out 4800. **Silence** Goddard planned to put their printer right in their on-line control room. And weren't about to put up with a noisy impact printer. With the Gould 4800, they don't have to. It's electrostatic. And very quiet. **Printout Width** Goddard wanted a full 80 columns wide. The Gould 4800 provides it. On convenient 8½" wide paper. The Goddard people also were impressed by several other important factors: *alphanumerics and graphics* — the Gould 4800 delivers words and pictures, simultaneously, direct from computer output; *permanent paper* — special, high-contrast, won't curl, get yellow or brittle . . . you can write on it with anything; *reliability* — smooth, quiet, impact-free operation means less wear and tear on parts, less maintenance, little downtime; *versatility* — Gould 4800 generates wide variety of fonts, from smallest matrix on up, in many weights, sizes and faces. It can be integrated into a console set-up (see Goddard installation photo on opposite page) or used independently as shown below. One more thing: The Gould 4800 is priced at or below printers that can't come close to the performance. So the Goddard people not only got quite a lot more than they bargained for. They also got quite a bargain.

Talk to your computer people about the Gould 4800. Then talk to us about a demonstration. We're ready whenever you are.

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GOULD

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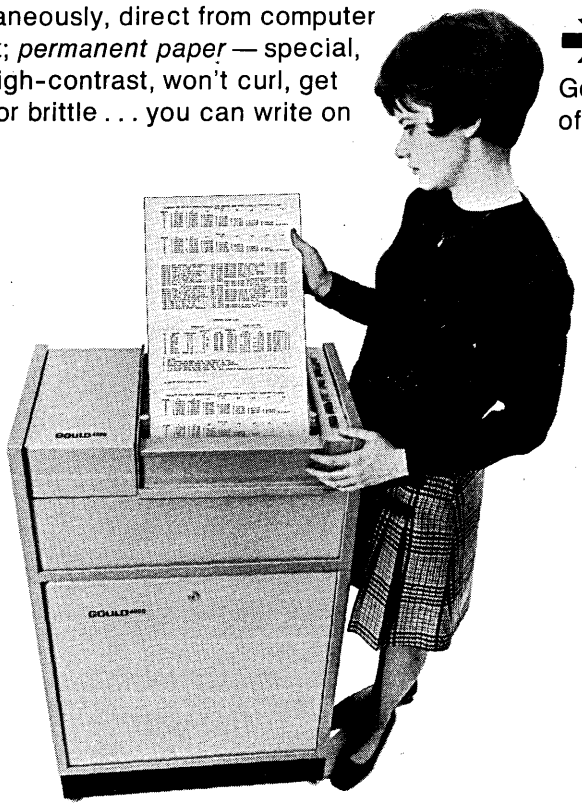
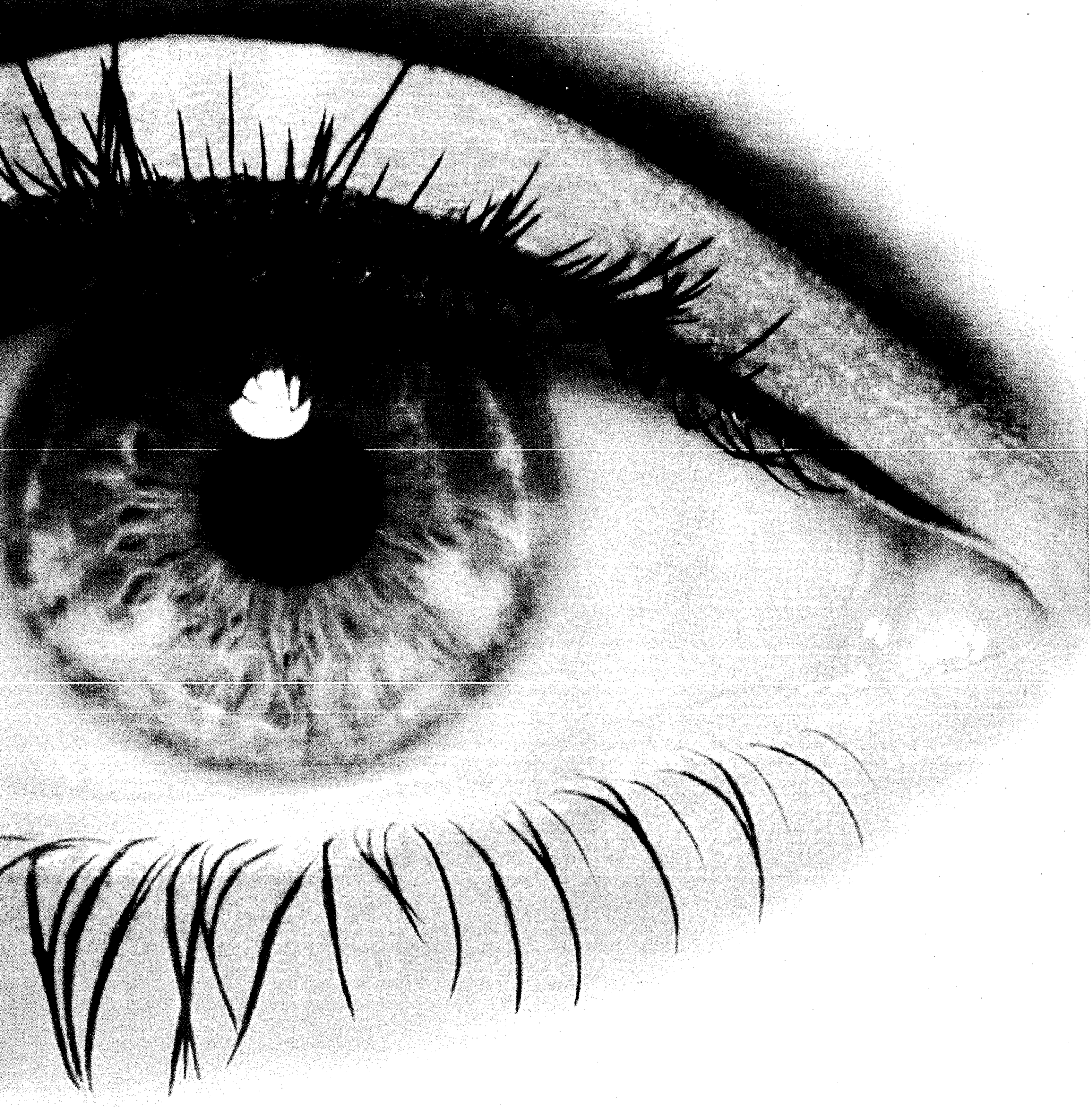


CIRCLE 93 ON READER CARD



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Simplicity is what the ENTREX™ System 480 is all about. We build in a comprehensive visual display because the operator who sees what she is recording, prepares data faster and more accurately. Simplicity is a good idea (foolproof is a nice word for it), and we've made it into a good system. With its own computer and disk, the System 480 controls up to 64 individual DATA/SCOPE™ CRT keystations. You can train a girl to run it in a couple of hours. If she can type, she can enter data on the 480. Verifying on the DATA/SCOPE's 480 character display is about as difficult as watching T.V.

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CIRCLE 75 ON READER CARD

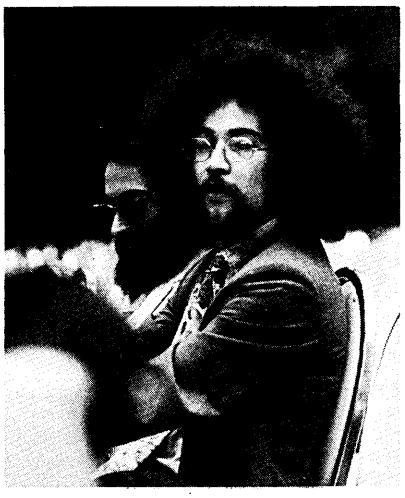
NEWS SCENE

A Consumer's Digest of ACM 70

Billed as the "Unconventional Convention," ACM 70 was a new approach to a national ACM conference; and while it may not have attained all the objectives its sponsors advertised (Aug. 15, pp. 22-33), the meeting went off smoothly enough to be a credit to the organizers. If ACM 70 fell short of its goal of "dialogue" with other industries and their public, this was hardly the fault of ACM.

Some 2,100 persons registered for the convention. About 600 were from outside the computer industry, and another 2,000 paid $2 each to view the nine noncommercial exhibits, including computer-generated art and music, a computer chess tournament, and the R.E.S.I.S.T.O.R.S. Presumably, the paid exhibit goers weren't computer people. A few hundred others, including persons from the general public, attended open meetings in the evenings.

Thus, the conference fell only slightly short of the expected 2,500



Two members of the Computer People for Peace pictured at the conference. The group changed its name from "Professionals" to "People."

registrants, but far short of the anticipated 10,000 attendees for the exhibits. If anything, then, attendance indicated that ACM was more interested in addressing the public than the public was in discussing computers and their impact on society. The promoters of ACM 70 could hardly be faulted for their efforts to entice the public to attend. Inducements included use of a sound truck, written requests to corporations to allow office workers long lunch hours to visit the exhibits, and a 12-page advertising section in the *Sunday Times Magazine*.

ACM keynote speaker Ralph Nader, celebrated consumer protector, tilted anew during recent convention in New York.

The mass media were very interested. The convention was widely reported on television and in newspapers. The venerable *New York Times* devoted a half page to a photo story of the computer chess championship, but neglected to mention ACM or the convention in the article. The big draw, however, was keynote speaker Ralph Nader.

The New York Hilton's Grand Ballroom was packed for Nader's speech on "Computers and the Consumer." He focused on how the computer could be used to assist consumers through aiding in the dissemination of information. For example, it might help the insurance companies to force the auto manufacturers to build cars less susceptible to accident damage by quickly establishing which autos are most easily damaged. Much of what Nader said involved the familiar themes of ever-growing data banks and the attendant problems of privacy. According to Nader, a credit reporting agency in Atlanta, called Retail Credit, has data on 45 million Americans. He also noted that computer technology is "too efficient for the anarchy that it operates within."

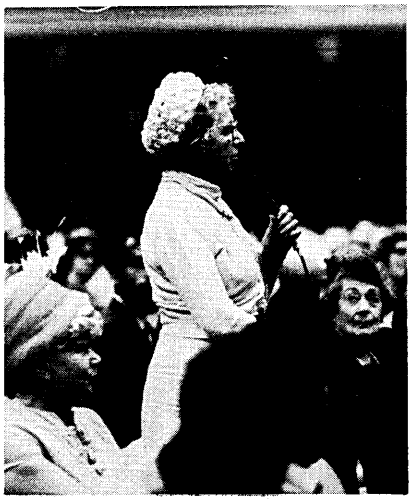
This idea was echoed later by Dr. Franz L. Alt, who remarked, after receiving the first ACM Distinguished Service Award, that "sometimes I feel that computers have gotten out of control, that we really can't handle them."

Nader accused IBM of being a monopoly, or, rather, spoke as if this were an established fact: "I suppose if a law professor were to teach his students about monopoly, his first example would be IBM." But if that upset a few people, perhaps they were pleased to hear his opinion of AT&T:

"AT&T, of course, had a monopoly position long before the computer came around. It is now a kind of dinosaur corporate structure that not only disenables it from utilizing freely and creatively this new technology, but blocks others, big and small, from creating new concepts in all the stages of the transmission and the receipt of information."

Finally, Nader warned that the computer industry had better act to police itself before the public does, as continued computer abuses could lead to increased animosity toward the computer, a "citizen backlash" against something the public doesn't understand.

Following the address, Nader stated that he had no plans to investigate the computer industry, but he



Nightly "Town Hall" meetings at the conference drew a relatively sophisticated audience.

would be interested in ways to utilize computer technology to assist the consumer. He requested that anyone who could offer assistance in this direction contact him at 1908 Q St., N.W., Washington, D.C. 20009. Nader also suggested that ACM offer an award for the best computer program written to aid the consumer, and said he would personally appear to pre-

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Don't let Vari-Punch's small size and $795 price tag fool you. This 15 lb. portable electric keypunch is making a very big contribution to EDP efficiency in many different businesses.

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CIRCLE 78 ON READER CARD

sent the award.

Since the conference was held in New York, the Computer Professionals for Peace were also present. But now they're the Computer *People* for Peace, since "Professionals" might have sounded too "elitist." At any rate, the organization was provided with a table in the registration area, and passed out its usual literature plus a "resume" for a jailed Black Panther who happens to be a programmer. Specifically, the CPP is trying to raise $50K bail for Clark Squire, a 33-year old Negro who allegedly earned over $17K a year prior to his arrest in January 1969; he had not yet been brought to trial. Squire is being held in conjunction with the armed robbery of a subway token booth. CPP contends his bail is unreasonably high, as they say he has no prior criminal record, and that Squire is being unjustly treated because he is black.

Many at the conference donated to the Squire bail fund, although CPP emphasized it could not guarantee return of the money in light of "the present situation in this country." Checks may be made out to Squire Committee, Computer People for Peace, Box 1597, Brooklyn, N.Y. 11202.

The various seminars and discussions at ACM 70 were supposed to continue the dialogue theme and avoid the usual esoteric technical topics. In this, they were mostly successful, though some discussions of industry applications did manage to get obscure, and a few seminars were attended by hardly more onlookers than speakers. Still, progress was made. After all, this was the first time such an approach has been tried. Sessions dealing specifically with people problems, such as personnel and education, were generally well attended.

The continuing problem of unethical programming schools was amplified by the presence of actual victims at an evening session on careers in data processing. One young man, asked how he had arrived at his choice of a school, explained that he had responded to a direct mail leaflet that had simply been addressed to "occupant," and that he had considered no other schools.

The "Town Hall" meetings held in the evenings, with the public invited free, were also somethat of a disappointment. Attendance figures varied from an official count of 640 the first night, down to 300 by members of the press. Attendees themselves seemed to be relatively sophisticated, and some, such as representatives of the League of Women Voters, were probably professional meeting-goers. At times, the distinguished panelists amused themselves by sparring with each other.

Overall, ACM 70 was only moderately successful. But it is easy to criticize with the benefit of hindsight, and one must respect the great effort that went into such a departure from traditional conventions. We must also consider the causes of failings. The scheduling of the convention for the last week in August, the week prior to Labor Day Weekend, may have been bad in that so many people are on vacation that week. Also, the low attendance at the exhibits may be partly a reflection of the attitudes of jaded New Yorkers, who are not easily excited. Five years ago, it was difficult to attract New Yorkers to the World's Fair, so how could ACM expect many to shell out $2 just to see some computer exhibits? Maybe it will work better next year in Chicago. It remains for ACM to decide whether to continue in this direction.

— FBN

Smith at ACM: More Members and a Code

At 51, F. Gordon Smith is a 30-year veteran of the data processing business. In his new post as executive director of the Association for Computing Machinery, Smith will have to draw on all of this experience to meet stiff challenges handed to him last month when the association's council formally named him to the post.

F. GORDON SMITH 100K members by 1975?

One task is to fulfill the promise of president Walter Carlson to quadruple ACM's membership by 1975, from today's 27,000 to 100,000. Smith already has been addressing himself to this task since taking over as executive director on an interim basis last July after Don Madden left to join Compata in Palo Alto.

Persons close to the association think its potential membership is as high as 200,000. Smith complains of a "helluva turnover" in ACM's membership, with people joining as students, and leaving two-three years later (Sept. 1, p. 40). Since July, when a member hasn't renewed, Smith has been telephoning him to find out why.

What may become an even stickier challenge for Smith is getting the association to accept a code of ethics. Before the code is accepted, the association would have to change its constitution from a society devoted to advancing computing science to one also taking political and social stands.

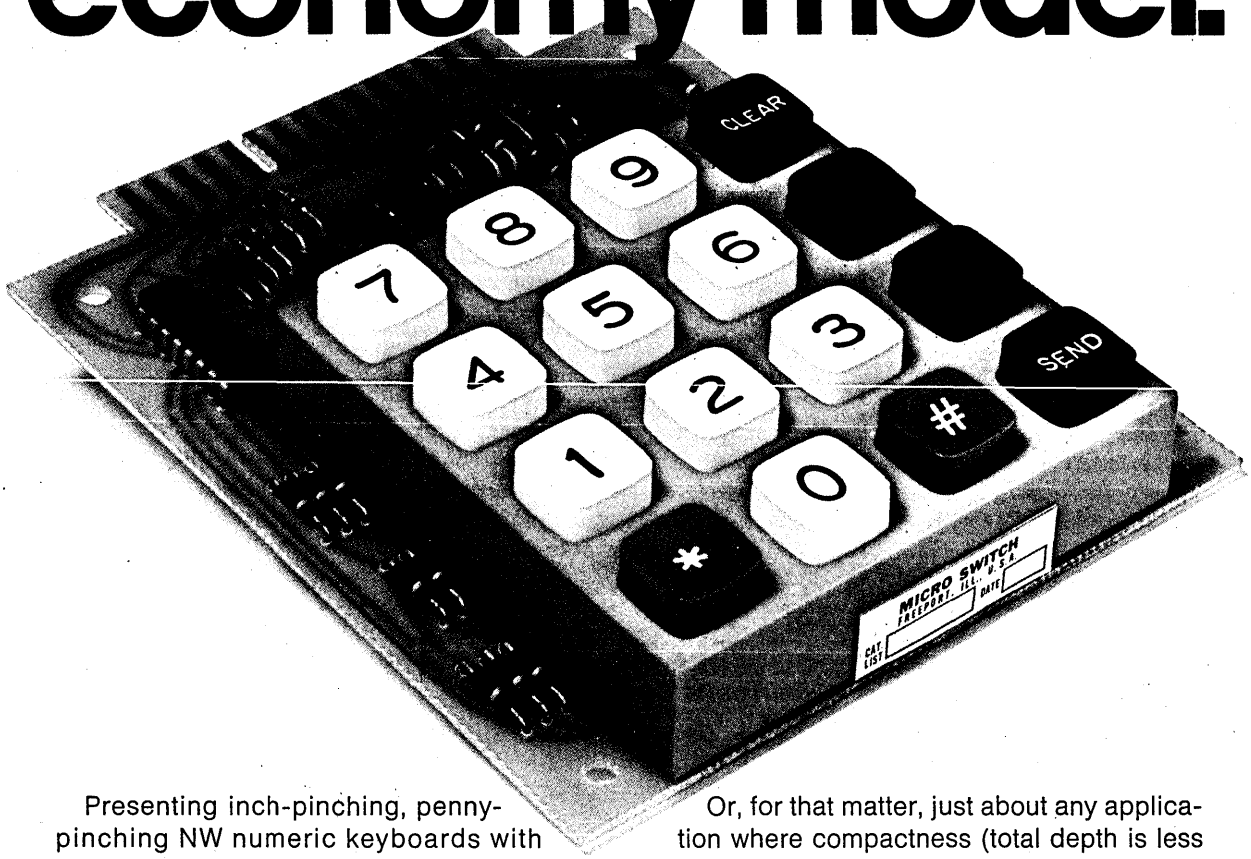
Association lawyers are now looking over a proposal for a code and for sanctions for those who violate it. Donn Parker, of Stanford Research Institute, who is a member at large on the ACM Council, has been a key figure in formulating the code. He says it spells out the responsibilities of a computer professional to the public regarding privacy and to his employer concerning loyalty. "It once was accepted practice for a programmer to leave his company and take his programs along to another employer," Parker notes.

The code also applies to practices within the association, providing guidelines in the way a candidate for an ACM office runs his campaign and who supports him. During his keynote address at last month's ACM convention, consumer crusader Ralph Nader charged that the Society of Automotive Engineers is controlled by the auto industry's Big Three. ACM will diligently avoid becoming the target of such a charge.

It also will change the way it sells its mailing list, giving members the right to prohibit use of their name on list sales or to limit the way it can be used, such as for non-profit organizations only.

Smith, born in China of Presbyterian missionary parents, joined

Our economy model.



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NW keyboards are available in either 12 (3x4) or 16 (4x4) stations. Each with BCD or Excess 3 codes. But if you don't require our encoding, non-encoded keyboards are also offered.

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HONEYWELL INTERNATIONAL: Sales and service offices in all principal cities of the world.

IBM as a salesman in 1940. He was director of communications when he left in 1958 to become director of public relations for General Foods. In 1959, he moved to Univac as director of marketing, vice president of public relations, and vp/gm for Europe, Africa, and the Middle East. In 1967, he joined Business Supplies Corp. as executive vp and general manager. In 1968, he became president and chief executive officer of Executive Sciences, Inc., an executive search affiliate of the Diebold Group.

Although Walter Carlson said four nominations were under consideration, the choice of Smith was not a surprise. Only his salary requirements might have held up the appointment. Although ACM keeps the salary of its executive directors confidential, it's learned that Smith's salary is more than $40K, considerably higher than the $30K range ACM has paid previous occupants of the post.

FJCC Far Out Down In the Astrohall

Astrohall, Houston (Space City USA) is the address of FJCC this November 17-19 where AFIPS is promising "a new market territory" for exhibitors.

So far 310 have signed. One hundred, according to AFIPS, are first-time exhibitors. The society also reports fewer cancellations and a shorter waiting list. Both are considered due to the economy. Companies, in this time of tight money, have reached the show-or-no-show decision faster than in the past.

AFIPS expects $300 million worth of products and some 40,000 people. Asked if tight money may affect attendance, AFIPS' Don Cruzen, noted that Houston is actually a shorter trip than Las Vegas for people in the East and Midwest. However, he expects fewer will come to Houston than went to Las Vegas, but those that do will be more qualified.

For those who do make it, there will be that "internationally recognized native Texan," Ross Perot, giving the keynote address. Art Buchwald will talk at lunch, and to give the flavor of the market there will be a "real down-home" barbecue.

Now y'all come.

Urban Symposium: Too Urbane?

Each year, the Urban Symposium of the New York area ACM chapters seems to be a little bit more removed from reality. Maybe computers really can't be used to solve racial problems, but it seems like this sort of application should at least be mentioned. And this year, no militants even bothered to attend. Of about 200 registrants, it was hard to find a half-dozen blacks.

Perhaps one of the problems was the attempt to link the symposium with ACM 70 by scheduling it on the Monday preceding the three-day convention. The symposium was too much like the convention, populated by many persons who had come to attend ACM 70. It was also summer vacation time, a poor period to attract students, though some were there.

This year's symposium did appear to be better organized than last year's, however. The papers presented generally were in the proper realm of computers and urban problems, and few strayed far from their mark, as occurred last year when such areas as university departmental organizations and traffic congestion were discussed with barely a thread linking them to computers. And some impressive speakers were obtained, including Dr. C. L. Miller, director of the Urban Systems Laboratories at MIT, and Dr. Herb Grosch, of the National Bureau of Standards.

Dr. Grosch had apparently come to attend the ACM 70 convention, and easily added the symposium to his itinerary. He made much mileage of having been fired from his job as director of the Center for Computer Science and Technology and demoted to "Senior Research Fellow" — proof that his rampant desire for reform had been recognized in high places. Dr. Grosch suggested that "typical incompetent programmers, analysts, and operators" should be utilized to solve simple jobs that have recognizable value in increased efficiency or some savings — goals that can be attained. "And you won't get fired when something small works, though you may get fired when the big project fails."

Dr. Marvin L. Manheim of MIT spoke on the use of simulation models, which, he pointed out, often consider only *one* variable. The construction of a highway, for example, will be governed by traffic patterns, to the exclusion of other effects of highways, such as the relocation of residents, barriers that isolate neighborhoods, pollution, urban blight, etc. He said the designer of Route 128 around Boston once remarked that it would have been a success if they hadn't let all those firms build factories along it. Manheim even went so far as to state that "the dangers of the use of computers *almost* outweigh the good in the use of computers."

The luncheon speech was effectively delivered by John P. Eberhard, Dean of the School of Architecture and Environmental Design at Buffalo State Univ. Eberhard spoke of change in the computer industry, how computer personnel have moved from concern over improved equipment to concern with how the equipment is used and how it affects people. He was not too clear in linking computers to urban problems, but he dramatically illustrated the need for improvement in our cities by describing how much better the "quality" of New York City was when he visited it as a child. At one point, he actually began to weep, saying "You look at New York now — it's a mess! It must be terrible to live here today, especially for the poor people." The audience was visibly moved. The effect was much like that of the showing of a film on a Bronx ghetto at the 1968 symposium.

The afternoon sessions provided a variety of mostly high-quality papers in the areas of social and physical environment. In fact, there were enough usable papers submitted so that the committee elected to include a couple of papers in the Proceedings which were not actually presented at the symposium, for want of time. Sessions were generally well attended, and audience participation was good. Indeed, a session on the social environment found proponents of systems for automating welfare payments and for automating the function of prosecutors nearly driven from the room by devastating remarks from attendees. A black man began a question by identifying himself: "I am a member of a minority group ..." It was the most action the symposium saw. *(Continued on page 78)*

data bits from Teletype

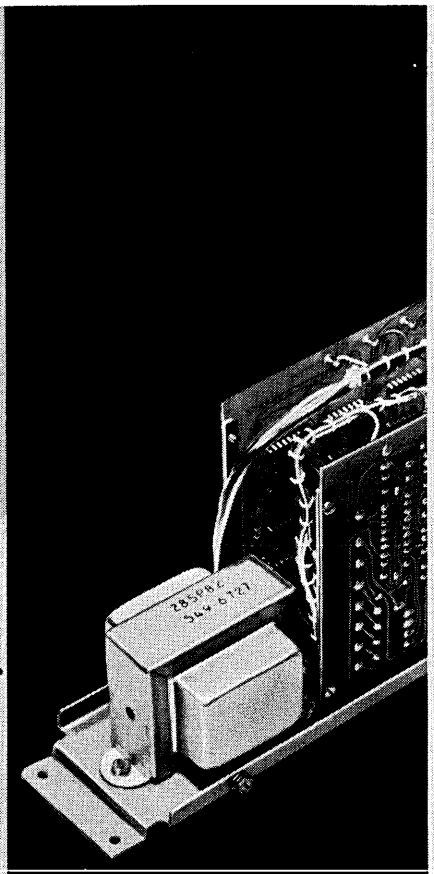
knowing who's going where, when and now!

Maintaining a passenger flight manifest is a vital part of airline operations. And highly complex. One carrier, that deals with hundreds of flights and some 25,000 people daily, recently reduced some of the problems involved by integrating high-speed Teletype® equipment into its system.

Computerized manifest data, compiled in the airline's central office, is sent to departing terminals two hours prior to each flight. It's used in a variety of ways: As a boarding checklist. In computing aircraft weights and balances. For meal details. To meet special requests for wheelchairs, etc.

At the time of departure, "no show" passengers are deleted from the manifest, standby names on board are added, and the list resubmitted via Teletype equipment to central office computer for updating. The computer then generates the "official" manifest and sends it to both departure and arrival terminals involved, at 1050 wpm. The send-receive operation usually is complete before the flight gets into the air.

Teletype's Stuntronic™, electronic selective calling station controllers, also helped reduce computer port requirements of this system by 90%.



keeping a multistation network under control

Teletype has a simple solid-state logic device that provides a truly practical and economical way of establishing automatic control over multi-terminal data systems. The Stuntronic™ station controller is what it's called.

This helpful accessory provides station interface, control, and response for all ASCII compatible Teletype data terminals. Can be used with model 33, model 35, model 37, Telespeed™ and Inktronic® equipment. It will recognize all incoming station signals and respond to its own address characters.

More than 100 different control arrangements are possible with the Stuntronic station controller — including detecting vertical parity errors and establishing computer communication and intra-circuit communication among a variety of system terminals.

total on-line time: divide by twelve

If you have a number of low-speed terminals in your time-sharing system that generate heavy loads of on-line time, it may pay dividends to do the above arithmetic. The Teletype Inktronic terminal is about twelve times faster.

This electronic, solid-state terminal will generate 128 ASCII combinations. Print 93 alphanumerics in upper and lower case. It achieves 1200 wpm printing capability. Charged ink droplets are drawn to the page through a series of electrodes that form the character called for. The ink supply and guidance system has only one moving part. So the Inktronic terminal requires little maintenance. And it's really quiet.

It has more than on-line operational economy, too. Uses ordinary teleprinter paper. And inexpensive ink. Like most equipment in the Teletype line, you won't find a more capable terminal on a price/performance basis.

on track with 80,000 cars

Numbers: important in every business. But, no one has to contend with more of them than a railroad. Keeping the digits straight that identify rolling stock alone, staggers the imagination. These numbers represent big money to railroad and customers alike.

One major railroad uses over 500 high and low speed Teletype terminals in its system to provide the type of car utilization that means business and profitable operation. The terminals are linked to a computer by communications channels.

The Teletype equipment has parity error detection capabilities. Important in keeping the identity and location of over 80,000 cars straight. Teletype solid-state terminal logic permits the computer to poll stations and terminals to respond automatically.

Data generated includes immediate car availability, projected car availability in 1 to 3 days, condition of cars, what type of goods each can handle. Locomotive power available. Enabling the railroad to provide shipper customers the equipment they need for loading, when needed. The data system handles over 30 million data bits daily.

recommended reading

Teletype has a number of brochures 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:

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

Men behind the Century 300 series at Rancho Bernardo assembly facilities in southern California: Sid Valentine and Stu Dale,senior project engineers, and Tom Tang, chief systems engineer for computing systems. NCR will develop most of the 300 at 525,000 square foot plant near San Diego.

NCR Introduces Century 300

In the 2½ years since NCR introduced the Century Series computers — specifically, the 100 and 200 — a total of some 1,400 have been installed worldwide. The number of 100s in operation is about double that of the 200. Last month, the Dayton, Ohio, firm introduced the largest in this series, the 300, and stressed the compatibility of user programs running on its two predecessors.

"With the 300," says O.B. Gardner, NCR's vp of market development, "we have extended operating systems and increased hardware capabilities to handle the multiprogramming and on-line requirements of the large-scale user at a lower price than any comparable system." Improvements over the 100 and 200, it is explained, are in the number of terminals accommodated rather than in response times. System prices range from $15-50K/month, and first delivery is scheduled for February 1972. Details of the new system appear on p. 93 in this issue.

In its marketing, NCR will be going after the 200 user who has outgrown his present configuration, as well as the larger 315 RMC user who's now paying about $20K/month. In addition, however, the firm is eyeing the IBM 360/40 and 50 user and anyone casting wishful glances at a 370/155 configuration in the $35-40K/month range. The Century 300, spokesmen claim, is maybe 50% faster than a 155.

Will The Real Univac 1110 Please Stand Up!

The ideal way to introduce a new computer is to build up a great deal of suspense so the entire industry is literally sitting on the edge of its chair waiting for the formal announcement. Univac appears to have accomplished this with its still-to-be- announced machine — usually called the 1110 — without meaning to.

For months, the trade and business press has reported the imminent debut of the large machine. Yet the computer remains under wraps.

Where is it?

The 1110 is reliably reported to be alive and well in prototype form. Different reasons are given by industry observers for the holdup of its announcement — soft ware problems, tight money market, circuitry difficulties.

When asked about this, Univac assumes the classic stance of all mainframe computer companies when asked about new equipment — it doesn't even admit the existence of the new machine, although company officials have said publicly that Univac is coming out with a larger and more powerful computer than the 1108. The latter is the firm's largest and perhaps most successful machine currently on the market.

The haggling over the 1110's circuitry may be the most interesting behind-the-scenes intrigue surrounding the new machine. At this writing, Univac had definitely settled on Ray III as the workhorse circuit for the 1110. In addition, Univac is said to be designing Ray III into most of its other new equipment, including the next machine down the road, called the 1112. The 1112 is still on the drawing boards at Univac's Roseville, Minn., plant. Also, Ray III has been designed into the PCC — a communications terminal under development at Univac Salt Lake City.

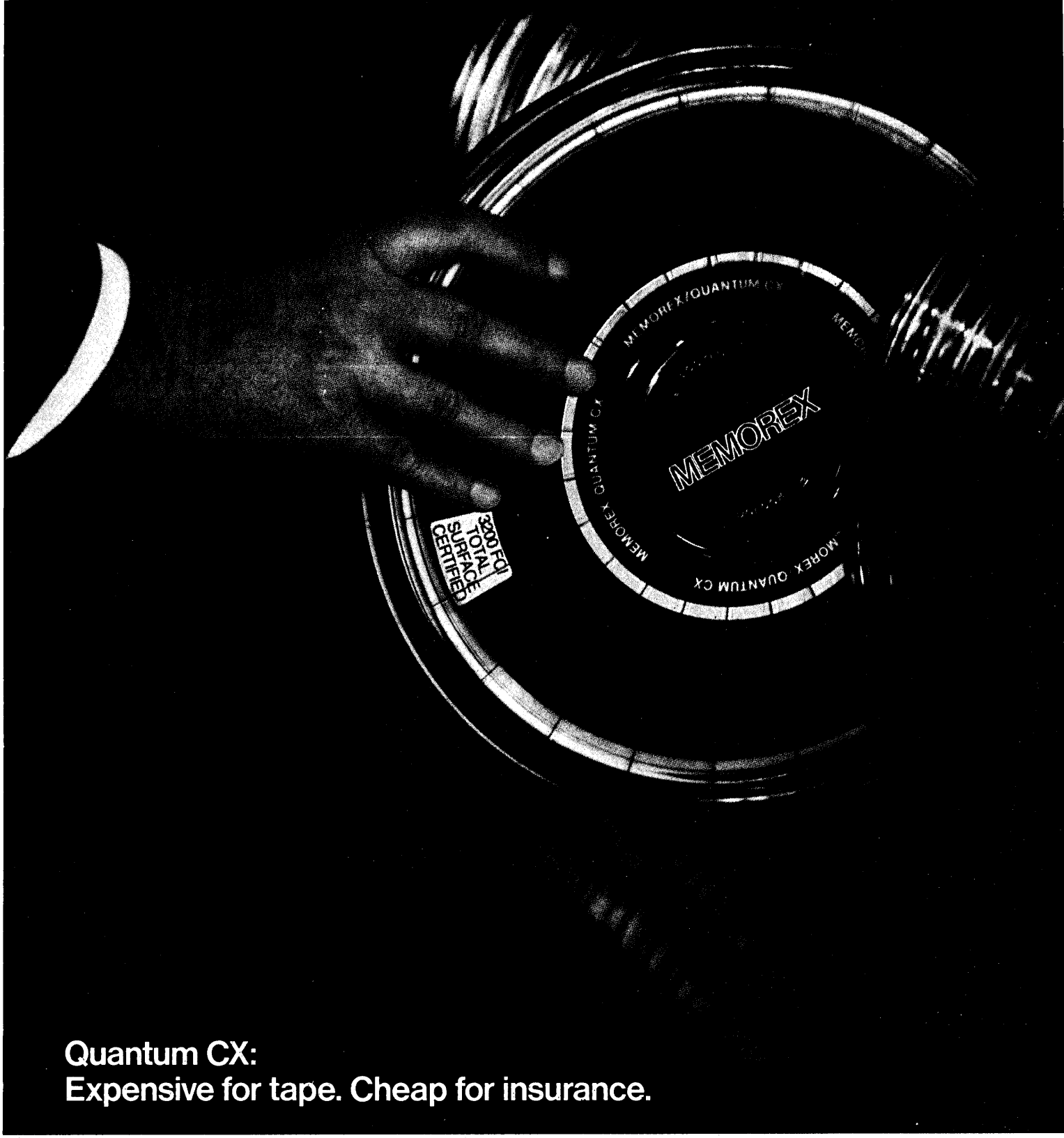
Ray III — originally designed by Raytheon Semiconductor — is an exceptionally high-speed circuit with propagation delay times of about 5 nsec. Actually it is a sophisticated evolvement of Sylvania's Suhl line. Univac is said to have chosen Ray III because it wanted the best and fastest circuit available.

But Ray III is also an extremely difficult circuit — expensive to produce and hard to get good yields on. At first, there were fears among some at Univac that the company could be repeating disaster with its old Larc computer when it decided to go with the innovational Ray III. (Univac's Larc was the first solid-state giant computer. Although technically superior, the Larc was too expensive to produce and Univac took a financial beating on the machine.)

At any rate, Univac found itself in something of a bind with Ray III some months ago when it became apparent that the circuits would sell for $3 each while 54/74 TTL circuits were selling for a fraction of that. Thus, Univac's competitors would have a price advantage.

The situation was complicated for Univac because Raytheon was the sole source for Ray III. Things got even worse when Raytheon's top management began a mass exodus from the Mountain View operation to other semiconductor companies.

Univac countered by giving development contracts to Texas Instruments, Fairchild, and Motorola. These three giants of the semiconductor industry are now regarded by many as Univac's prime sources for Ray III. Raytheon's role is somewhat unclear, largely because of the top-level exodus. However, Francis Dowd, general manager of Raytheon Semiconductor, says that Raytheon's deliveries of Ray III to Univac are on schedule and that he regards Univac



Quantum CX:
Expensive for tape. Cheap for insurance.

At this very moment, critical data in your tape files may be deteriorating. Until Memorex Quantum came along, there wasn't much you could do about it.

Now there's Quantum CX. It protects against lost data two ways.

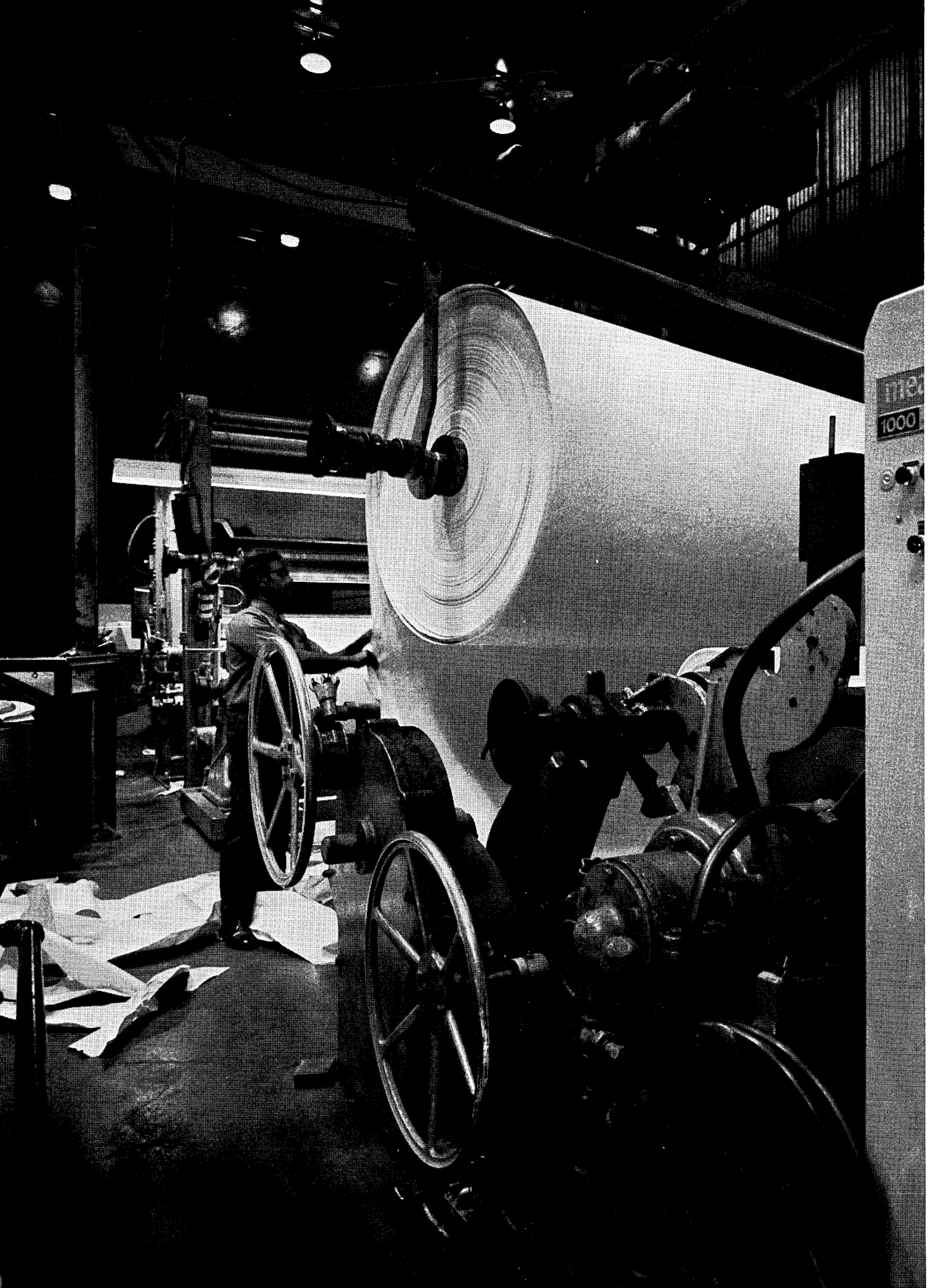
First, with the proven Quantum oxide coating that's more resistant to "growing errors". Second, with a a new back coating. It reduces errors caused by static-attracted contaminants and by debris from back scratches.

It costs more to make a tape the way Quantum CX is made. But remember, the premium you pay really isn't for the tape. It's for the insurance.

For more information on Quantum CX, write: Memorex Corporation, Information Media Group, Memorex Park, Santa Clara, California 95050.

MEMOREX

CIRCLE 46 ON READER CARD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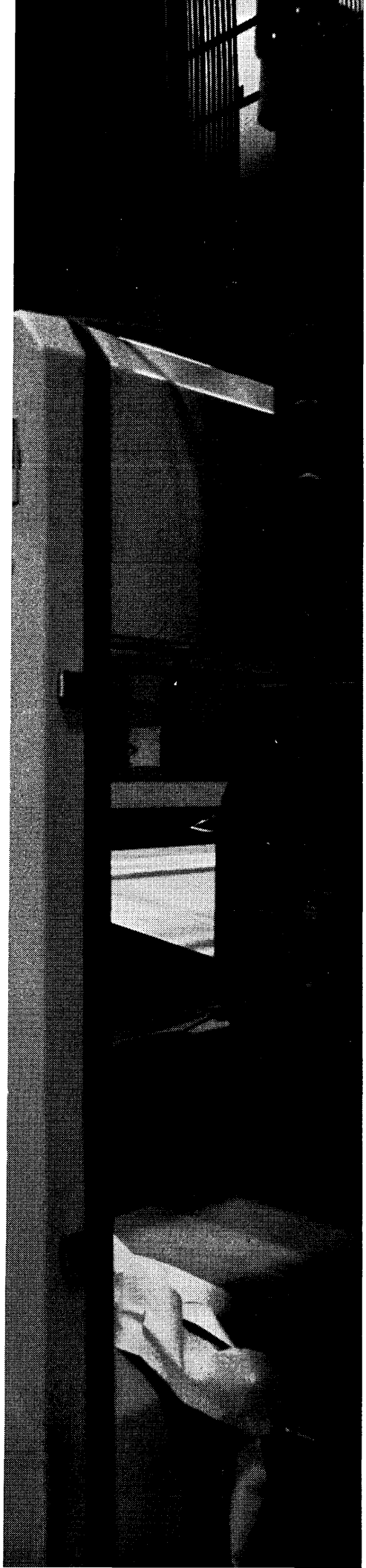

A minicomputer here? Sure! And ours is helping boost profits up to $20,000 a month.

Paper mills can be pretty rough on electronic equipment. So any computer system put there had better be able to take it—especially if it's guaranteed to increase profits. And Measurex of Santa Clara, California does just that. They guarantee profit increases from $4,000 to $20,000 a month.

That's one big reason why they chose our 2116 computer as the heart of their paper mill process control system. They knew it would keep on working in spite of heat, humidity, vibration and corrosive fumes—acting as an on-the-spot control center in Measurex's unique system for regulating the moisture and fiber content of paper speeding along at hundreds of feet per second.

It's a job that affects profitability in a big way. Misjudging fiber or water content, even slightly, can be costly. But improved reliability and accuracy can pay off to the tune of half a million dollars a year in added profit. With so much at stake, it's not surprising that Measurex chose our computer.

There are other things to like about our small computers: good specs, comprehensive software and simple interfacing with all system components. Constant updating without obsoleting your present system. Plus our complete line of input/output devices, available off-the-shelf.

Another benefit: our minicomputers don't put the squeeze on an OEM like Measurex—or any other purchaser. For instance, you can buy our powerful 2116, with 8K of core memory for $24,000. And it can be expanded in 8K increments up to 32K. If you don't need that kind of power, our 4K version of the 2114 costs just $8500.

Get the full story on computers you can depend on. Call your nearest HP sales office or write to Hewlett-Packard, Palo Alto, California 94304; Europe: 1217 Meyrin-Geneva, Switzerland.

22010

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DIGITAL COMPUTERS

CIRCLE 24 ON READER CARD

Honeywell computers may be applied liberally.

If you're looking for a general-purpose computer that really is general purpose, you ought to know about Honeywell computers. Like the H316 computer below, and other members of the Series 16 family. Then there's the Series 32 family. And the H112 minicomputer. They're being used in all sorts of applications.

On off-shore oil rigs, they're helping keep free-floating ships directly over the drill.

In supermarkets, they're speeding checkouts and maintaining total inventory control.

In airline systems, they're concentrating data to cut back on expensive telephone line lease costs.

In hospitals, they're providing on-line, real-time access to both in-hospital communication systems and remote data facilities.

And if that isn't enough, try these: Space capsule simulation. Antenna control. Numerical control. Remote manipulator control. Industrial control. Weather reconnaissance. Weather forecasting. Patient monitoring. Navigation. Target tracking. Fire control. Seismic studies. Travel reservations. Medical research. Credit verification. River traffic control. Communications. Graphic data conversion . . . Whew.

Now that's what general-purpose computers are all about.

Get more information about Honeywell computers and the uses they're being put to. Write for our Control Applications Kit. So you can consider the alternative: Honeywell, Computer Control Division, Framingham, Massachusetts 01701.

The Other Computer Company:

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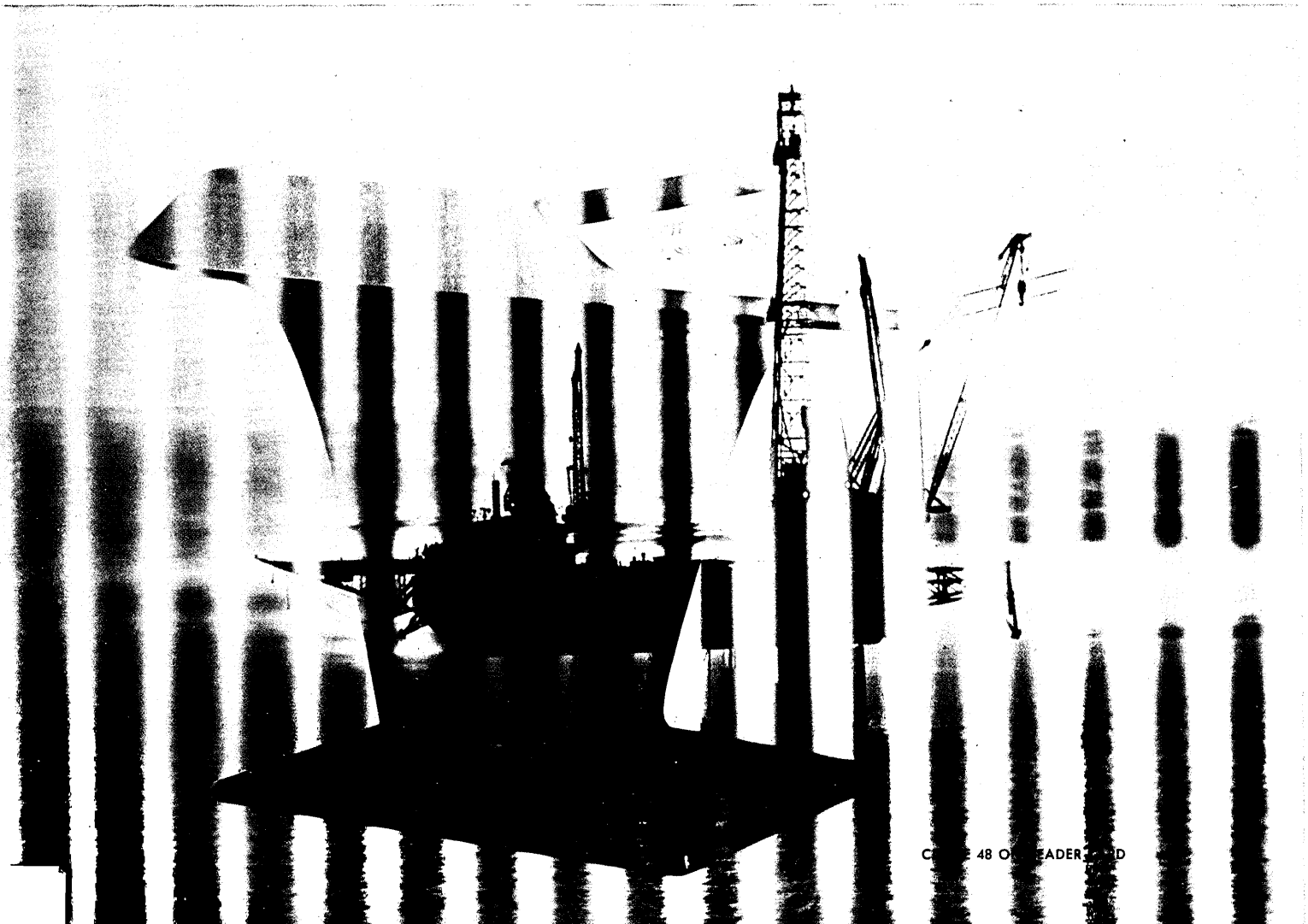


CIRCLE 48 ON READER SERVICE CARD

as one of Raytheon's most important customers.

The fifth company known to be supplying Ray III to Univac is Intersil, a relatively new but highly sophisticated semiconductor firm. Intersil is understood to be supplying some of the tougher Ray III circuits.

In all, there are currently about 15 Ray III circuits that are being supplied to Univac, some with MSI functions.

Univac is reported to be getting the circuits in small quantities now with full-scale production scheduled to be under way by mid-1971. Already, the price cutting among the semiconductor companies has begun, and Ray III gates are now reported to be selling for 90¢ each as against $3 a year ago. Furthermore, prices are expected to continue to drop.

One of the ironies in the whole situation is that Sylvania Semiconductor, the company that developed the circuitry family line of Ray III with its Suhl line, is not producing Ray III at all. And the company that designed Ray III — Raytheon Semiconductor — is in danger of being pushed aside in the market by TI, Fairchild, and Motorola.

All in all, though, Univac would appear to have solved its circuitry problems, although the whole situation illustrates the perils that face a large mainframe company when it must deal with the semiconductor industry. (IBM is the lone computer company with a gigantic in-house circuitry capability.)

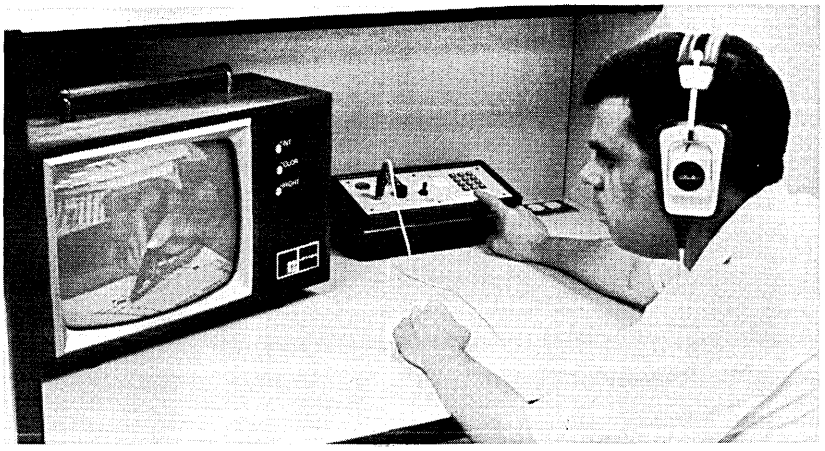
As for Univac's 1110, its status remains pretty much where it has been for months — it is expected to be announced shortly. As has been noted before, the 1110 will be more than twice as fast as the 1108 and will use both plated wire and magnetic core for memory. It is expected to execute 1108 programs without modifications.

— W. David Gardner

We Could Call It Dial-A-School

This fall's batch of students at Fullerton Junior College near Los Angeles will be receiving many hours of instruction in a way that statisticians say is most comfortable to them — in front of a tv set where they control the channel selector.

The unusual part of the system's operation is that the viewing students also will be controlling the programming through function keys at their crt stations.



Eventually, he need not even show up on the campus.

Valtec Corp., of Irvine, Calif., has installed a network of terminal controlled tv sources, movie projectors, slide projectors and audio equipment. A student may, for instance, power up a video tape projector — which may be far from his terminal — and address a specific lecture on the tape which then will be screened at his convenience for his terminal only but which may be accessed by many others simultaneously.

A master control unit, which actually is a sophisticated polling device, picks up commands entered at terminal function keyboards and connects the terminal user with whichever source he has chosen. At present, five video tape recorders, a commercial television receiver, and the film sources can be addressed. These are accessed by 32 individual stations and 10 conference rooms. Thirty more terminals are definitely to be added, but the switching system is capable of handling up to 1,000 terminals and 1,000 sources — with a response time of 0.3 seconds.

The school also will have the option of adding more logic to the system, so that the students can be tested at the stations, the amount of system usage can be monitored, and "average student" profiles can be compiled. "Some schools," Valtec spokesman Jim Calvagna says, "are considering using the whole random access and control system as a single peripheral to an existing on-site computer. They will be able to use their computer for all their normal data processing tasks at the same time."

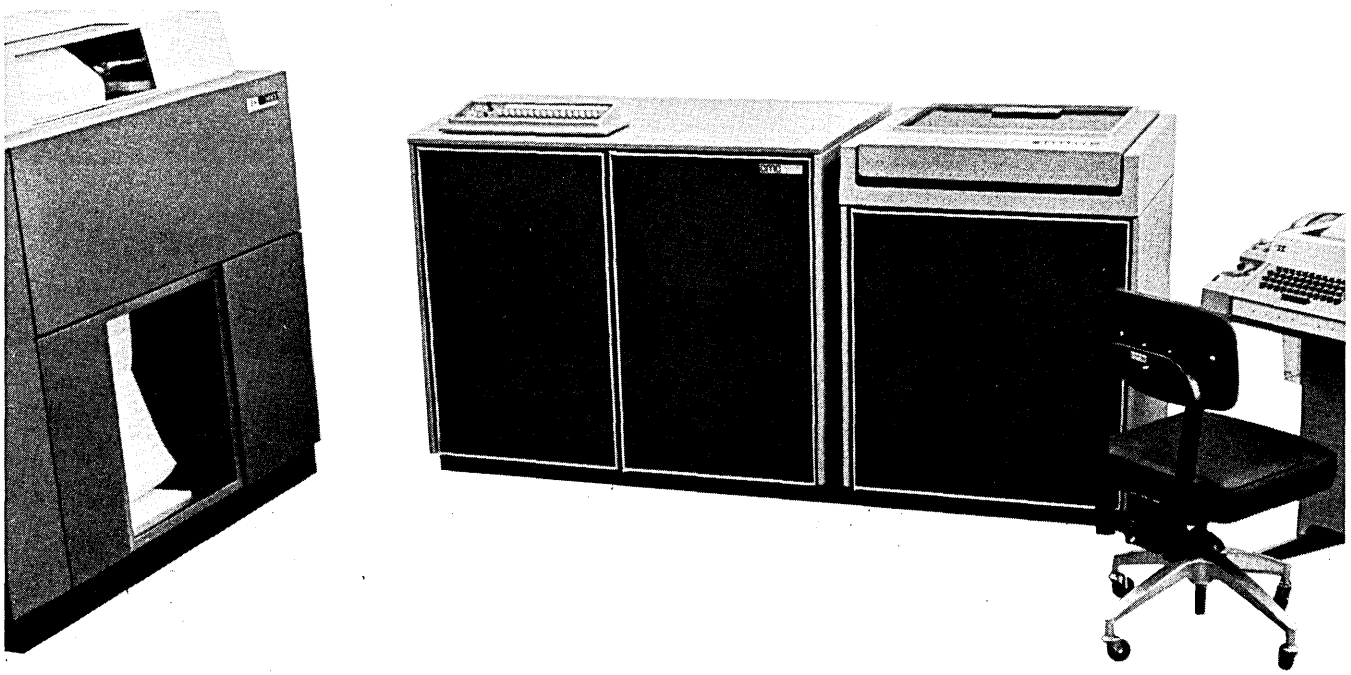
Each week Fullerton JC publishes its own version of *TV Guide* and perhaps, in the not so distant future, a student could subscribe to the publication and not come to campus at all. This is not possible now, as each crt is attached to 10 twisted pairs of cables, but that is undoubtedly a temporary hang up.

"Software": Something New in Art Exhibitions

There's an art show at the Jewish Museum in New York right now that has some of the earmarks of a computer exhibit and a science fair. It's called "Software," and its raison d'etre as an art exhibition is explained by exhibit curator, Jack Burnham, professor of art at Northwestern Univ.: "At a time when esthetic insight must become a part of technological decision making, it seems nonsensical to make qualitative distinctions between art and technology."

"Software," which continues in New York until Nov. 8, eliminates the traditional media of painting and sculpture. In fact, says the museum, "Many of the 'Software' artists, feeling that any information or insights that they have can be relayed to people in more direct ways than through a painting or sculpture, have ceased producing objects at all." Symbolic of this, artist John Baldessari has cremated all his paintings, the remains of which are in a vial embedded in the museum wall.

The show's emphasis is on revealing the artistic process itself and in-



DataPrint.

It'll give your computer time to think.

DataPrint™ is our brand-new system that lets you treat your computer less like a typist and more like a computer.

Most computers don't compute when they're printing on line. They're too busy telling the printer what to do. Expensive computer time is wasted.

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DataPrint is a real solution. A complete system—small computer, tape unit, printer—that takes the entire print load away from your main computer.

DataPrint is easy to program. It accepts raw data from magnetic tape. Formats, edits, and further processes it. And drives the best printer you can get—the IBM 1403.

And since DataPrint was designed only for output, it costs a lot less to run.

What do you think of that?

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volving the museum goer in the exhibits. The tools of the "nonsalable art" are transistor radios, computers, crt's, closed circuit tv, and 40 furry gerbils.

Poets like Allen Ginsberg, William Burroughs, and Aram Saroyan are broadcasting their readings within the museum so visitors can pick up continuous readings on rented radios. TV monitors are showing artists at work in their studios. And a film by Evander Schley provides the artists' explanations of the meaning of "Software."

A DEC PDP-8 linked to a crt and hard copy printer provides the attendee with his "interactive catalogue" of the exhibit. Using Theodor Nelson's long-standing "hypertext" system, the catalogue is displayed on the crt screen, with key words in the text footnoted so that the viewer may access the footnote through the typewriter and delve more deeply into his areas of interest. He ultimately ends up with a tailored printout.

Artist Hans Haacke is credited with the idea for an information storage and retrieval system that will produce and display statistics on the characteristics and opinions of the museum goers (such as 7,000 are women against the war in Vietnam).

Those furry gerbils are involved in a modern-day Pavlovian experiment in which not only the gerbils but also the computer learns behavior. Called the SEEK system, it was developed by Nicholas Negroponte and the Architecture Machine Group of MIT. The gerbils are in a box with 2,000 plastic cubes and a mechanical grappler that zips around on sliding tracks, picking up blocks and trying to rearrange them so that the gerbils are walled in. (It switches off when it hits the poor fellas.) An Interdata 3 computer is used.

Another exhibit permits the attendee to "see through his skin." Developed for the blind by the Smith Kettlewell Institute of Visual Sciences, the system consists of a tv camera, a converter to transform the image into electrical impulses, and 400 vibrators mounted in the back of a chair. The person seated will feel the vibrations on various parts of his back, conforming to the configuration of the image transmitted.

If the interested miss the New York showing, "Software" will be in Washington at the Smithsonian Institution Dec. 16 to Feb. 14.

CAB Has Reservations On Airline Reservations

Prospects for a common automated interairline reservations system for travel agents dimmed drastically last month when the Civil Aeronautics Board deferred action on a subscription agreement among 11 major U.S. Airlines and Atar Computer Systems, Inc. which would provide the system.

The CAB decided to investigate Atar's proposal and the whole idea of airline reservations systems. Since Atar won a tentative contract two years ago from eleven airlines through Air Traffic Conference, bargaining agent for the airlines, Atar has been considered front-runner in the on-line airlines reservations field.

It received a slap in the face with the CAB from the Justice Department which contended it would obtain a monopoly if its agreement with the 11 carriers was approved. So, Atar amended its proposal. Instead of an exclusive agreement with the 11 signatory airlines, theirs would be non exclusive, meaning any other firm with a reservations system could sell it with ATC approval. So, presumably, the Justice Department was placated. But a number of "interested parties," other firms who feel they have the capability to offer airlines reservations systems, were not, and CAB concluded that ... "the differences between the parties ... as to the intent and effect of the agreement are as irreconcilable as they were at the outset and ... cannot be resolved on the record before us."

If, as one airline spokesman predicted, "the whole idea of a common automated system for travel agents is dead," then it probably means a wide open market for anyone who has a saleable system which could be marketed airline by airline.

Airlines signatory to the Atar proposal met in Washington following the CAB decision and, according to George Buchannan, executive secretary of the Air Transport Assn. who presided, concerned themselves mostly with what the CAB investigation would involve and how long it would take. Estimates on the latter ranged from one to four years.

Atar has assured, no matter what the involved airlines decide, they are still very much in the airlines reservation business.

One of the "interested parties" in the CAB hearings which protested the Atar proposal was Telemax Corp., a recently acquired subsidiary of Wellington Computer Systems. Telemax considers itself in a strategic spot as a result of the CAB deferment. It presently interfaces its hotel-motel reservations system with American Airlines' SABRE system, and its customers can access all of American's flights plus all connecting flights. Telemax currently services some 80 travel agents. They also have an agreement with Frontier Airlines which operates in the Rocky Mountain states. There are some reservations industry observers, however, who feel Telemax lacks the resources to step in and provide an Atar-like system very soon.

Telemax has a plan which calls for storage within its own Univac 494 system of seat availability data on all flights on all airlines operating within the U.S. Said a Telemax spokesman, "we would take a big load off the airline systems by shifting the processing of travel agent reservations to our computer complex." Another big advantage, he said, is that, "our plan doesn't require CAB approval." He added that the programming needed to support the proposed system should be finished "late this year or early in 1971."

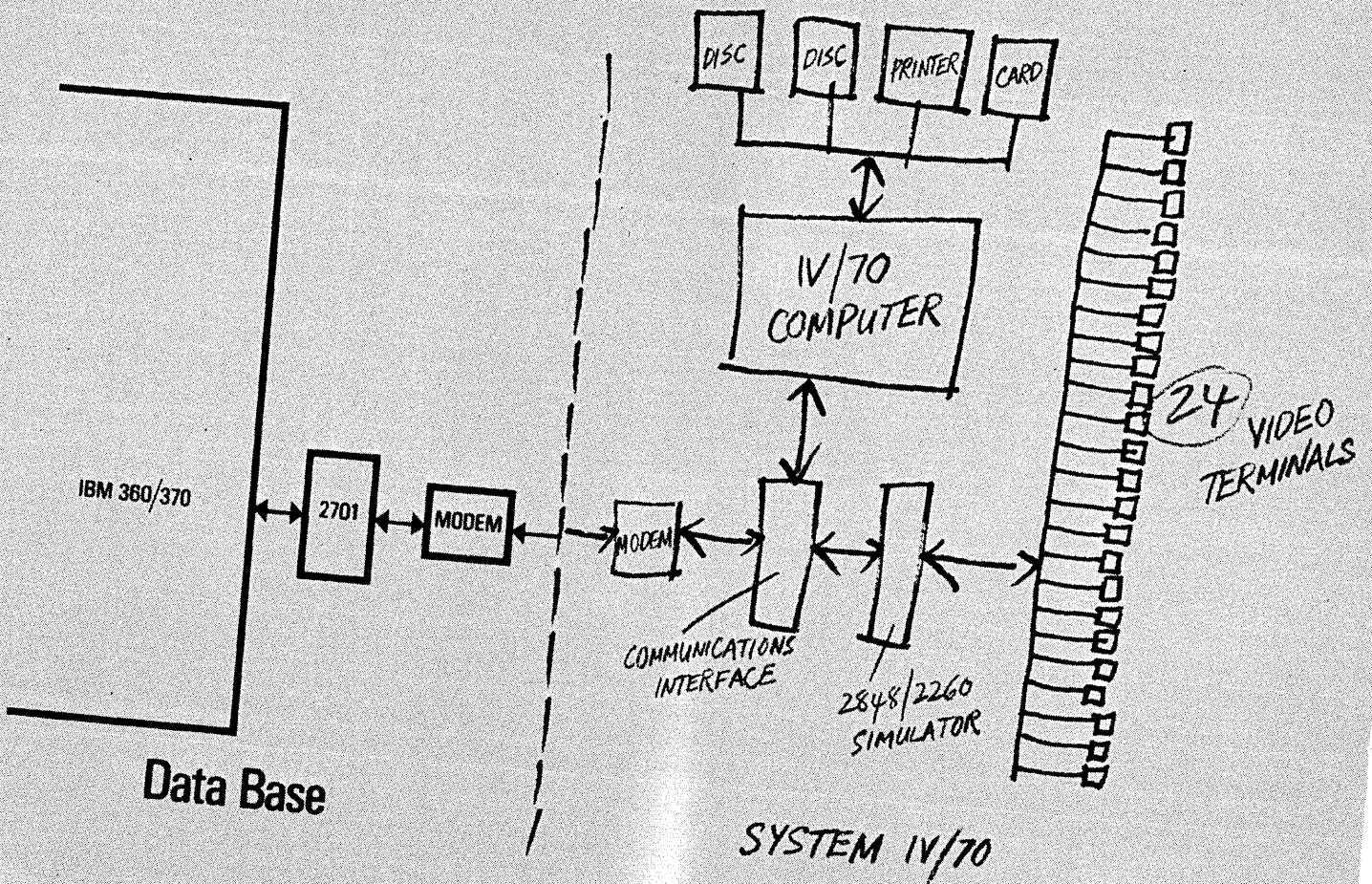
In the meantime, Atar, which has invested some $2.5 million in its airline reservations system and was organized to the end of getting this system going, certainly can't be counted out. If the 11 airlines involved in the subscription agreement decide they don't want to wait for CAB approval, it can be assumed Atar would be able and anxious to peddle its system airline by airline.

But the votes weren't in at this writing, especially from the airlines. And the biggest question mark was posed by American Airlines who has a contract with Telemax for the interfacing with its SABRE system and which has a substantial interest in another "interested party," Reservations World, which has expressed interest in getting into the airlines reservations business. Like Telemax, ResWorld's primary business to date is hotel and motel reservations.

A point made by the CAB in its directive to defer decision on the Atar-airlines proposal was the absence of

proof:

System IV/70 is the low-cost data-base access system of the 70's



The cost of a 24-terminal System IV/70—with a 24K CPU, two moving-head disc drives, a line printer, communication interface, and a card reader —is less than the cost of IBM's 2848/2260 terminal system alone!

our-Phase Systems, Inc., 10420 North Tantau Avenue, Cupertino, Ca. 95014 (408) 255-0900

CIRCLE 22 ON READER CARD

American Airlines at any of its hearings, particularly in light of the airline's relationships with both Telemax and ResWorld.

In addition to Telemax, Atar and Reservations World, companies that may offer airlines reservations systems include Univac, American Express, and CDC, which recently acquired the airlines division of Computer Communications Network, Inc., Atlanta, which processes reservations on-line for several regional airlines.

Security, Funds Mutual Concerns of Seminar

The problems and anxieties attendant on running a university computing center were shared recently by 40 center directors during a three-day seminar at the Univ. of Colorado in Boulder. Attendees came from the U.S., Canada, and Puerto Rico, and seminar chairman Dr. Rex Krueger stated that he was quite pleased with the turnout and the quality of the presentations. The seminar will be discussed at an ACM SIGUCC (Special Interest Group on University Computing Centers) meeting at the FJCC.

The papers presented at the seminar indicated the concern of the participants over such troublesome matters as funding and security — there was little attention accorded to technological development or "magical, monstrous machines." Among the papers offered were "Funding a Computer Center: Color it Green," "Having a Computer in Your Budget is Like Having a Tumor — Let's Hope the Growth is Benign," "The Computer User: A Necessary Evil," and "Implications of Educational Innovations."

Funding came under particular scrutiny because of the National Science Foundation's recent decision not to provide any more funds to university computer activities. According to Robert Gillespie, director of the computer center at the Univ. of Washington and a seminar activist, this action halted the development of computer centers by drying up the "seed" money necessary to obtain further financing. Very few centers in the U.S. are fully funded by the universities, he said, and where to get the money is becoming a most nettlesome, if unoriginal, difficulty.

Gillespie felt that the seminar was useful in that it enabled the attendees to find out that their problems are all about the same and that the solutions, if any, will be similar. The solution to the security problem, however, seems to be remote — the predetermination of possible sabotage to a computer is as likely as that of skyjacking an airplane. Perhaps, Gillespie suggested, the day of the window view to computer operations is over, and that is sad, because it presented an image that was clean and open, something that is needed as the computer daily acquires a more unnecessarily esoteric mystique.

The group intends to hold another seminar next year for "whoever's left" (as directors) and it hopes to have more solutions; "We really aren't libraries but would like to be funded that way."

NEWS BRIEFS

Computer Against Disease

Today TB, tomorrow all communicable diseases in Texas. The state's health department hopes to control them all by computer. For openers the department has installed an RCA Spectra 70/45 in Austin that is remotely handling in-patient accounting for the State Tuberculosis Hospital in San Antonio. If this goes well, two more state TB hospitals will be added to the network, which ultimately is expected to link 12 regional centers and handle everything from hospital inventory control to laboratory reporting. And the department hopes this ultimately will lead to implementation of a comprehensive health information system for controlling all communicable diseases in the state.

For Back Offices

Honeywell has begun offering an automation system called Security I that it describes as designed to accommodate every back-office function of a brokerage. It will be one of the services offered by a new Wall St. DataCenter the firm is opening this month and also will be available at 16 other Honeywell DataCenters. In addition to being available as a service, Security I can be purchased or leased by a brokerage or can be provided as part of a facility management contract.

From Minis to Midis

Cincinnati Milacron (nee Cincinnati Milling Machine) Inc., which began making a line of minicomputers at the beginning of the year under licensing from Micro Systems, Inc., of Santa Ana, Calif., has sold 237 of them to Eldorado Electrodata Corp., another California firm planning to use them as data terminals and in small office applications. A fixed-price royalty will be paid to Micro Systems for units sold.

In a separate venture CMI, which originally started to design and make its own computers but discontinued, will launch a midicomputer it says it has been developing independently for some three years, debuting at the Fall Joint Computer Conference.

Consolidated Computer, Ltd.

Consolidated Computer, Ltd., the two-year-old Toronto company, is enjoying healthy sales in the U.S. and eventually expects most of its revenues will come from the U.S.

The firm recently received support from the Canadian government, which is guaranteeing loans obtained by the company from financial organizations.

(A report in the Sept. 15 issue on the company contained a typographical error which inferred that most of the firm's sales would be to the Canadian government.)

IBM Deposits Money, Banks on Minority Firms

In another of its quiet efforts to help correct the nation's racial economic imbalance, IBM is now implementing two programs aimed at aiding and abetting minority-owned banks and minority-owned companies that are able to serve as vendors to IBM. Aid to the banks is, naturally, in the form of money, which IBM has on deposit at all 23 member banks of the National Banking Association, a group composed of minority financial concerns.

(Continued on page 88)

The amount of the deposits is not known, but the interest is nominal and gives the banks a chance to make money, as is the custom with banks, and to support other minority enterprises.

The minority vendors program is a double-edged attempt to help minority suppliers and at the same time build up IBM's own range of purchasing capabilities. To qualify as an IBM vendor, a company must be a going concern, no matter how small it is; it must have a product or service that is needed by IBM; and it must meet IBM's technical and quality standards. However, during startup procedures on a new contract, IBM will provide technical support to help the supplier get going. Bids offered by prospective vendors are "subject to price negotiation," which probably means that IBM will protect any overzealous bidder who comes in too low to make a profit.

IBM is nearly mum on the subject, leery, perhaps, of charges of paternalism, but neither of the programs is a giveaway, and both seem to be sensible, effective ways to get things done.

NEW COMPANIES

An organization with 32 specialists, count 'em, has been established by an engineering outfit, Arthur G. McKee & Co. in Cleveland, to provide services in process control for materials handling, critical path scheduling, simulation, and general management information. Predictably called **McKee Computer Services Co.,** it will be presided over by a 17-year IBM man, Laurence G. Brown, who was previously with Progressive Data Management Corp.... Along the same lines, **Action Communications Systems, Inc.,** has been formed recently in Dallas to make and market a new telecontroller, a message switching system for small- to medium-size setups — a market "largely ignored by other manufacturers of such equipment." ... Another company set up to "bridge the gap between minicomputers and their peripherals" for dedicated tasks is **Text Machines Associates,** L.A., which offers complete custom packages ready for "immediate" use for people who could not afford computers before.... **Math Associates** in old Great Neck, L.I., offers electronic packages for control systems to "nonelectronic manufacturers" with mechanical interfaces.... In microfilm, Don Avedon, NMA director and author *(Computer Output Microfilm),* has formed **Microfilm Presentations, Inc.,** Ridgefield, Conn., to furnish training and educational 35mm slides for presentations at seminars, complete with script explanations, aimed mainly as an introduction to microfilm (COM) systems for management and corporate personnel.... In leasing, a company has been formed by a combine: Microform Data Systems, Menlo Park, Calif., in partnership with U.S. Leasing International, San Francisco (which will furnish leasing outlets), and a St. Paul, Minn., insurance and venture group (which will furnish cash). The result, **Microform Leasing Co.,** is hq'd in S.F. Other such combines are contemplated nationally with the same backers, different suppliers....Another software brokerage for generalized packages has been formed by **Information Processing Systems, Inc.,** Englewood Cliffs, N.J., offering systems developed by users, and marketing them nationally. IPS already has a marketing network through its used equipment dealerships.... **General Data Systems, Ltd.,** is yet another bank servicer — mainly for system review and evaluation — in Philadelphia, headed by Louis A. Marabella, president, a Honeywell alumnus, and John D. Famularo, vp. They have developed something they call Modular System Technique (MOST).... **Xerox,** going along its computer way, has established a new division, Special Products and Systems, encompassing two older units, Electro-Optical Systems and Xeroradiography, in Pasadena, Calif., which will be headed by Dr. Robert J. Potter as vp/gm.

This leopard lizard, exposed to low levels of gamma radiation in a controlled experiment in the Nevada desert, is being monitored by computer. Scientists and technicians from the UCLA Laboratory of Nuclear Medicine and Radiation Biology are using an IBM 360/91 to study the effects of the radiation on native populations of plants and animals. One conclusion to date: female leopard lizards exposed to the radiation become sterile after three years.

MERGERS, ACQUISITIONS

There are still some acquiring companies on the prowl. **Tracor Data Systems,** based in Austin, Texas, has agreed to acquire all the assets of **Datamark, Inc.,** Westbury, L.I., producer of high-speed line printers, and has acquired a 36% interest in **Remcom Manufacturing Co.** of Dallas, with an additional warrant for another 20%. Remcom makes communications terminals, and Tracor's president Lloyd C. Hubbard has avowed further strengthening of the company's line of peripherals.... AFCOA **(Alumina Ferrite Corp. of America)** has completed acquisition of **Computer Components Corp.,** custom core memory stack producer, and **Sagetec Corp.,** a peripheral "coupling" system maker. All are adjacently located in California's San Fernando Valley.... **Brandon/Systems Press, Inc.,** will not die on the vine after all. It has been taken over by venerable **Auerbach Corp.,** and will continue publishing professional and reference books, hq in Princeton, N.J., but under the Auerbach Vertex imprint.... **Syner-Data, Inc.,** Beverly, Mass., has acquired **Fort Electronic Products, Inc.,** data entry manufacturer in nearby Wilmington. S-D makes peripherals, including terminals.... A Delaware corporation located in Houston has been acquired by a Sunnyvale, Calif., firm, **Anderson Jacobson, Inc.,** time-sharing peripherals maker and lessor. A-J is one of the fortunate few who have been able to finance their own leases. In taking over **Computer Equities,**

Inc., from another leasing company, **Computer Complex** of Houston, for an exchange of stock, A-J feels the acquisition will help it greatly in the t-s market. . . . A majority interest in **Applied Computer Time Share, Inc.,** Detroit, has been purchased by **Lear Siegler, Inc.,** terms undivulged. . . . **Consolidated Computer Industries, Inc.,** a service bureau and COM operator with facilities in central Florida, has acquired **Business Machines, Inc.,** of Orlando, which will continue to furnish computer services, particularly customized ones. . . . **MBI, Inc.,** Palo Alto, Calif., data and telecommunication manufacturer, has been acquired by **Prentice Electronics Corp.** of the same town, which will thereby augment its line of data communication devices, plus engineering and marketing services. . . . **Data Management Services, Inc.,** Hartford, Conn., which had agreed to sell a majority control to **Wabash Magnetics, Inc.,** a company with a computer subsidiary in Phoenix, withdrew to make a deal with a group of independent businessmen, including a former vp/gm of RCA's dp division and the president of a diversified holding company already in the computer services business. . . . **Dynasciences Corp.,** L.A., has agreed to acquire **Computer Measurements Co.,** a division of Newell Industries in Sunnyvale, Calif. . . . Finally finalized: **Novar Corp.,** Mountain View, Calif., data terminal maker, has become part of **General Telephone and Electronics. . . . Worldwide Computer Services, Inc.,** Hartsdale, N.Y., wants to change its direction from purely technical consulting to more general communications, so has agreed to buy **Aspen** magazine, published by the **Roaring Fork Press,** catering to the artistic community of film makers, literateurs, the modern dance, and publisher of Beatle John Lennon, with collaborator Yoko Ono.

SHORTLINES

Although it was only founded in mid-1968, a Santa Clara, Calif., firm has won the 1970 National Venture Capital Award for being one of "the five most interesting and rewarding investments" during the past four years. It is Iomec, Inc., started by IBM alumni who went on developing disc drives for themselves. After less than a year of marketing, the company has a $10 million backlog; plant facilities have more than doubled; there are presently 175 employees. Smart investors include EDP Resources, Max Palevsky (Xerox Data Systems), and the Rockefellers. . . . TeleMart, the San Diego firm whose computerized system enables housewives (or house husbands) to shop for groceries by phone (March, p. 163), has now gone into operation. A new division of the company, TeleTravel, is also just starting up, will organize group and individual tours, ultimately will utilize TeleMart's computer facility at the Rohr Corp. in S.D. . . . Ampex, which needs more space in the Los Angeles area to make its peripherals and the MOS memory systems it plans to market, is building a 300K-square-foot plant in Marina del Rey. ■

X-RAY™

Now, for the first time, there's a way to monitor total system performance.

Our new X-RAY enables you to "see inside" your computer system to determine operating efficiency and to pinpoint ways to dramatically improve performance and reduce costs.

X-RAY is a truly unique hardware/software monitoring system which is capable of analyzing all aspects of system performance, specifically including:

- **Configuration Utilization**
- **System Software Overhead**
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X-RAY (Execution-Recorder/Analyzer) provides a high resolution, real time signal collection and data reduction facility for a detailed analysis of total system performance, yet creates no operating overhead for your system. Data is collected using passive techniques, partially reduced on line, and then recorded on magnetic tape for post processing by the X-RAY Analyzer.

Detail and summary reports are produced for system configuration usage, operating system overhead, individual problem program execution, and data base activity. Results may also be a source of input to the CASE system simulator for performance predictions.

X-RAY is available under purchase, lease, or service plan. To find out how X-RAY can improve your operations (actually pay for itself many times over), contact us for more information.

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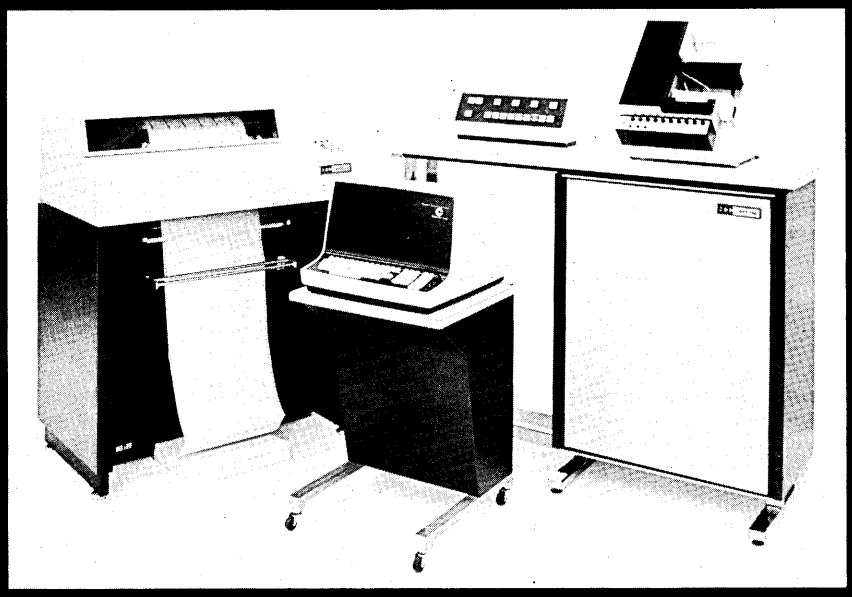
CIRCLE 97 READER CARD

Whether you're replacing terminals or building a new communications network...

This Remote Batch Terminal saves you money now!



To your computer, our terminal looks like an IBM 2780 or 360/20, CDC User 200, Univac DCT-2000 or 1004 — or any multiple combination your network requires.

None of these hardwired terminals can match the flexibility of our DCT-132. It uses software instead of hardware to communicate in several manufacturers' languages. And as technology advances, all you need to keep pace are simple terminal software routines.

The DCT-132 has more off-line capability than any comparably priced terminal. Extra peripherals may be added easily in the field.

Talk to Scientific Control about a complete communications program. We offer a flexible, short-term lease plan and a major savings on purchase.

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CIRCLE 17 ON READER CARD

System/370 is a highly advanced computer system.

Speed? System/370 Model 165 is up to five times faster internally than System/360 Model 65.

Core Storage? Model 155, for example, provides you with the greatest range we've ever offered on a medium-sized system, up to two million bytes, and Model 165 has up to three million bytes.

So you can take advantage of multiprogramming. To handle more jobs at the same time.

Channels? Model 155 has six and Model 165 has 12. So information can get in and out of the CPU much faster.

Its high-speed disk file houses three and a half times more information than any file IBM has ever made. Up to 800 million bytes in all.

Its printer fires out words and numbers at the incredible rate of 2000 lines a minute.

All this is reason enough to consider moving up to System/370.

But it becomes all the more reasonable when you consider that all those advances were made while retaining compatibility.

Now you can move up to IBM System/370 and still keep using the same terminals.

The 370.

Now you can move up to System/370 and still keep using the same programs. All of which makes System/370 easy to install.

System/370's new monolithic circuit families give you more computing per cubic foot.

More computing. With compatibility.

You wouldn't want it any other way.

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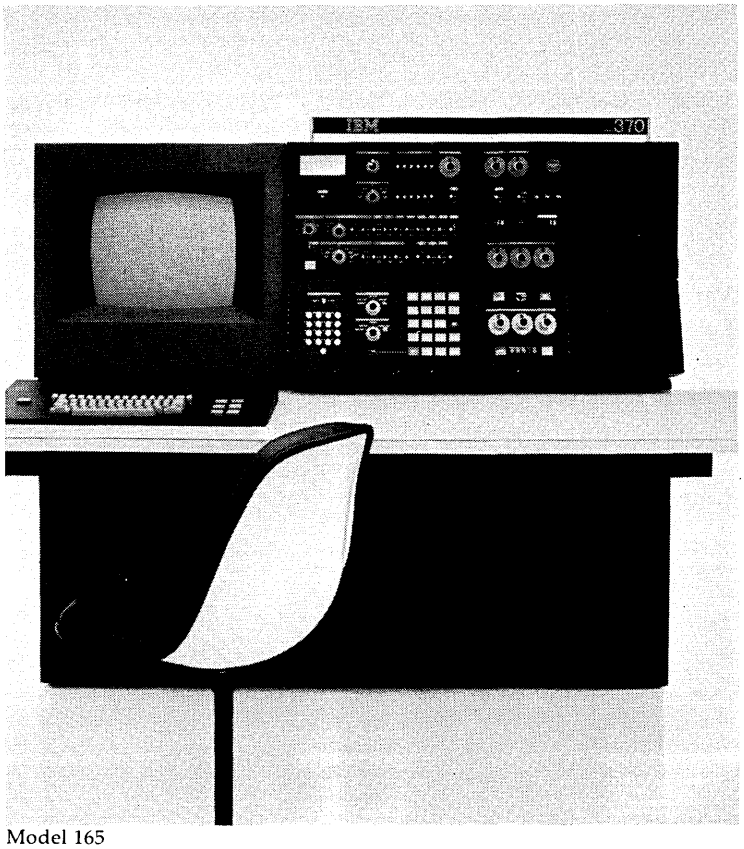
It's great to know it's compatible with the 360.



Model 165

IBM System/370: the computers for the seventies.

the MSI-100 speaks out.

The MSI-100 system includes a terminal, acoustic coupler, polling device, and receiver. This provides a complete electronic data recording and transmission between remote sources and a central location. The polling option, with the automatic answer bar, allows for unattended terminal operation.

The terminal records numerical data on a magnetic tape cassette. The data is then transmitted over dial up phone lines to a receiver at the data center. Your choice of receivers will allow for output to be converted to seven or nine track magnetic tape, punched tape, or data can be fed directly into the computer.

The MSI system is complete with all hardware, software and systems and service support. Over 3,000 operating terminals prove the economies and efficiencies of the MSI system.

If your problem is data gathering and transmission, look to the MSI Data Corporation for the answers.

Gentlemen:
I would like more information on the MSI electronic data transmission system.

Name_____

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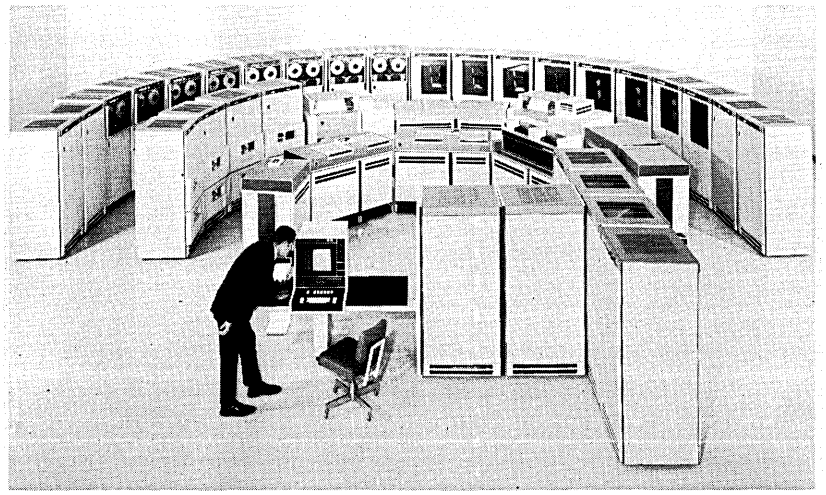
PRODUCT SPOTLIGHT

First Century of the Decade



Easily the most powerful computers ever offered by this manufacturer, the Century 300 line provides not only a logical place for growing Century 100 and 200 series users to go to, but also should give 360 model 50 and 65 users something to think about as they study specification and price sheets for the IBM 370 series.

Totally hardware and software compatible with Century 100 and 200 models, the 300 architecture is interesting. The arithmetic/logic processor consists of a separate command set-up unit and command execution unit. Each has its own access port to memory and their parallel operation effectively eliminates command set-up time. In addition, the I/O control provides up to 18-way simultaneity. By providing independent access to memory for the ASCII-coded I/O, the system achieves a maximum transfer rate of 4.3 megabytes/second with a minimum of cycle stealing. The four-way interleaved memory is 650 nsec core ranging from a basic 128K bytes up to 2 megabytes.

Other features of the layout are: one standard multiplexor channel rated at 210 kilobytes/second maximum for eight positions, six 850 kilobyte/second channels having four positions, and optionally, up to four 1.1 megabyte/second channels having eight positions. The priority interrupt scheme provides for hardware termination queuing on 16 levels. The vendor claims the overall design is approximately 50% more powerful than a 370/155.

Programmers will appreciate having 63 index registers per program to play with while executing 67 standard one- and two-word instructions containing one or two addresses. Arithmetic is accomplished in binary and decimal, with all decimal operations built into the hardware.

Multiprogramming in COBOL, FORTRAN, and NEAT/3 is supported by a new operating system featuring job accounting, automatic job scheduling, common systems disc and program library, file and unit sharing, time-sharing for approximately 250 terminals, and system-aided recovery.

To insure that system requirements for random access storage are met, the model 650 drum is offered, accessing 4.2 megabytes in 8.3 msec (average), and transferring information at a rate of 1 megabyte/second. The standard assortment of peripherals is available including a 1,500 lpm alphanumeric printer that jumps up to 3,000 lpm when printing numbers only, and the recently announced model 657 disc unit gets a new controller boosting its capacity up to a maximum of 47.8 megabytes per spindle (95.6 megabytes per unit). The 657 accesses information in 60 msec and transfers it at up to 500 kilobytes/second.

The lease range of the Century 300 is from $15-50K per month, and first deliveries are scheduled for February, 1972. NCR, Dayton, Ohio. For information:

CIRCLE 372 ON READER CARD

Info Storage/Display

Anyone for a COM data base? This updatable microfilm information terminal allows for maintaining a 90,000-image library on a 200-foot roll of 105mm COM fiche—dubbed "roll fiche" by the vendor. Changes to the information are generated and stored on a 16mm film cartridge with address locations corresponding to addresses on the main film. The operator enters the address of the frame he wishes to view. If an update image is found, it is automatically displayed on the 11 x 14-inch screen. The operator can override the update and look at the previous image, or if no update has been generated, the original image appears. Average access time is 2.5 seconds.

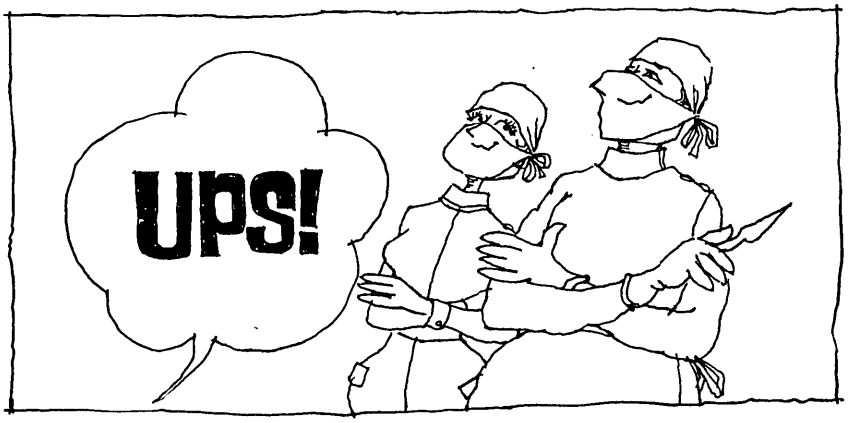
Options to the basic unit include an alpha keyboard and a computer interface enabling searches to be made by name, key word, or other similar techniques. In this application, an index is prepared which can be stored on disc as the film is generated on the COM unit. The operator addresses the computer through the keyboard and, after searching the index, the computer will direct the microfilm terminal to the proper location.

Another option that will be available next year is a read-only memory enabling the unit to change information not requiring an index change (such as a catalog listing where only the page numbers change and not the titles), and a printer unit will be available late next year.

Depending on options selected, the updatable microfilm information terminals sells for $3750 to $7500. MORGAN INFORMATION SYSTEMS, INC., Palo Alto, Calif. For information:

CIRCLE 375 ON READER CARD

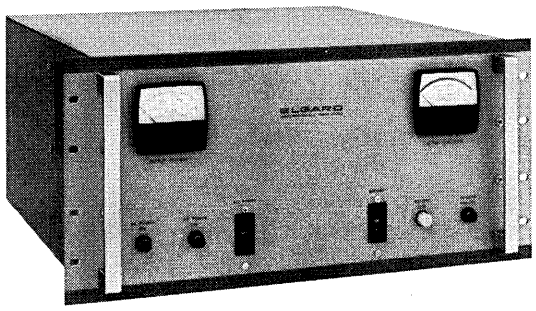
(Continued on page 94)



The new ELGARD
Uninterruptible Power Source
is what's UPS.

No need to worry about blackouts, brownouts, or dropouts in your critical operations. *Elgard* UPS 1001 supplies up to 1 kVA of high-quality, no-break power to individual instruments and systems . . . as though your life depended on it. Compact, with an integral, maintenance-free battery pack, the *Elgard* UPS is an absolutely unique power source. And it's from the company that pioneered reliable AC power sources and line conditioners. Its $2075 price makes it the least expensive preventive for the mounting headache of unreliable commercial power. Get relief fast; write or call collect Don Burgar, president, for full information.

ELGAR CORPORATION®



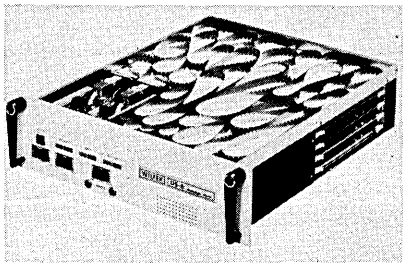
8159 Engineer Rd., San Diego, Calif. 92111 Tel. (714) 279-0800

CIRCLE 41 ON READER CARD

Tape Buffers

Reliability, low cost, and the ability to send and receive data at different speeds simultaneously are the initial claims for the Digi-Store line of tape buffer stores. The manufacturer expects them to see extensive use in store and forward and crt data entry systems.

The three units—DS-3, -6, and -7—can receive and transmit up to 333 cps and store up to 50,000 characters. The storage medium is a tape loop



which passes through two heads, one writing while the other reads.

The DS-3 is the basic unit for store and forward and data entry. DS-6 provides polling or call selection within a network or between two computers. DS-7 can do both polling and call selection. The units are plug-to-plug compatible with paper tape equipment, and interfacing options are available. Prices range from $3000 to $5000. Delivery is 90 days ARO. WILTEK, INC., Wilton, Conn. For information:

CIRCLE 380 ON READER CARD

Conversational Terminal

Price is pegged as the biggest (or smallest) feature of this IBM 2741-type terminal. Terminal/900, at $2315 (per single unit) is a modified Selectric with electronic keyboard, superscript, subscript, self-contained data set with both acoustic coupler and hard-wire capability, and "computerized" tab set. Line length is 130 characters and print speed is 15 EBCDIC or BCD characters/second. The terminal can operate in both full- and half-duplex modes.

There is also a special ($218) option that gives a degree of plotting capability via reverse line feed and half spacing. Terminal/900 is available 30 days ARO. KSW CONTROLS, INC., Fairfield, Conn. For information:

CIRCLE 376 ON READER CARD

(Continued on page 96)

"We're the third largest company in disk drive sales. Eighteen months ago we didn't even exist."

century data

"That's one of the most significant statements I can make about our company, because it tells you something about our product, about our people, and about the way we do business.

"In a highly competitive, very technically oriented marketplace such as the computer industry, you don't build this kind of sales record unless you have significant product superiority. Especially when you're competing against the giant of the industry.

"And no company can survive such a rapid growth rate without the right kind of people. The people in charge here are experienced veterans of other fast-growth companies. They know where the problem areas are, and how to cope with them successfully.

"Most important, to grow this fast, you really have to deliver. Our marketplace has been misled too often and it's suspicious of anything new and unproved. So we're out to establish a reputation of being honest, of being solid, of meaning what we say and delivering on what we promise. We can't afford the luxury of mistakes. If we fail we don't get a second chance. So we don't fail.

"With this kind of product, this sort of people, and this attitude, we're rapidly becoming the second largest company in disk drive sales."

George Canova
President
Century Data Systems

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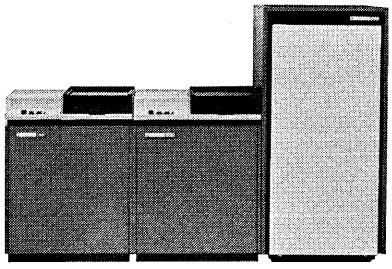

Keep computing time records accurately, automatically

Increase your computer system's efficiency by plugging a Chrono-log Programmable Clock / Calendar into an existing I/O channel. Then you'll be able to eliminate human effort from computer timekeeping and instead:

- Use the computer to keep accurate, automatic records of computing time
- Sequence jobs on the computer without wasted time or operator intervention
- Bill jobs directly by the computer
- Identify printouts by date and time
- Summarize computing time, nonproductive time and downtime

The Chrono-log Clock / Calendar, unlike an internal core clock, *cannot* be stopped or its settings accidentally altered by the operator or by the program. It operates under program control to provide a real-time input of date and time into core storage. And it automaticaly corrects for 28-, 30- and 31-day months and for leap year so that manual resetting is never required.

To learn how you can use your IBM or CDC computer as its own timekeeper, write Chrono-log Corp., 2583 West Chester Pike, Broomall, Pa. 19008 or call (215) 356-6771.

CHRONO-LOG CORPORATION

CIRCLE 59 ON READER CARD

1130 Line Printer

The 1130/Sprint is a 400-lpm chain printer, intended to replace IBM 1403 printers used with 1130 computer systems. The Sprint is compatible, of course, and includes all control circuitry for direct interface with the 1130. Specifications include a 48-character set, 120-character line width, 6 or 8 lines/inch spacing, and accommodation of forms from 6 to 18¾ inches wide in up to six parts. A 96-character print set and 136-character line width are optional.

No 1130 software modifications are required to use the 1130/Sprint. Rental is $795 per month on a two-year lease. Delivery requires about 90 days ARO. INTERCOMP, Cambridge, Mass. For information:

CIRCLE 379 ON READER CARD

PDP-11 Commo Interface

A fully buffered, asynchronous communications line interface will be available next month for the PDP-11 line of computers. Designated the DC-11, the unit connects a PDP-11 to a variety of asynchronous terminals or to another computer through common carrier communications facilities. The DC-11 could also be used in data acquisition and control, numerical control, and in small time-sharing systems. It can interface to Bell 103 and 202 modems or their equivalent.

One of four clock rates is selectable by program control, with baud rates of 110, 134.5, 150, 300, 600, 1200, and 1800 available. Character size is variable under program control to five, six, seven, or eight bits. Stop code is programmable to one or two bits.

The Unibus bidirectional bus structure of the PDP-11 can serve as a multiplexor for adding interfaces. Each two interfaces require a single unit (there is room for four DC-11 line units in one tabletop PDP-11). A DC-11 system unit with clock (for mounting two module sets) sells for $250; module sets are $600 each. DIGITAL EQUIPMENT CORP., Maynard, Mass. For information:

CIRCLE 374 ON READER CARD

Data Inquiry and Display

The IBM 2260/65 terminal has attracted a lot of attention lately—mostly from competitors. Building an intelligent controller (practically a minicomputer) and attaching a number of terminals to it seems to be great fun, and the Datapoint 3360 data inquiry and display system is the latest "front end." Up to 64 local or remote terminals can be attached to the 3360 controller.

Model 3360 Datapoint terminals operate at 1200 baud through Bell model 202 data sets, hooking up to the controller, which attaches to one or more IBM 2701 data channels, depending on volume. Installation of a controller adjacent to a computer requires only a channel adapter for direct connection to the multiplexor channel. Local terminals operate at 2400 baud.

The 3360 controller software provides channel management with flexible display format, editing, and automatic tabbing features. Error control and code and format conversion for use with optional peripheral equipment is also handled. Significantly, no software changes are necessary to the host system since all interfacing is done in the controller.

The Datapoint 3300 terminal (see Aug. 1969, p. 162) has been relieved of a lot of its responsibilities (now handled by the controller). It now has 24 lines of 80 characters, and with these specifications debuts as the model 3360. You can make them put some of the innards back in the terminal by ordering an internal buffering option.

Lease rates are tentatively set at $565 per month for the controller, and as low as $58 per month per terminal—which must mean on a 64-terminal configuration. Delivery of the 3360 system is 45-60 days ARO. COMPUTER TERMINAL CORP., San Antonio, Texas. For information:

CIRCLE 373 ON READER CARD

(Continued on page 98)

"Staying one jump ahead of IBM in disk drives is easy. The hard part is not to get two jumps ahead."

century data

"In most industries a manufacturer who comes up with a better product than his competition is rewarded with success. In the computer peripheral business he may be digging his own grave.

"The reason is simple. The users of computer peripherals believe that they're tied to the technological level of the mainframe manufacturer. This is wrong. We proved, for example, that we can significantly increase the productivity of a 360 simply by substituting our own disk storage system for the one supplied by IBM.

"Nevertheless, computer users have come to accept IBM's standards as industry standards. This means that only IBM has the privilege of introducing a new product and that any significant innovation or improvement that is not initiated by IBM is viewed with suspicion and distrust.

"And what is even more difficult is that they have a habit of announcing new products long before they are able to provide the interface specifications. In the case of the 3330, for example, it will be months before the peripheral manufacturers will have access to the interface requirements.

"The ultimate loser, of course, is the computer user himself. He could have our most advanced disk drive today if he were willing to accept it. We have had 400-track units operating in the field since spring. But the production models will probably have to wait until IBM has delivered theirs.

"In spite of this, our technical leadership has enabled us to come up with more firsts than anyone else in the industry. And that's why Century Data will ship more state of the art equipment than anyone else. For, after all, better disk drive systems are what we have to sell."

Willi Jilke
Senior V.P.
Century Data Systems

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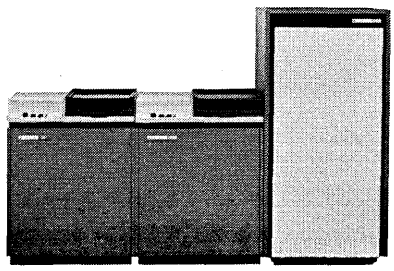

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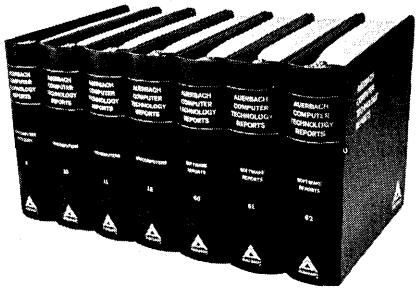

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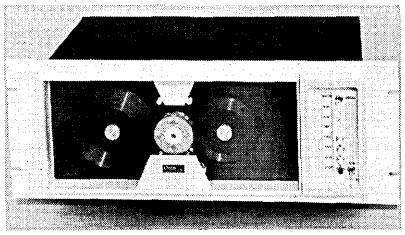
CIRCLE 23 ON READER CARD

Tape Drive

Convinced that cassette drives are not the best way to have low-cost data storage (because cassettes sometimes jam), this vendor offers the more conventional tape memory. The basic Delta model records serial data on two tracks at 10 ips after a 20 msec start-up time. Density of the information is 100 bpi on 900-foot, quarter-inch tape reels.

A list of options including synchronous or asynchronous operation, parallel or serial recording, and bi-



directional playback, allow the single capstan unit to be attached to a mini as a scratchpad memory, or to peripheral terminals.

Available in November, single units of the Delta mtu will be priced in a range from $2K to $2500 depending on options, and not including the interface. ORION PRODUCTS CO. INC., Sunnyvale, Calif. For information:

CIRCLE 377 ON READER CARD

PDP-8/OEM

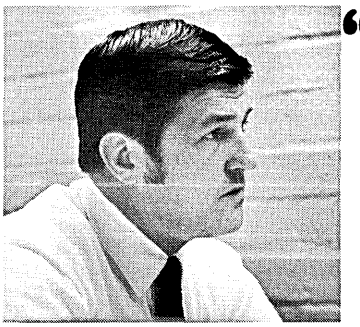
It's really a PDP-8/E (July 15, p. 140), with a bit of customizing, and without its core. The new model has the same central processor, but is intended solely for oem's who in many instances require less than 4K (12-bit) words of core that are standard in the 8/E. So the 8/OEM comes with 256 words of read only memory, and a 256-word scratchpad memory.

Prices are $3250 in single quantity, to as low as $2800 in lots of 100. The base price includes, in addition to cpu, memory and turn-key panel, a power fail detection and restart device, a combination power supply, the chassis, and the Omnibus internal bus system. Options include increments of 256- and 1K-word ROM's at $800 and $1500 each, respectively. Price of a 256-word scratchpad is $1000. First deliveries are next spring. DIGITAL EQUIPMENT CORP., Maynard, Mass. For information:

CIRCLE 378 ON READER CARD

(Continued on page 100)

century data



"We sell our disk drives to more OEMs than anyone else in the business. That says something about our quality, delivery and price."

"OEMs buy from us for the same reason users do: we make an excellent disk drive, sell it at a fair price and deliver it on time. But OEMs are hard to satisfy. They have to be.

"An OEM has a reputation to protect. It's his name that goes on the equipment, and it's his reputation that suffers if anything goes wrong. So he's looking for the best performance and the highest reliability he can get.

"And an OEM is cost conscious, he has to keep the price of his equipment at a competitive level. If he could get the same quality equipment at a lower price he could increase his profit margin or pass the savings to his customers and gain a competitive edge.

"As for delivery, it's absolutely crucial. The OEM is committed to a delivery date. If his supplier lets him down for any reason, he's the one who looks bad to his customer. You can bet he wouldn't let that happen.

"Like users, OEMs have the option of buying equipment from anyone. They also have the added option of making their own. So when they come to us it means they have a lot of confidence in our product, and know that we'll work as part of their team."

RJ Chartrand

Robert Chartrand
National Sales Manager
Century Data Systems

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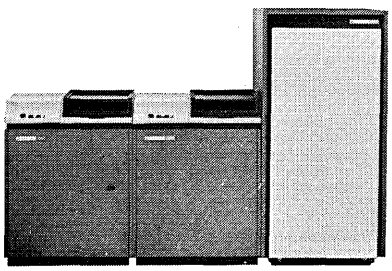

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CIRCLE 76 ON READER CARD

Channel Controller

The Monoliner is a single channel controller for binary synchronous communication. It is a replacement for IBM 2701 equipment and can be used for connecting various devices to System/360 multiplexor or selector channels. It provides for data transmission with inhibited control character recognition and allows use of USASCII, EBCDIC or six-bit patterns. Connection to communication lines is through modems, and line speeds can range from 600 to 9600 baud. Options include an internal clock (instead of external clock) and code conversion. The Monoliner purchase price is $12,000. It is also available on a three-year full-payout lease for $445 a month. TECHNITREND, INC., Pennsauken, N.J. For information:

CIRCLE 381 ON READER CARD

Multiplexor

From 16 to 60 transmission lines can be serviced by the MUX 2000 series of pulse code modulation time-division multiplexors. Divide the number of lines into 150,000 to derive the baud rate at which they can be supported (9600 baud would be good for 15 terminals, while 60 lines would be serviced at 2500 baud).

Signal conditioners for various remote transducers, as well as analog/decimal and decimal/analog converters are included in the unit. Also available are a seven-day digital clock programmer with real-time clock display, digital reset, start/stop remote control, and other options.

Single unit price for the MUX 2000 starts at approximately $2K. AMERICAN MULTIPLEX SYSTEMS, INC., Anaheim, California. For information:

CIRCLE 382 ON READER CARD

Cassette Recorder

Since the ST series of cassette recorders run at up to 30 ips and record at up to 1000 bpi, it is possible to get a transfer rate—30,000 baud—which would be more fitting for a full-size tape drive.

Two models are offered. The ST1, for oem sales, goes for $540 in lots of 100 with read/write electronics. The ST2, for end users, runs $2K with a minicomputer interface. GENISCO TECHNOLOGY CORP., Compton, Calif. For information:

CIRCLE 391 ON READER CARD ■

century data

"The companies that forget about service today will be remembered by their customers tomorrow."

The successful companies in two years will be the ones that give the best service now. That's been repeated a lot lately in the industry papers and magazines. And, we know it's true. The people who use disk drives know our products, and know they're the best. But they're really concerned about field support. They can't stand system down-time.

But because our disk drives are marketed through a number of OEM's, leasing companies, systems houses, etc., we have to take a unique approach to service. It starts with our product support specialists . . . the grand-daddies of the industry . . . the guys who were solving service problems before the problems even existed. They're involved right from the beginning . . . at the design stage so they not only know "what," but more important, they know "why." And, because they are "old pros," they've seen the problems before and know how to fix them. **But they don't** and that's where we're truly unique.

Their mission is to help establish the strongest possible service pyramid . . . to actually create service organizations. To train your training staff . . . your maintenance people . . . the user's maintenance people and independent service companies, until they become almost as efficient as their instructors. And we back them up with parts, documentation and a "hot" crew that's immediately dispatched to help solve those seemingly unsolvable problems.

We don't keep any secrets from our customers or their service people. We give them everything . . . wire lists, schematics, tech manuals, etc. And our tech writers go through the same training cycle as our product support specialists, including hands-on experience, so the documentation is concise, factual and easy to use. I guess the whole concept is unusual, but it's got to be right . . . particularly since it saves the customer time and money.

So if service is what will keep us ahead, we'll just have to keep doing it better.

Ray Rogers
Technical Operations Manager
Century Data Systems

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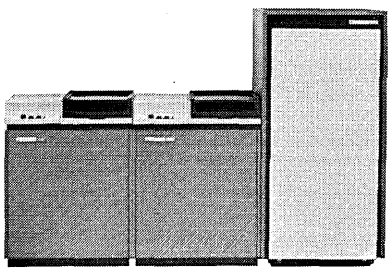

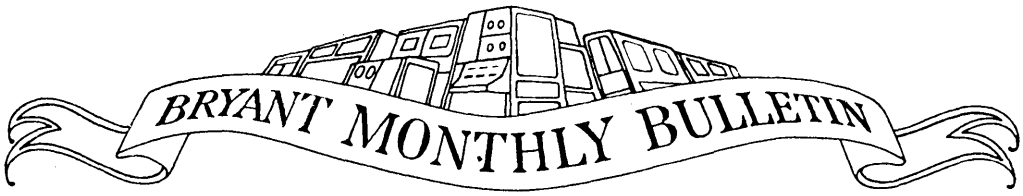

Bryant offers more ways to plug in more memory.

Bryant can deliver plug-to-plug compatibility in a wider range of storage capacities than anybody else.

Anybody else.

Which comes in pretty handy when your storage needs start to grow. Because you can simply unplug one Bryant drum, and plug in another with the larger capacity you're looking for. Or you can leave both drums hooked up.

Then you just keep repeating the process as you keep growing.

You've got plenty to work with. Because we've designed this plug-to-plug compatibility into our entire line of drums.

There's our 10″ CLC-1, offering from 600,000 bits to 2.4 million bits. There's our 10″ Auto-Lift® Series, capable of up to 19 million bits. And there's our 18″ Auto-Lift Series, good for up to 76 million bits. All of these drums feature a bit serial transfer rate of 2.2 mh.

To take advantage of the plug-in expandability offered by all these Bryant drums, simply start with a Bryant 720 controller. It's designed around the plug-in concept, and will interface with eight of the above drums in any combination up to *608 million bits.* (The Auto-Lift Series is also offered as a plug-in series in a 2.2 mh. byte serial transfer rate.)

If you prefer to build your own interface, a Bryant engineer will help design it around our plug-in concept. He'll also show you how to allow for the larger and faster units we'll be developing in the future.

Want to get more specific? Get in touch with a Bryant representative. Or write: Bryant Computer Products, 850 Ladd Road, Walled Lake, Michigan 48088.

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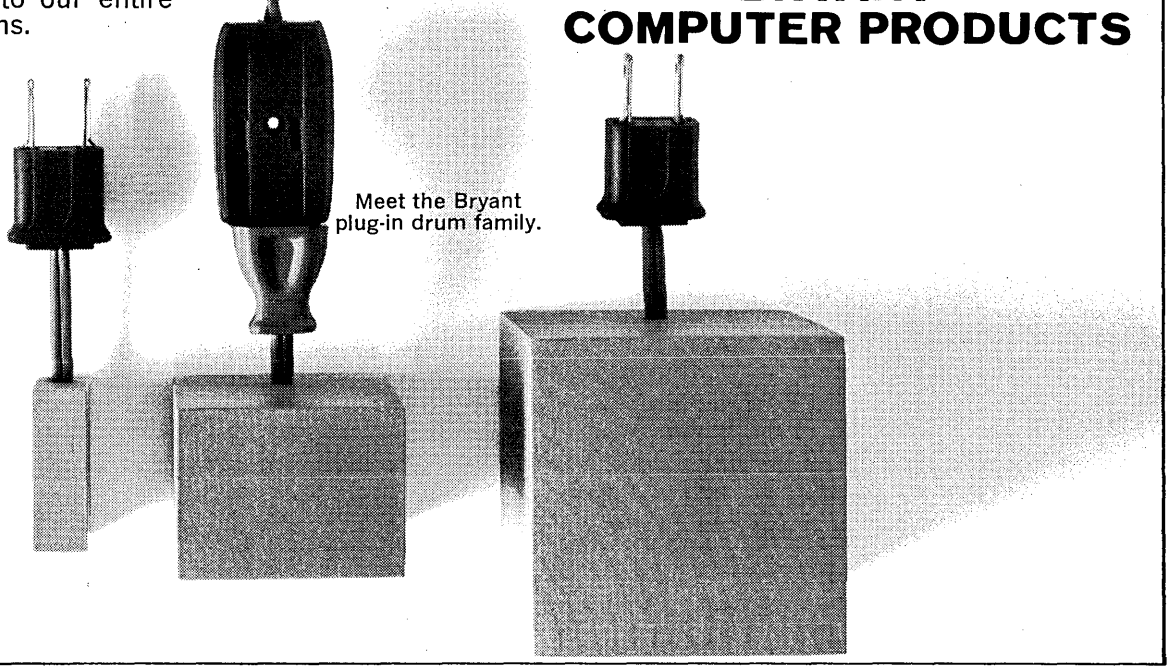

Meet the Bryant plug-in drum family.

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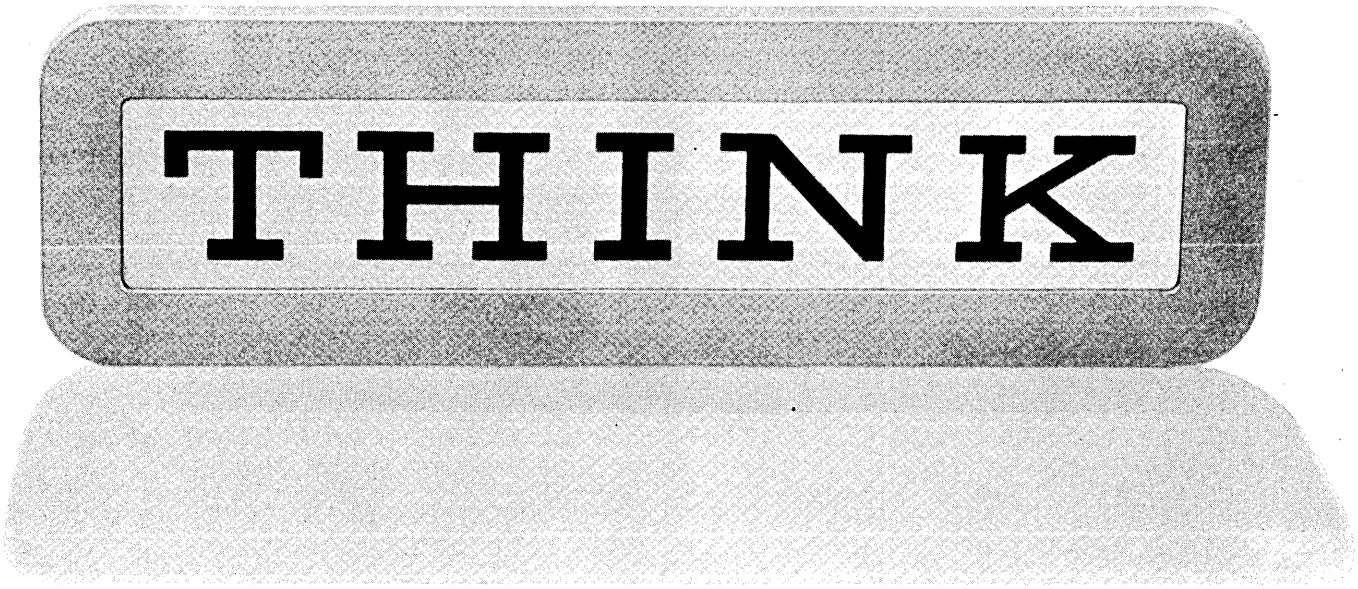
Compare the IBM 360/20 with the NCR Century 100.



Compare price/performance. The NCR Century 100 computer delivers one of the best price/performance ratios in the EDP business.

On the average, the NCR Century 100 is 23 per cent to 43 per cent more productive than 360/20 Models 2 and 4, according to a benchmark study performed by an independent consultant.

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CIRCLE 67 ON READER CARD

To be published in the Spring of 1971...

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Confessions of a disk pack reject

"I'm good. I know I'm good. Almost everybody says so. And I was sure I could make it as an RCA Disk Pack.

"The 6-high RCA 506. Some of my best friends are 506s. And some are 11-high RCA 511s. For disk packs, either is a goal worth striving toward.

"Anyway, I thought I had it made when I started my final physical at RCA. They checked my sense of balance. Went over my tracks. Examined the quality of my coating. Gave me the toughest mechanical and electrical tests in the industry.

"Those people don't miss a thing. I didn't even get to the final test, a chance to prove myself on a computer. Seems I had a slight case of the run-outs.

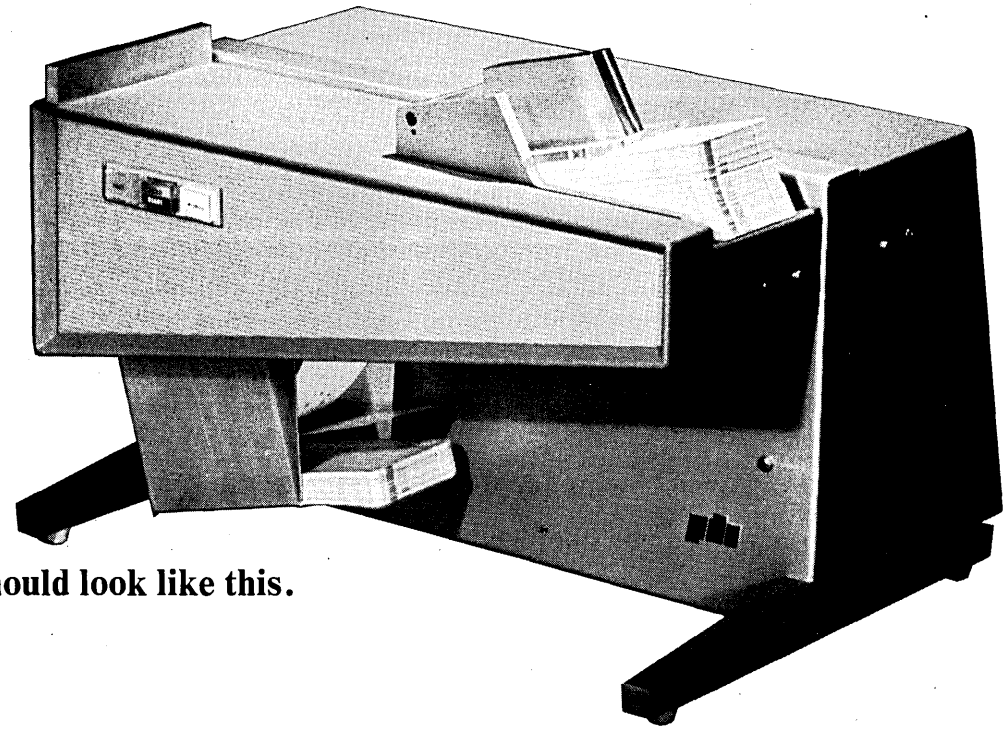
"What's a disk pack to do? I'm good enough to be somebody else's disk pack. But all I want to be is an RCA 506. And if I were 11-high, I'd want to be a 511."

Nobody needs a reject. Write RCA Magnetic Products, 201 East 50th Street, New York 10022.

Our disk packs make it.

RCA Disk Packs

A word of advice to anyone concerned
with developing an inexpensive, ultra-dependable 300 (or 600) card-per-minute reader that comes in rack-mount or table-top models, can be maintained by almost anybody, and has interfacing that makes it plug-compatible with just about every system on the market . . .



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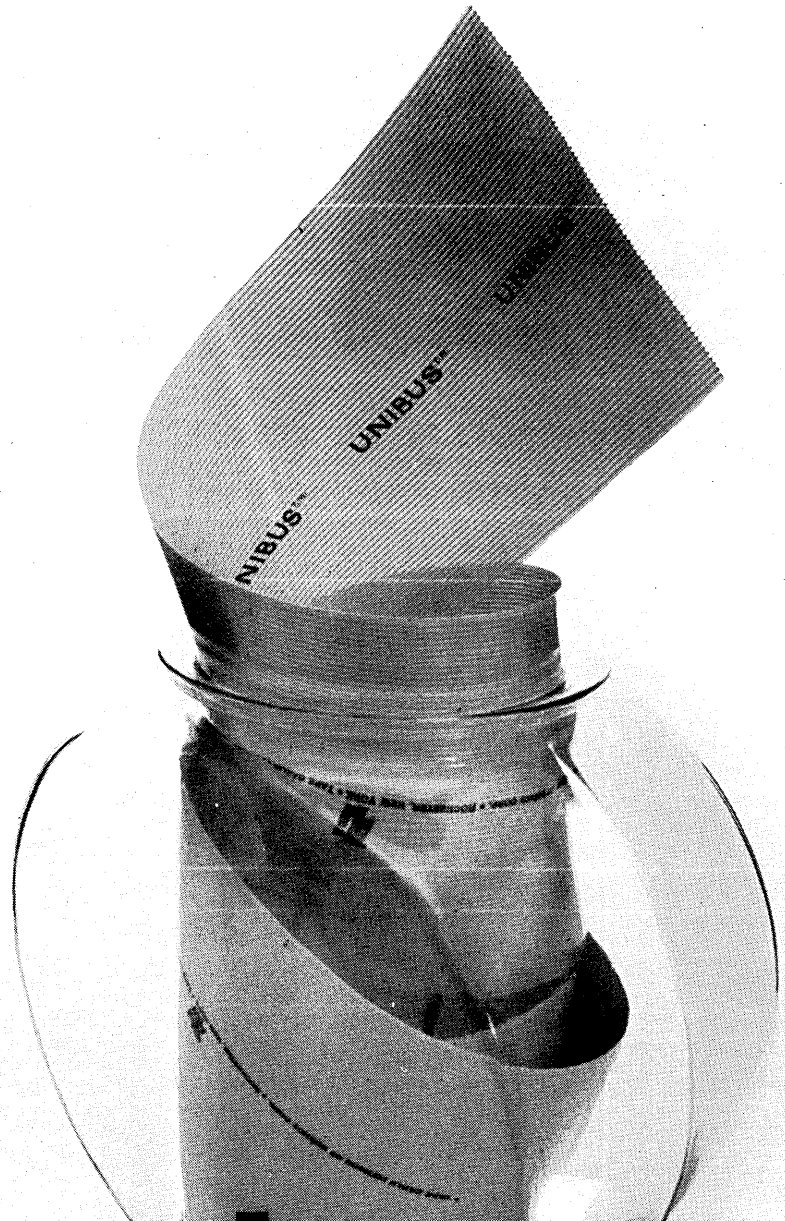
CIRCLE 52 ON READER CARD



Guess how much PDP-11 is in the jar.

A dedicated computer with 1K of read-only memory and an ASR-33. A multi-terminal, multi-user, 32K, general purpose system. A data acquisition system with disk file.

Actually it's only a ribbon of 56 conductors called UNIBUS.™ But into it you can plug any of the above systems—or anything else that will solve your computing or control problem, now or then.

Plug in. That's all. PDP-11 is an asynchronous system. All devices, all memory, and indeed the central processor are independent of each other. Devices can transmit direct to devices, disk to display. Device to memory. Meanwhile the central processor is largely free to compute—which is an understatement when you realize that 400 instructions are in the order code.

Small system or large system, PDP-11 is the world's most powerful mini-computer architecture. Listen: Variable word length (bit to multiword); 8 general registers, hardware stacking; automatic nesting of interrupts; reentrant and relocatable code; multi-channel DMA.

Now guess the basic price: to include the processor, 1K read-only memory, 256 words of read-write, an ASR-33, and six inches of UNIBUS. (Hint: make it under $10,000.)

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CIRCLE 21 ON READER CARD

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

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

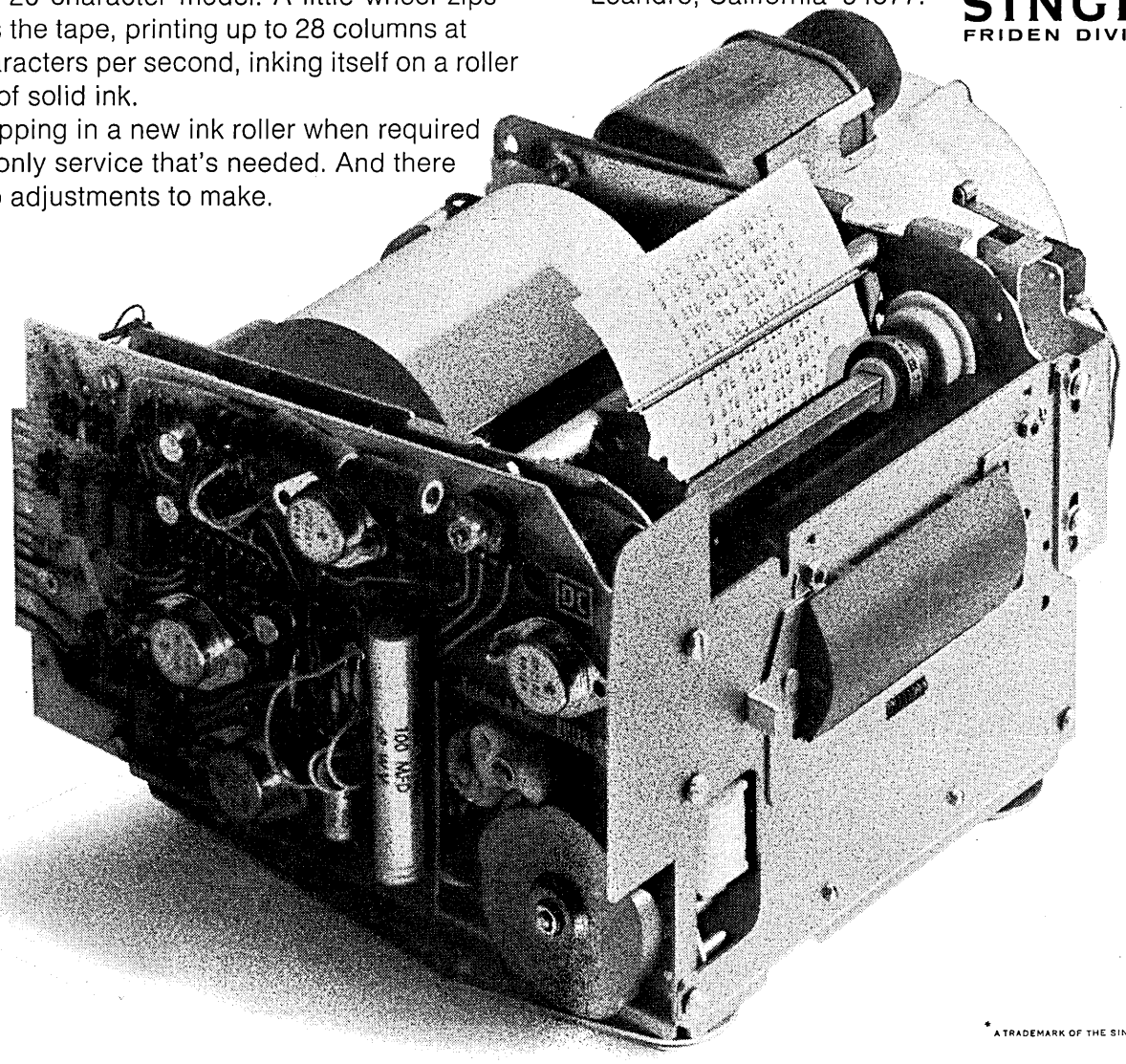
With this ad, we're introducing 30-character and 40-character alphanumeric printers, both of which work exactly the same as the standard Friden 20-character model. A little wheel zips across the tape, printing up to 28 columns at 46 characters per second, inking itself on a roller made of solid ink.

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

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

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

SINGER
FRIDEN DIVISION



* A TRADEMARK OF THE SINGER COMPANY

Sort for 1130s

A better sort for the IBM 1130 is the claim by the vendor of SORT/1130; it's faster and more flexible. Written entirely in assembly language to optimize sort speed, the program can be invoked via control cards or called as a FORTRAN subroutine. When called by a FORTRAN program, SORT/1130 saves and restores the calling program on disc, so that the sort can be performed more efficiently. SORT/1130 may be stored on disc in core image format to eliminate the need for core load building on each sort call.

The package can sort files generated by FORTRAN, RPG, or BAL programs into ascending, descending, or mixed sequence, either in place, or onto another file. The sort key can have up to 16 fields that may be scattered throughout the record. Additionally, SORT/1130 handles many field formats, including character, packed or unpacked decimal digits, single and double word integers, and standard and extended precision floating point. Record limits can be specified for the sort, or else a user-defined end-of-file mark can be specified as the sort terminator.

SORT/1130 is said to be particularly economical for installations running large production jobs. For example, a reverse-ordered FORTRAN file of 2,840 11-word records was sorted on a 10-word key in 3.5 minutes (using an 8K 3.6 usec core), including the time required to read the control cards. SORT/1130 is available under license for $575 per installation. COMPUTER SYSTEMS LABORATORIES, INC., Red Bank, N.J. For information:

CIRCLE 365 ON READER CARD

Data Transmission

BOCS (Bisynchronous Oriented Communications System) is a program for computer-to-computer transmission of sequential data files over leased telephone lines at speeds ranging from 1,200 to 240,000 baud. The vendor feels it would be useful for centralizing a dp operation, allowing one central computer to direct the transmission of information to and from smaller remote computers. BOCS can even be utilized to level the work load among several large computer installations where centralized data processing is not desirable.

Written in BAL for 32K IBM 360 models above the model 20, BOCS transfers data between disc or tape files over multiple circuits or over a single circuit between sites. Features include error recovery routines, as well as the capability for stopping transmission on a circuit and resuming later without retransmitting any data, or retransmission of single or selected volumes of a multivolume file. In addition to controlling multiple circuits, BOCS will support several remote locations on the same circuit with the installation of bypass switches at the remote centers.

The BOCS package, consisting of a master computer pack requiring 15K of storage and four buffers per circuit, and a remote processor pack requiring 10K and four buffers per circuit, is priced at $9,650 including machine installation. There is no additional charge for multiple use of the remote pack. GT&E DATA SERVICES, Tampa, Fla. For information:

CIRCLE 366 ON READER CARD

Contour Plotting

With the assistance of a large System 360 computer and a plotter this contouring package can generate mappings of terrain, magnetic field strength, water depth, temperature, gravitational fields or mineral concentrations.

Written in FORTRAN with some subroutines in assembly language, the program's size ranges from about 80-120K bytes depending on the options selected. (This includes a 30-35K module that formats output for the plotter, which can be the Gerber 600 and 800 series, CalComp 570, 770 and flatbed, or the Stromberg-Carlson 4020 crt plotter.) The plotter interface is magnetic tape.

The minimum system configuration for the package is a model 40 with 128K of storage, plus a sufficient amount of memory for the data base. The package can handle up to 150 x 150 data points.

Options with the program include: automatic labeling of high and low centers, integer, decimal, or exponential format contour and center labeling, plotting of original input data, provision for nongridded data input with a choice of plane or polynomial interpolation, plotting in Cartesian or polar coordinates with correction for skew or rotation, and overlaying of Cartesian or polar grid lines on the plot.

The contouring package has a price range of $3200 to $4500. Documentation is provided and machine installation is available at extra cost. Updates to the package are provided free for the first year. Delivery is 10 days ARO. WOLF RESEARCH & DEVELOPMENT CORP., Riverdale, Md. For information:

CIRCLE 367 ON READER CARD

360 File Formatting

Large amounts of multi-source information can be manipulated and analyzed with NIPS 360 Formatted File System. The object language package, designed for a 360 Model 50 with 256K of core, collects, categorizes, and files the data for rapid selection and analysis. It can also operate on Model 40 and 65 computers.

NIPS 360 FFS is obtainable in two versions: one for OS release 17 which includes VISAM and is priced at $520; and another for release 18 without VISAM which is priced at $380. Documentation for either is $130. UNIV. OF GEORGIA, Athens, Ga. For information:

CIRCLE 369 ON READER CARD

Optimization Programs

ALPAC is a set of optimization programs that provide for the solution of linear or non-linear parameter optimization problems. Eight nonlinear parameter optimization algorithms are available in ALPAC.

The programs are available in FORTRAN IV or FORTRAN II, and run on EAI 8400, 640, IBM 1130, and 360/40 mainframes, with installation on other systems available. The price of $4500 includes documentation, source or object card deck. ELECTRONIC ASSOCIATES, INC., West Long Branch, N.J. For information:

CIRCLE 371 ON READER CARD

(Continued on page 111)

the MOD* couple!

LG 10/30 Remote Computer Terminal

Loaded with features that score big with end users, the LG 10/30 is versatile, and meets a wide range of specific demands at high speed:

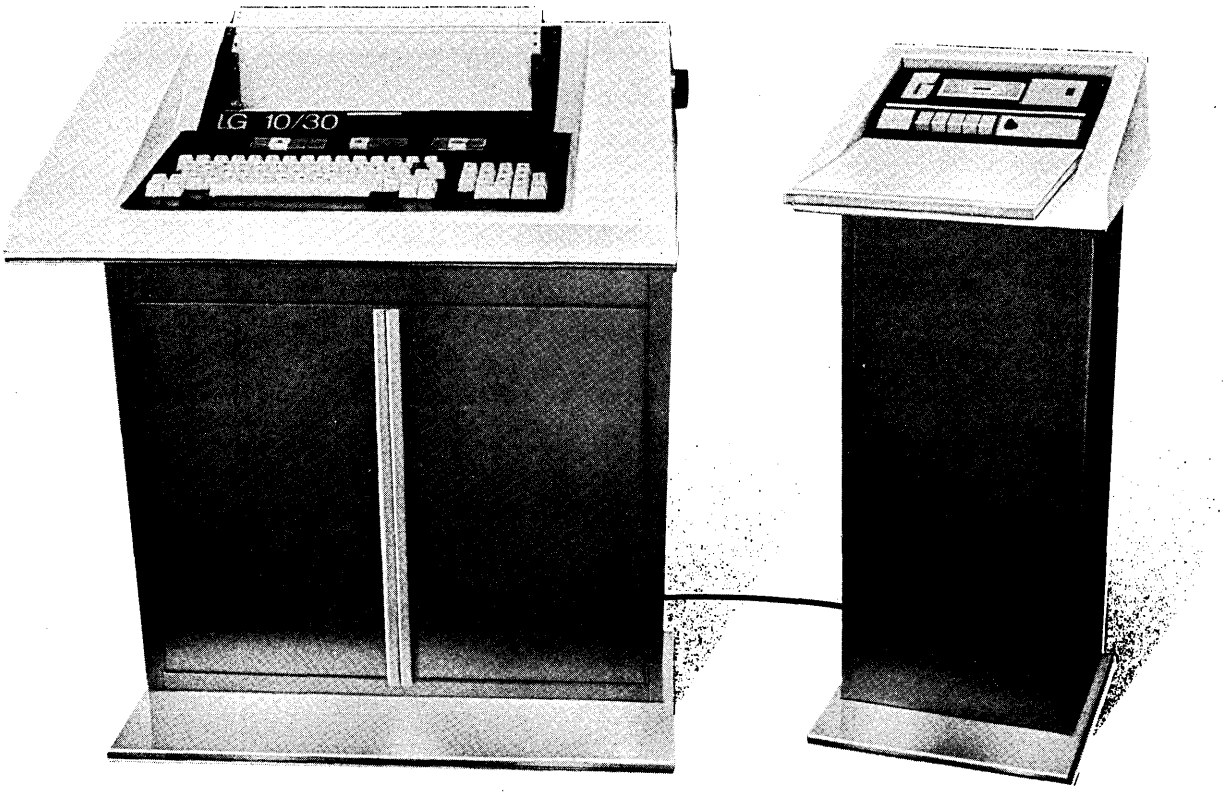
- 10, 15 or 30 characters per second
- 26 to 132 columns per line
- Fully incremental
- EIA standard RS-232B interface
- USASCII code
- Full right-hand numeric keyboard
- Compatible with Teletype at 10 and 15 cps with EIA Standard RS-232B interface

Single-quantity price $ 3950.00

G 1031 ASR Reader/Recorder

The companion Magnetic Tape Reader/Recorder is an accessory to the basic Gulton 10/30 terminal. It saves on-line time for greater economy and is fully incremental. Plug-in cassette permits faster start cycle and easy tape storage.

Single quantity price $ 1200.00



* **M**atched for performance!
Off the shelf-delivery now!
Discounts to OEMs!

Inquire today: Call or write Gulton Computer Systems Division for additional information on this unique new combination terminal/tape capability.

Gulton COMPUTER SYSTEMS DIVISION Gulton Industries, Inc.
13041 Cerise Avenue Hawthorne, California 90250, Telephone (213) 679-0111

CIRCLE 57 ON READER CARD

Letter Writer

LWS (Letter Writing System) is available in two versions for the IBM 360; a DOS version residing in 12K bytes of core on all models above model 20, and an OS version requiring up to 20K bytes. LWS is written in BAL and produces one or two-up personalized letters (two letters side by side in the printer), also one or two-up continuous form envelopes, and one to four-up labels.

The letter size cannot exceed 50 input lines of 75 characters per line. Letter text width may be varied from the console from 10 to 75 characters, and five inserts may be used any number of times in a letter; entire paragraphs are adjusted for the varying sizes of inserts. The preparation of the fixed letter text is similar to typing a letter.

Including documentation and a one year warranty, DOS LWS is priced at $2K and the OS version requires $100 more. A customer may trade one version for another within a year, receiving credit for 85% of his original cost. CBIS INFORMATION SYSTEMS, Los Angeles, Calif. For information:

CIRCLE 368 ON READER CARD

System Utilization

The System I computer utilization package aids in job accounting by providing application usage figures so that a dp manager may accurately calculate charges even in a multiprogramming environment. The system produces an application and run utilization report that provides an analysis of jobs within minor and major account structure, such as engineering, marketing, financial, etc., for which the computer was used during the time reported. It automatically accumulates time by day, week, month, and year. The package also produces eight other reports, giving a detailed listing of utilization and downtime for each device, summarized and graphed by day, week, month, or quarter.

System I uses the output from IBM 360 SMF, RCA Spectra 70 Autolog, manual console job logging, or other automatic logging systems. The price is $4K, with reductions for multiple installations. VALUE COMPUTING INC., Cherry Hill, N.J. For information:

CIRCLE 370 ON READER CARD

Tape Library Utility

The primary purpose of the Tape Library Utility is the maintenance of programs on a tape library. Its main advantage for System/360 DOS and TOS users is the saving of main library space so that less frequently used programs can be stored in an auxiliary tape library.

The program provides 11 options: card to tape of programs onto the library tape, tape to card of all programs on the tape, tape to card of selected programs on the tape, tape to tape copy of all programs, tape to tape copy of selected programs, add selected programs to the tape, delete selected programs from the tape, print all programs on the tape, print the program identifications only of programs on the tape, copy card to card, and copy card to card and resequence a COBOL source deck.

The price of $300 includes documentation. MATRIX COMPUTER SYSTEMS, INC., Rockville Centre, N.Y. For information:

CIRCLE 400 ON READER CARD

Cobol Compiler

Expressly designed to be as machine independent as possible, this COBOL subset compiler is currently running under DOS on a 64K 360/30, where it inhabits 44K bytes. In six months the vendor will customize it to your machine—16-bit machines would require typically 20K words for the compiler.

The vendor claims the compiler has a large dictionary entirely resident in memory during the first two compiler passes, which should help decrease compiling time, and the compiler should be easy to adapt to variable-micrologic machines.

The compiler is priced at approximately $50K, including installation, changes necessary to get it on your machine, and full documentation. SEIDEL COMPUTER ASSOC., Reseda, Calif. For information: ■

CIRCLE 390 ON READER CARD

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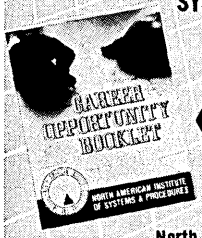

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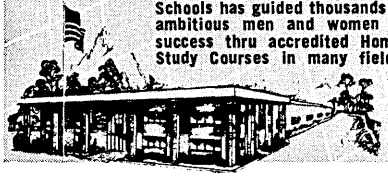

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CIRCLE 61 ON READER CARD

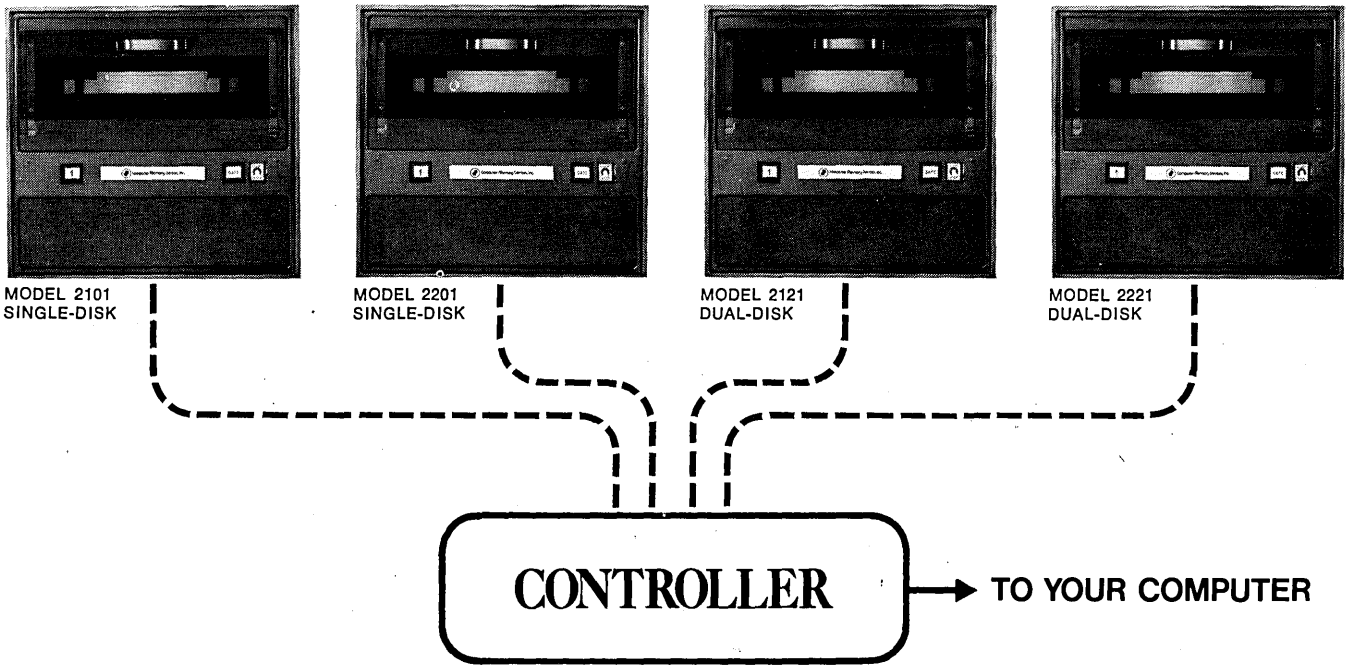
Computer Memory Devices Announces a $9,950 Disk Sub-System

...for any computer

We proved that a good disk memory drive doesn't have to be expensive, with our MD-2101-2. Now, we're proving that a disk sub-system doesn't have to be expensive. Computer Memory Devices is offering a complete disk sub-system including our MD-2101 single disk drive, power supply and controller for *any* computer for $9950... and that's just *one* of the systems available.

Because CMD offers a complete family of ultra-reliable disk drives using the IBM 2315-type disk cartridges with capacities ranging from 11.5 megabits to 46.0 megabits; in single (removable) and dual (fixed and removable) disk configurations *you* can choose the sub-system which best fits your needs... at the lowest prices in the industry.

Your disk sub-system will be backed up and serviced by a nation wide field service organization. And most important, you get *proven* CMD quality and in-the-field reliability. For detailed information contact Tazz Pettebone at Computer Memory Devices, Inc., 5170 W. Bethany Home Road, Glendale, Arizona 85301, Phone (602) 939-9444, TWX 910-950-1244.



	MD-2101	MD-2201	MD-2121	MD-2221
Density (bpi)	1100	2200	1100	2200
Capacity (megabit)	11.5	23.0	23.0	46.0
Disk Sub System Single unit price*	$9950.	$10,995.	$11,600.	$12,200.

* OEM DISCOUNTS AVAILABLE

All models measure 19" wide, 17½" high, 28½" deep.
All fit standard 19" rack.

Computer Memory Devices, Inc.

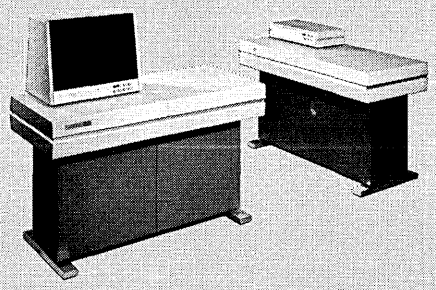
5170 W. Bethany Home Rd., Glendale, Ariz. 85301 · (602) 939-9444 · TWX 910-950-1244

Test our COM

We'd like you to see for yourself that the PTI 1300 off-line and 2600 on-line/off-line Computer Output Microfilmers give you more flexibility, simplicity, reliability and print clarity than any other COM's on the market under $50M.

The 1300 and 2600 are 360/370, 7 or 9 track compatible. With our exclusive card reader option you can print from nearly any computer tape without reformatting. Job set-up takes only seconds.

Standard: 64 and 86 lines/page, 132 characters/line, automatic tape reread, VRC tape checking,



12 channel vertical tabbing, automatic page advance, built-in alignment and test generator, and more. Options: card reader for quick set-up for non-IBM formats, microfiche camera, lower case letters, dump mode, forms overlay, retrieval coding, rotatable cine or comic image. Cost: under $50M. Lease from $1450/month. Or try the PTI Use Plan, only $850/month! Mail this coupon, or call us collect.

No medium matches microfilm. No microfilmer matches PTI.

PERIPHERAL TECHNOLOGY INCORPORATED

with your tape.

Mail to Peripheral Technology Inc., 757 North Pastoria Ave., Sunnyvale, California 94086, (408) 732-4940; or 865 Busse Highway, Park Ridge, Illinois 60668, (312) 696-4074; or 485 Lexington Ave., New York, New York 10017, (212) 972-9740; or 11661 San Vicente Blvd., Suite 101, Los Angeles, California 90049, (213) 826-6591.

Name_____

Title_____

Firm_____

Address_____

Phone_____ City_____

State_____ Zip_____

☐ I'd like to see for myself. Please call me to make an appointment.

☐ My tape is enclosed. Send it back with my sample printout on PTI microfilm.

Tape Check List:

Tape Density:
☐ 800 ☐ 556 ☐ 1600

Tape Format:
7 track ☐ Odd ☐ Even
9 track ☐ Odd ☐ Even

Character Code:
☐ BCDIC ☐ EBCDIC

Control Code Format:
☐ ASA ☐ 360 Machine
☐ DatagraphiX Std.
☐ Other_____
Print line length_____

See us in Houston at the FJCC, Nov. 17-19, Space 2137.

CIRCLE 53 ON READER CARD

DRIVE IT FOR A MONTH. FREE.

We'd love to tell you all about the new DPF-2425 and DPF-2427 tape drives.

But we figure you'd rather see for yourself.

So to introduce them, we've offered to lend one to any serious potential customer who wants to try it. Free. For a full month. To test under the most realistic, demanding conditions there are: on-line in their systems.

The first six companies to take us up on our offer already have their drives. And their tests are underway right now.

We think a month should be enough time for them to make sure the DPF-2425/7 is completely compatible with the IBM 2420, models 5 and 7. Plug to plug.

And it's enough time to check out the 100 to 200 ips speeds, 160 to 320 kc transfer rates and 1600 bpi phase-encoded recording density.

A month should be enough time to test the completely automatic loading operation. Using either IBM tape cartridges or any other standard tape reel from the 10½-incher to the mini.

It should be enough time to evaluate its tape handling characteristics, too. From the air bearings at all turnaround points to the servo control that protects the tape during rewinding. From the one-point contact head to the fail-safe brake system.

It's more than enough time to make sure the DPF-2425/7 will never need more than 60 seconds to rewind a full 2400-foot reel.

But it may take them a full month to notice all the little refinements that make these drives more reliable than all the others. The solid-state, integrated-circuit controls, for example. The new photo-electric tape sensing in the vacuum columns. And even the UL listing.

If, at the end of a month, they aren't convinced that it offers the best price/performance they can get — from any tape drive — we'll pull it out and take it back.

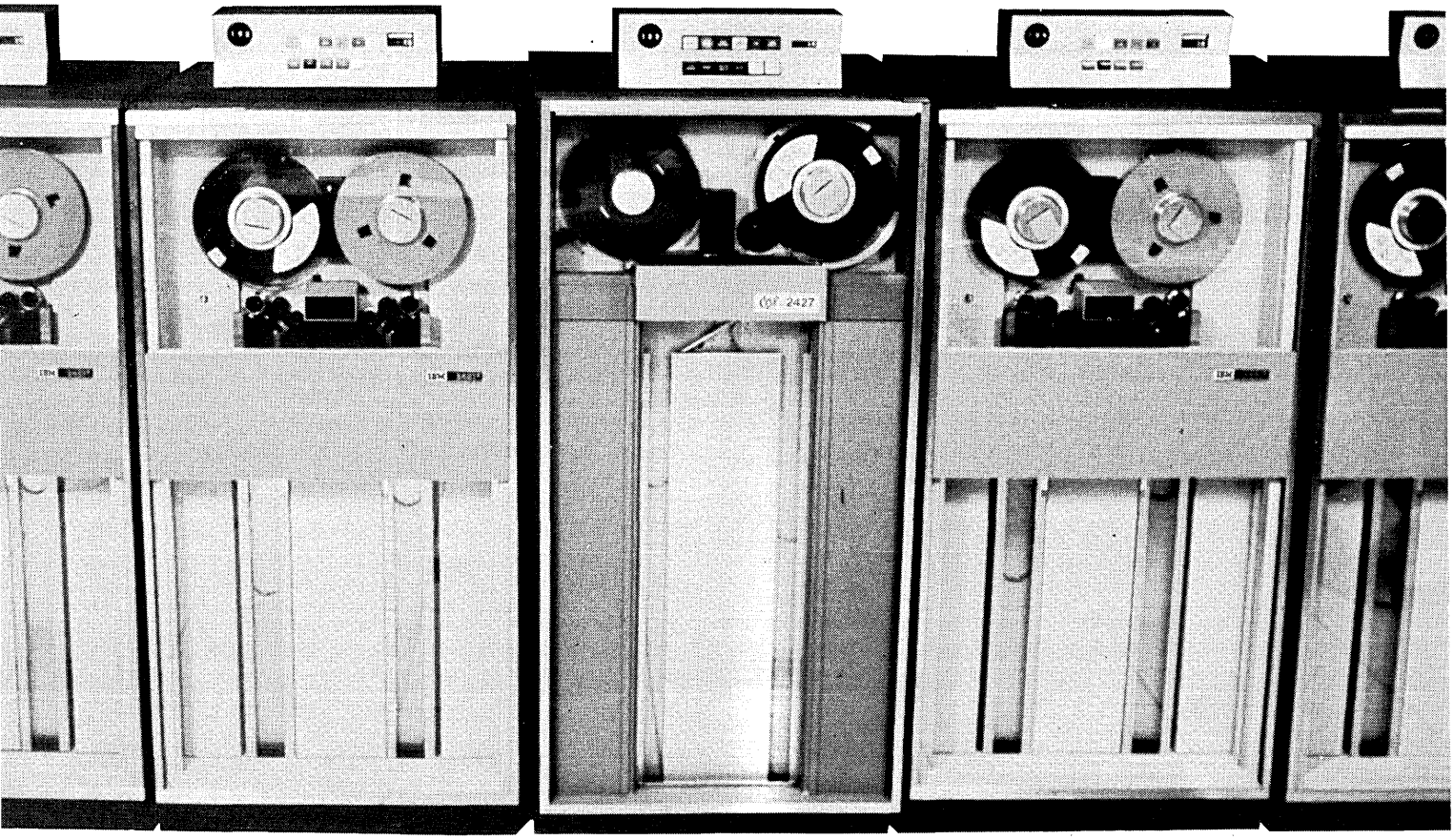
No hard feelings. No problems. No charge.

We think they'll not only want to keep it, but will want more like it. Because we've tried it ourselves. We've tested everything there is to test. And we've not only used it, but we've abused it.

We've even established our own nation-wide maintenance organization to service it.

So we know what the new DPF-2425/7 can do.

And the offer still stands.



Call Don Raby, (914) 428-5000. And while you're talking to him, ask him about the new DPF-2406 tape drive, too. Completely compatible with the IBM 2401 model 6, this new drive has 9-channel phase-encoded recording density, a single-capstan motor, automatic loading and power window as standard features. And SIMS and dual-density as special options.

dpf Data Processing Financial & General Corporation, 141 Central Park Avenue South, Hartsdale, N.Y. 10530

What can a service bureau with a Kodak KOM-90 microfilmer offer?

COMplete Service.

Many service bureaus, nationwide, are now equipped to convert magnetic tape data directly into sharp, clear microfilm images using a KOM-90 microfilmer. For lower cost printout, faster data retrieval, lower distribution costs.

Kodak provides important back-up support to help these bureaus do a complete job for you. In personnel training. In software programs to prepare your tapes for microfilm. In film processing. In providing the most efficient retrieval systems to suit your requirements.

For COMplete service...and for the nearest service bureau equipped with a KOM-90 microfilmer, check with your Kodak microfilm systems representative. Or write Eastman Kodak Company, Business Systems Markets Division, Dept. DP691, Rochester, N.Y. 14650.

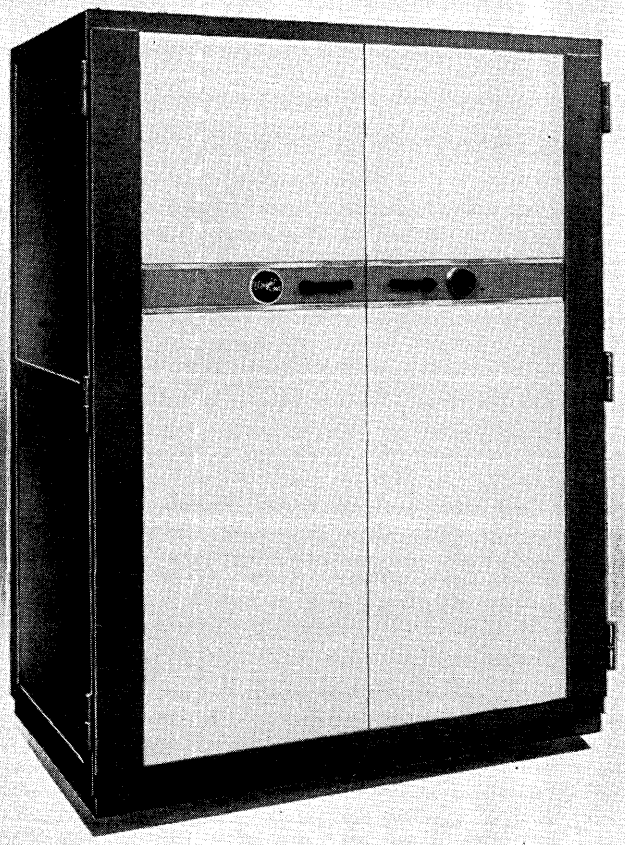
The Kodak KOM-90 microfilmer, product of Eastman Kodak Company, may be one of the components used in...

Kodak Microfilm Systems

Wright LINE

EVERYTHING FOR DATA PROCESSING

...except the computer



NEW SAFER STORAGE FOR VITAL EDP RECORDS

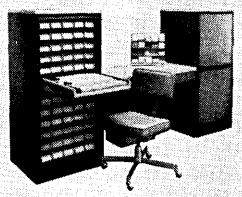
Even if you are now in a "fire proof" building, storing tapes off-site or using a conventional vault, you probably don't have the complete protection you need.

At 150°F or 85% relative humidity, information stored on tape or disks is subject to read out loss. The cost of losing records could put many companies out of business, but you can guard against losses by properly protecting EDP records.

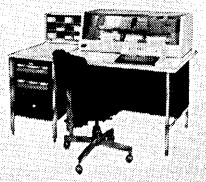
Wright Line Data Bank Safes were the first storage equipment to carry the Underwriters' Laboratories 150°-4 hr. label for safest protection of vital EDP media. They are available in four sizes and with a variety of internal configurations for the storage of tapes, and disk packs.

For complete details circle readers service no. 101

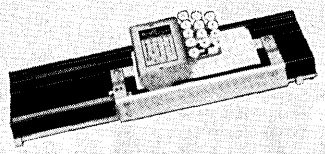
GOLD STAR FILES The most beautiful and versatile card files available. Line includes three wide files and counter-top model with plastic-laminate surface.
For details circle Readers Service No. 103



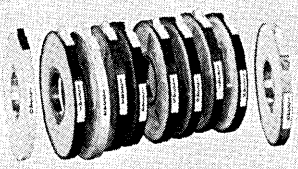
SYSTEM/3 ACCESSORIES Coordinated card handling, storage and filing equipment for use with IBM System/3
For details circle readers service no. 108



COUSTI-COVER reduces keypunch noise level by as much as 75%. Hinged transparent acrylic cover allows easy access to keypunch.
For details circle readers service no. 104.



PORTABLE CARD PUNCHES for punching cards and plastic cards. Punch has tab stops.
For details circle Readers Service No. 105



TAPE-SEAL® SYSTEM The safest, easiest handling, most economical method of storing tape. Line includes cabinets, trucks and accessories.
For details circle Readers Service No. 106

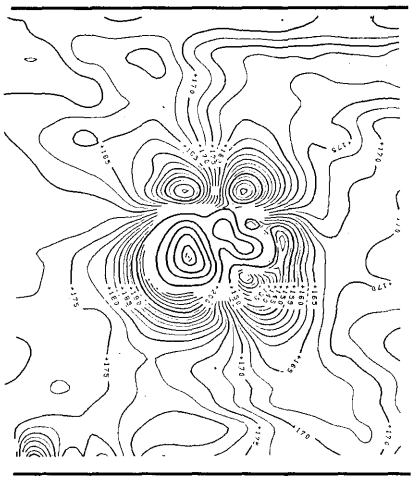
DISK PACKS AND DISK PACK STORAGE 1316, 2316, and 2315 Disk Packs with Data Coat Surface and a complete line of storage units to give you maximum safety and protection.
For details circle Readers Service No. 102

Wright LINE

DATA PROCESSING ACCESSORIES

160 GOLD STAR BOULEVARD, WORCESTER, MASSACHUSETTS 01606
A DIVISION OF BARRY WRIGHT CORPORATION

LITERATURE



Plotting Ploys

Computerized mapping is product-illustrated in a 12-page booklet that shows and tells the results of routines generating contour maps, shaded-level variable density data plots, three-dimensional perspective data presentations, and spatially filtered, derived, enhanced and annotated mapping. The same data also is shown presented in different ways. The illustration at left is not of a Mayan monster, but a magnetic map of an archaeological zone in Vera Cruz, Mexico. GEOMETRICS, Palo Alto, Calif. For copy:

CIRCLE 350 ON READER CARD

At the Source

Systems for source data collection are described in eight-page full color brochure. They can operate off- or on-line and are compatible with recorders and "all modern computers." Components consist of a push-button data entry station, badge reader, and choice of two central controllers. All messages are checked for errors. Series come with two-wire or cable connections. Applications run from the front office (purchasing) to the warehouse (material and inventory control). COLORADO INSTRUMENTS, INC., Broomfield, Colo. For copy:

CIRCLE 351 ON READER CARD

Software Packages

Five handbooks investigate various aspects of software packages: *Improving DP Performance with . . . , Improving Supplier Support of . . . , Selecting Better . . . , Obtaining Better Sales Contracts for . . . , Determining Desired Features for . . .* The set is supposed to forestall individual organizations from "reinventing the wheel," by enabling the new user to avoid the usual initiation problems, and by being available as the source of new systems. Price, Vols. I-III, $25 each; Vols. IV and V, $35 each; complete set $120. AMERICAN COMPUTER INSTITUTE, INC., Suite 2301, 100 Colony Square, Atlanta, Ga. 30309.

Forms Ahead

This 64-page report with numerous tables and appendices prepared for the business forms industry is titled *Beyond OCR—Data Communications and Forms*, and includes a 10-year forecast on data communications and terminals, with their impact on business forms technology. Both users and forms manufacturers have been extensively interviewed, and findings summarized in two separate parts of the report, with individual outlooks given by company. Price: $25. INTERNATIONAL BUSINESS FORMS INDUSTRIES, 1730 North Lynn St., Arlington, Va. 22209.

Help! Quietly

Data sheet explains a solid-state emergency communicator—no moving parts or magnetic tapes—that can automatically go on-line, verify dial tone, and transmit warning data to a central location, all over regular telephone lines. The device is self-testing, also monitors communications lines and central office equipment; i.e., if something is wrong at central, or if lines are cut, a local alarm is sounded. Up to 1,000 locations can be monitored, each registering variations from the norm on eight sensors. Alerts are printed out, with time of occurrence. IDAK CORP., Beverly Hills, Calif. For copy:

CIRCLE 352 ON READER CARD

Order Up

A 45-page manual for planning and installing an electronic ordering system, with requirements for the store, dp department, warehouse, operations and merchandising department, is a summary of experience gleaned from completing 3,000 such installations. Explanations of the equipment used in the systems are furnished, and personnel needed to operate them are taken into consideration, particularly the project coordinator. MSI DATA CORP., Montclair,Calif. For copy:

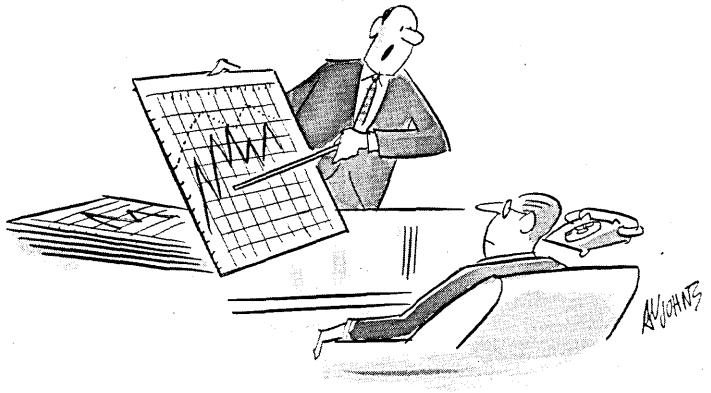
CIRCLE 355 ON READER CARD

Numbers of Columns

A photoelectric reader that can cope with IBM's System/3 as well as standard 80-column cards is illustrated and detailed on data sheet. The Model 8000 reads at 300 cpm, with 300-500 cpm for stub varieties. The 96-column System/3 card is handled by an optional multiple card field conversion kit. Information is furnished on feeding, reading, automatic resync and stacking features. The feeder mechanism is illustrated in a line drawing. The whole unit weighs less than 50 lbs. BRIDGE DATA PRODUCTS INC., Philadelphia, Pa. For copy:

CIRCLE 354 ON READER CARD

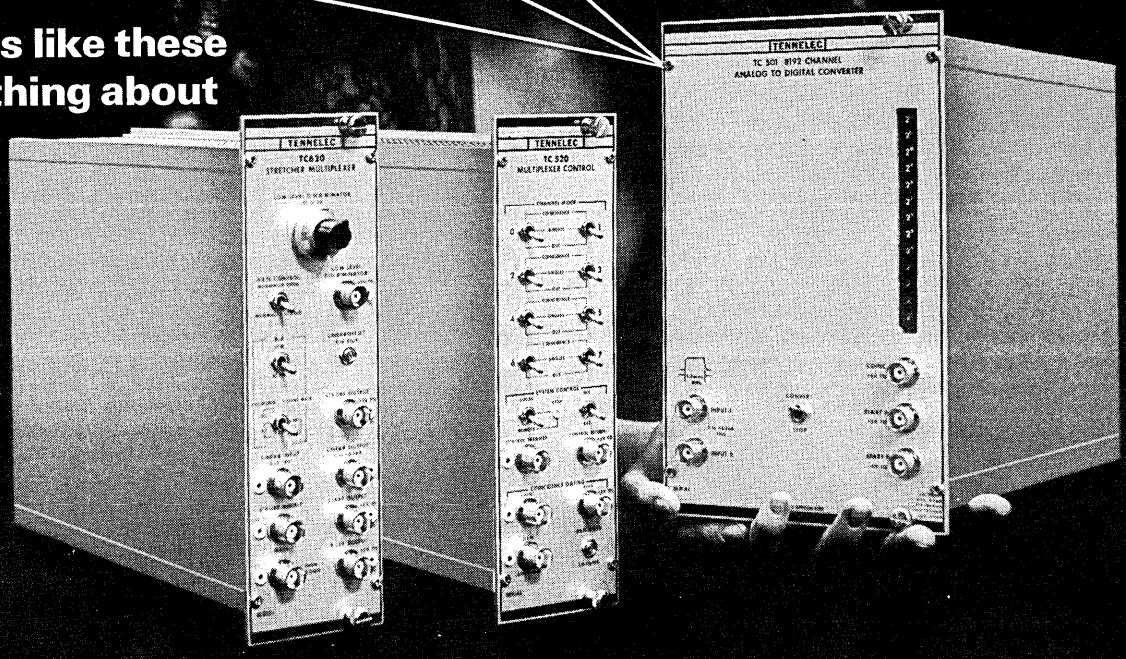
Continued on page 123



"... and, finally, this is a graph showing the time and money spent by us masking graphs"

© DATAMATION ®

8192 channels
13 bits
4.5 μsec



Measurements like these tell you something about Tennelec's Model TC 501 Analog-to-Digital Converter

The Tennelec Model 501, 13 bit, Analog-to-Digital Converter does it faster than you have ever done it before. In fact 4.5 μsec fast!

With conversion time like this, the Model 501 makes it practical to multiplex several signals into one Analog-to-Digital Converter. The output of the TC 501 is designed to feed data to a computer or memory section of a multi-channel-analyzer.

Connecting two TC 620 Stretcher-Multiplexer units to the TC 501 allows two channels of data to be multiplexed. The addition of a TC 520 Multiplexer Control allows up to eight TC 620 Stretcher-Multiplexer units to be connected to the TC 501 Analog-to-Digital Converter.

SYSTEM SPECS:

- Conversion Time—4.5 μsec.
- Resolution—13 bit (8192 channels) 8v full scale input
- Differential Linearity—0.25%
- Integral Linearity—0.05%
- Outputs—Standard TTL Levels

Please rush complete information to:

NAME _____

COMPANY _____

ADDRESS _____

CITY _____

STATE _____ ZIP _____ D

CIRCLE 86 ON READER CARD

TENNELEC INSTRUMENTATION

Box D/Oak Ridge, Tenn. 37830/Telephone (615) 483-8404

New Directions in Computer Programming from Wiley-Interscience

A GUIDE TO COBOL PROGRAMMING, Second Edition
by DANIEL D. McCRACKEN, McCracken Associates, and UMBERTO GARBASSI, Esso Mathematics and Systems, Inc.

"For the uninitiated, COBOL is the name of a computer language which uses terminology consistent with business use...This book has extreme merit in that the reader does not need to know a particular machine, but he can understand the purpose and construction of COBOL and its general application to the area of business problems."—from a review of the first edition in The Accounting Review

"The revisions made in the second edition bring in the experience of heavy use of COBOL in the years since it was introduced. Emphasis is laid on the options that people really use, and special warnings are given about errors that experience shows are commonly made. Suggestions from many instructors are incorporated, clarifying troublesome points and adding explanations where classroom experience has shown it is needed. The changes in COBOL itself are fully reflected in the second edition. Material on discs has been added, in particular, and there is a discussion of operating systems."—from the Preface to the Second Edition

1970 220 pages (approx.) paper, $6.95 tent.

SYSTEM/360 JOB CONTROL LANGUAGE
By GARY DeWARD BROWN, The Rand Corporation

This manual presumes no knowledge of System/360 JCL and is appropriate for those familiar with any computer language whether they code in COBOL, FORTRAN, PL/I, assembly language, RPG, or some other language. The manual serves as a learning text for the programmer who wants to understand and use System/360 Job Control Language, and as a reference for the experienced JCL programmer.

"Each Job Control Language feature is described in complete detail, examples are given for its use, and possible applications are discussed. Many System/360 facilities are also described in detail, with abundant examples given to show how they can be used through Job Control Language. These facilities include the linkage editor, indexed-sequential data sets, and several IBM-supplied utility programs."—from the Preface

1970 292 pages paper, $7.95

AUTOMATIC DATA PROCESSING
System/360 Edition
By FREDERICK P. BROOKS, JR., University of North Carolina at Chapel Hill, and KENNETH E. IVERSON, Thomas J. Watson Research Center, IBM

Of direct interest to data processing specialists and to workers in all fields, this outstanding volume covers the fundamental aspects of data processing common to all fields of application. It illustrates and applies theoretical material solely in terms of IBM's System/360 computers. Since Professor Brooks managed the design of the System/360, this is an especially authoritative introduction to machine principles and functions. The book is suitable for self-study, due to its emphasis on references, exercises, and self-contained development although it is expected that the reader will have some experience with a programming language and college algebra.

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DP Directory

Combined 100-page-plus 1970-71 computer services buyer's guide and ADAPSO membership directory includes information on computers, peripherals, supplies, computer and dp services, and software applications. ADAPSO's nearly 600 data centers also are listed. Price: $10. ASSOCIATION OF DATA PROCESSING SERVICE ORGANIZATIONS, 551 Fifth Ave., New York, N.Y. 10017.

In the Chips

Four-page brochure with eight-page inserts of detailed listing charts itemizes transistor and diode chips available, 100% DC probe tested, scribed, broken, and 100% visually inspected. Shipping containers are of glass/mylar, each with dry nitrogen atmosphere for prolonged storage. SEMICONDUCTOR SERVICES, INC., Salem, Mass. For copy:

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Eight-page brochure describes the "first fully programmable crt display," containing a built-in stored program computer. A program can be entered by paper tape reader at site, by transferring from another display by communication line from the central site using a "remote loader" feature, or by local tape cassette terminal store. Basic system configuration consists of computer, display, keyboard and communications interface. INCOTERM CORP., Marlborough, Mass. For copy:

CIRCLE 359 ON READER CARD

Capital Directory

A 116-page booklet directory lists company name, address and telephone number of computer organizations in the Washington, D.C., area. Categories include software, hardware, users, suppliers, research, personnel, education, and government computer centers. When possible, names of key personnel by company also are listed. The directory also is available in mag tape or mailing labels. Price: $6.95. APPLIED LIBRARY RESOURCES, 3801 North Fairfax Dr., Suite 50, Arlington, Va. 22203. *(Continued on page 125)*

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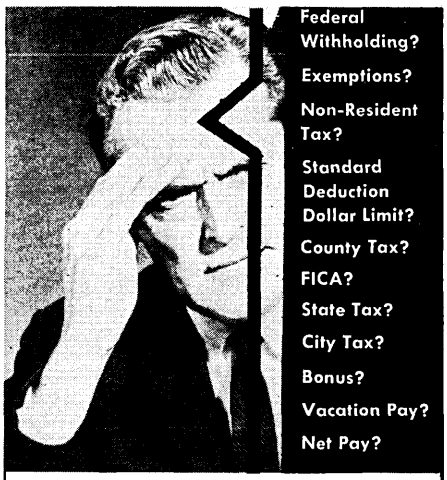

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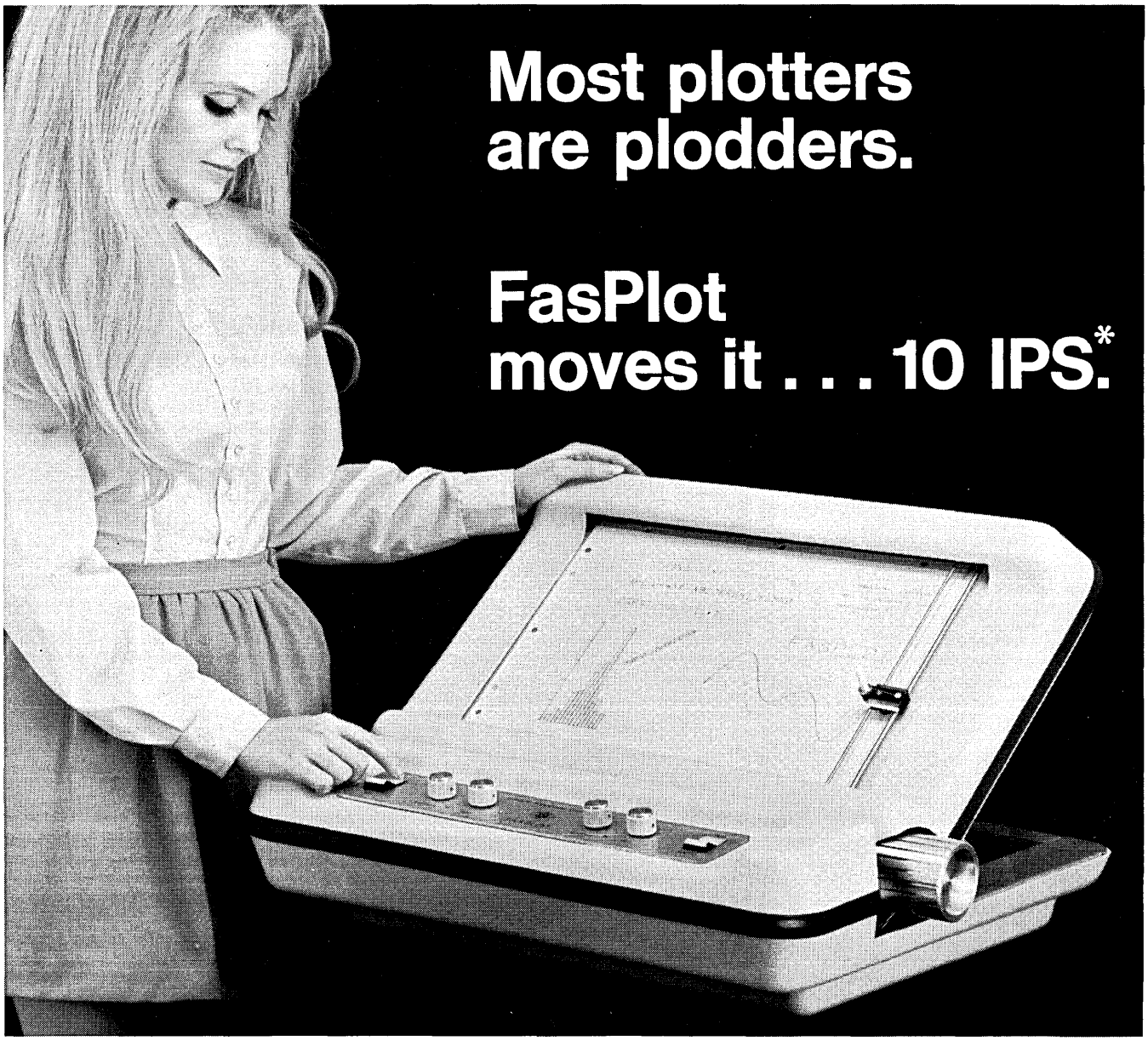

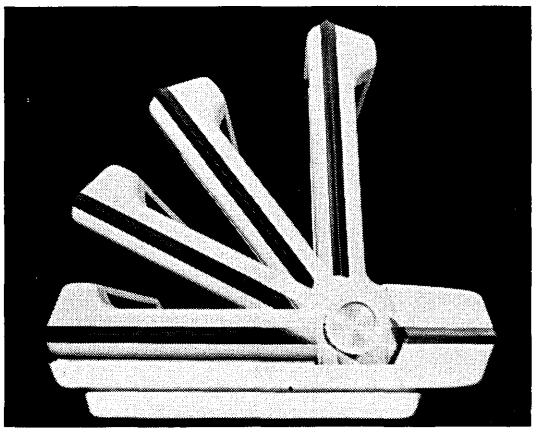

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Standard and custom electronic keyboards are described in four-page brochure that also contains do-it-yourself instruction worksheets enabling an individual company to design its own keyboards. Except for the most complex requirements, keys and electronic circuitry can usually be accommodated on a single printed circuit board. I/O terminals can be of almost any type desired. Specifications also are listed for standard off-the-shelf 55-key ASCII boards. CONTROLS RESEARCH CORP., Santa Ana, Calif. For copy:

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System application diagrams are included in four-page brochure about data sets and multiplexors. They are Bell-compatible, designed to operate over dial network or C2 lines synchronously at 2400 bps, available in stand-alone or OEM units. Complete specs are given. TELTECH CORP., Rockville, Md. For copy:

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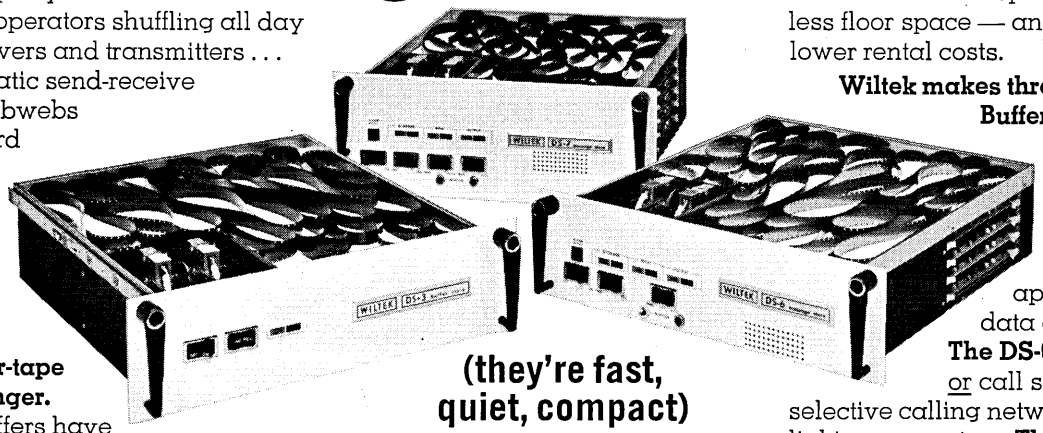

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WORLD ROUNDUP

GE-HONEYWELL PACT WILL IMPACT JAPAN

The Honeywell and GE computer deal probably has more ramifications for the Japanese industry than for any other country in which the two American groups have had operating companies. The reasons lie in the very complicated regulations that the Japanese government has imposed for participation of foreign firms without harming its own manufacturing development. The policy so far has been to stall any further direct foreign capital investment that would lead to an independent totally owned operating computer subsidiary. Nevertheless there have been talks within the Keidanren (a federation of the major Japanese industrial combines) of a third round of "capital liberalisation" or relaxation of some of the import rules. Some members of the steering committee of the Keidanren wanted computers to be included, but the proposal was opposed by a solid vote from the computer and electronics industries.

Honeywell has been tied with Nippon Electric (NEC) and General Electric with Tokyo Shibaura Electric (Toshiba). The Honeywell-GE deal could effectively reduce the six Japanese computer makers to five, thus leading to strong external pressures and the necessity for the other four to combine and reorganise. The Japanese industry holds about 50% of the domestic market largely through machines made under license, and inevitably against IBM's challenge. But there is a strong feeling that any undue upheaval now would cause the Japanese share to plummet sharply.

The protectionist policies have, nevertheless, been quite skillfully designed in comparison with actions of the European countries trying to fend off American competition, for there has been open acknowledgment of the technology and capital gaps existing between the U.S. and Japanese industries. The willingness to negotiate licenses without attempting to disguise the fact has probably been one of the major factors in pushing the country into second place in a league table of installations. The breathing space bought by this policy has also been used in an earlier concentration of building up software groups, a process that has been helped by some university-industry cooperation that is far more comparable to some of the projects in the States that occurs in any other country.

However, the capital investment demands are beginning to stretch resources. This is reflected particularly in the operations of the Japan Electronic Computer Company (JECC), which buys computers from the six sponsoring manufacturers and leases them to users. JECC's customers have been increasing by 50% a year and the leasing operation is grossly underfinanced at the moment. Progress in the general development of t-s systems has been subject to the all-too-familiar restrictions of the telecom systems. But the Nippon Telegraph and Telephone Public Corp. has been ploughing considerable investment into data transmission facilities. New data communications coming into service in Tokyo and Osaka this year are expected to be rapidly duplicated for subscribers elsewhere.

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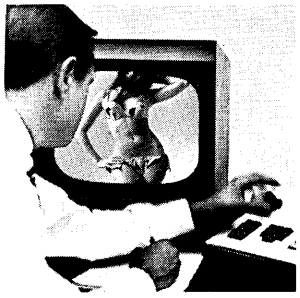

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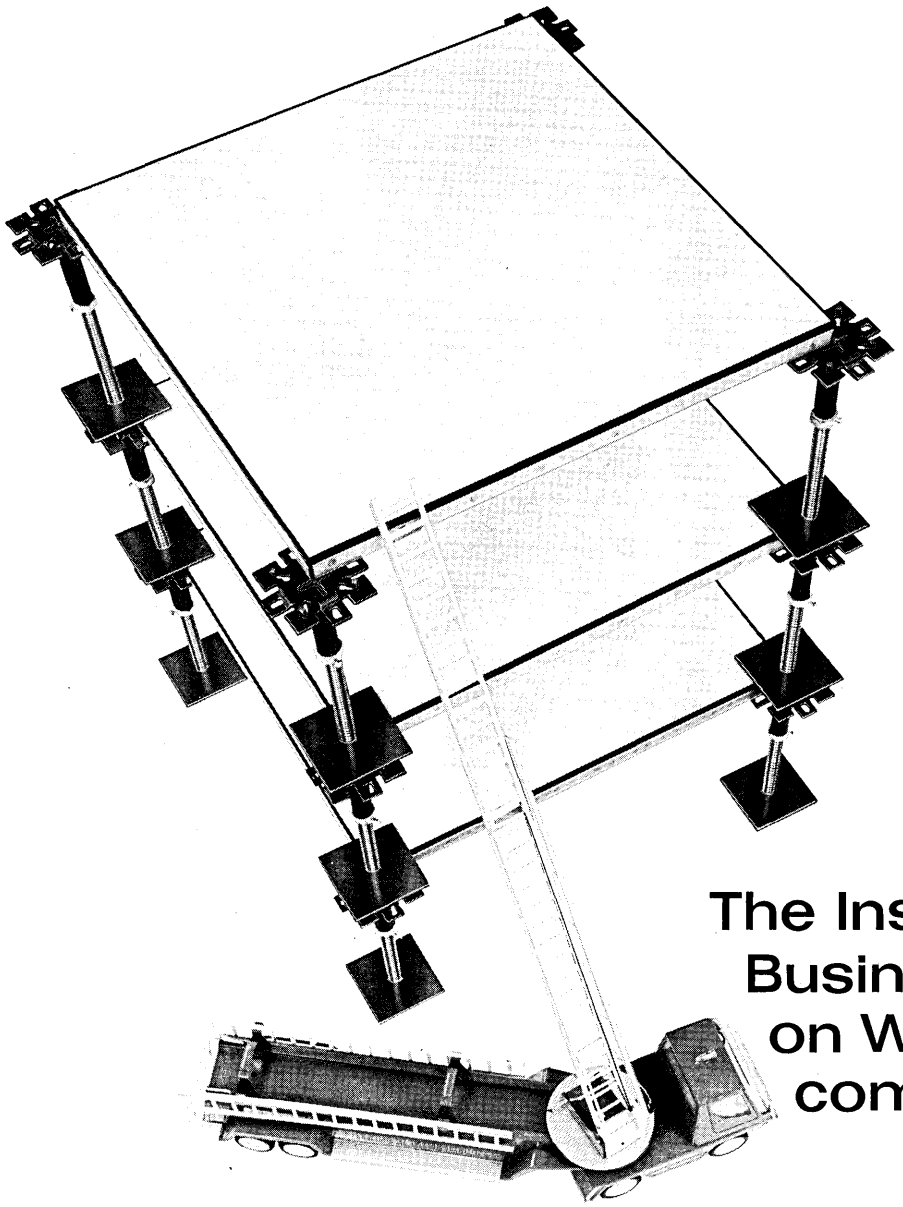

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will establish a connection, now unknown, between Mayan and Indian mathematics), at worst a deliberate misstatement. How many readers' understanding of the history of western mathematics will be distorted by this ad?

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R. LOESER
Smithsonian Institution
Cambridge, Massachusetts

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All day protection

Sir:

There is a strategy to deal with the number system suggested by Christopher Shaw (Aug. 1, p. 9) for dealing with the Hoffman-Miller search strategy (May, p. 74) for acquiring a personal dossier from a statistical data bank. Shaw's protection measure is a method of implementing our suggestion of not returning small counts. This measure is an important one and should be used whenever possible. A strategy that can be used against the Shaw measure is to try different sets of properties, P_1, P_2,... P_n until one finds a set of properties such that:

(1) $\#(P_1 \& P_2 \& P_3 \ldots \& P_n) = \#(P_1 \& P_2 \& P_3 \ldots \& P_n \& P_o) >$ "FEW."

If one is unable to find a set of properties P_1, P_2, . . . , P_n such that (1) holds, then the protection measure of not returning small counts (or utilization of Shaw's number system) is indeed effective. Otherwise, the above strategy reduces the situation to our second case, where counts are large.

The user with a console that permits updates is able to generate the special case of the first strategy. If m is the first integer greater than "FEW", add (m-1) fictitious entries with properties $P_o \& P_2 \ldots \& P_n$. Then the algorithm works for:

(2) $\#(P_1 \& P_2 \ldots \& P_n) = (P_1 \& P_2 \ldots \& P_n \& P_o) = m$.

The Shaw number scheme is a "static" protection measure which can provide a great deal of protection in many cases. However, we feel that "dynamic" protection measures such as threat monitoring are necessary to deal with some cases such as those mentioned above.

LANCE J. HOFFMAN
W. F. MILLER
Stanford, California

The right change

Sir:

In "Getting Ready" (Aug. 1, p. 22), Mr. Davis McCarn indicates that he could find virtually no literature describing the change process. Mr. McCarn didn't look in the right source. The *Journal of Systems Management* and *Ideas for Management* have regularly published articles on this subject.

T. C. WILLOUGHBY
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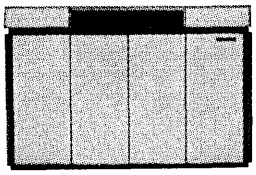
Get our Large Core Store into it  now.

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PEOPLE

One of the more interesting and challenging jobs of late (if it doesn't do him in) has been ventured by **George A. Sinnott** as director of NYC's bureau of management and dp for the city's public schools, encompassing the system's administration and educational briar patch. He will have a staff of 175. He comes from a vice presidency at First National City Bank, where he was in charge of its data center, was previously with ITT as manager of the programming services department, and before that with RCA, so he doesn't have to do what he's doing. Maybe one of the reasons is because he was educated in the NY public schools, including Brooklyn College and NYU. . . . As part of beefing up its organization, the Association of Independent Software Companies has appointed **Merle Thomas** to be executive director. First order of business is a membership drive to build on the original 11 (August 15, p. 37). . . . There are also new officers for the Society for Information Display: **Phillip P. Damon,** president; **Dr. Carlo P. Crocetti,** vp; and **Robert Klein,** secretary. SID hq is in L.A. . . . In Dallas, World Computer Corp. has switched board chairmen, from **William A. Pyke,** who has left for parts unknown, to **Robert W. Cross,** who also has been elected chief executive officer. Cross was formerly general counsel for Electronic Data Systems and helped make its initial stock offering. **Robert Corey** remains president of WCC. . . . With the Jones boys: **David P. Jones** has resigned the presidency of Caelus Memories, Inc., the San Jose, Calif., subsidiary of Electronic Memories & Magnetics which has been laying off lately. His plans are unknown, except to go on his honeymoon. At press time, Caelus had not replaced him. . . . **Dick Jones,** ex-president of Applied Data Research, is back in business as a consultant on marketing and general management to both hardware and software firms. He's spent part of his time getting a first-hand view of world markets and the overseas business climate. . . . At Fairchild C & I in Mountain View, Calif., **Richard deJ. Osborne,** an IBMer for nine years, was named vp for corporate development. He originally came with the company as staff assistant to **Sherman Fairchild.** Three new Fairchild Semiconductor vp's will be reporting directly to president **Dr. C. Lester Hogan** instead of to **F. J. Van Poppelen, Jr.,** who has relinquished the vice presidency of the division to head another group: **Wilfred J. Corrigan,** domestic vp/gm; **Leo E. Dwork,** vp/gm, memory systems; and **George M. Scalise,** vp/gm, Far East. . . . American Computer Communications Co., Inc., Columbus, Ohio, has elected **Samuel L. Oppenheimer** president and chief executive officer. He was formerly a vp of Bell & Howell Schools, and is the author of several textbooks on electronics technology. **Lawrence Lutzger,** coinventor of AmComCom's forward error corrector which is scheduled for first delivery in December, was elected senior vp; and **Howard Lustig** was elected engineering vp. . . . **T. A. McChristy,** IBM sales alumnus, has been named president of Dicom Industries, Inc., Sunnyvale, Calif., developer of software for minicomputers, supplying CTOS (Cassette magnetic Tape Operating Systems) to the end user. . . . **Jules I. Schwartz,** famed for JOVIAL (Jules' Own Version of an International Algorithmic Language), is now a senior scientist at Computer Sciences Corp. in L.A. He came from the computer systems division of King Resources Co. **Erwin L. Allen** has been named systems development vp of CSC's information network division, coming from the systems division at Silver Spring, Md., to oversee the national progress of Infonet. . . . **Zachary K. (Jack) Geanes** has come from Republic Corp. to be president of Proprietary Software Systems, Inc., L.A. software house noted most recently for developing DUAL, a package for originating user languages. . . . Management Assistance, Inc., (MAI), NYC equipment dealer, is still looking for a chief executive officer, but until Whenever, has fallen back on original president **Jorge M. Gonzalez,** and exec vp **Raymond P. Kurshan** as chief operating officer. The company deemed its previous committee setup unsatisfactory. . . . The newly created position of exec vp/gm has been given to **J. C. Washington** at Computer Automation, Inc., Newport Beach, Calif., minicomputer manufacturer. He was previously a vp with Robertshaw Controls, is also commander of a power boat squadron. . . . Computer America Corp. (COMERICA), equipment and services dealer based in Oklahoma City, has a new president, **Richard L. Deaton,** and vp-controller, **Jess Vanhooser.**

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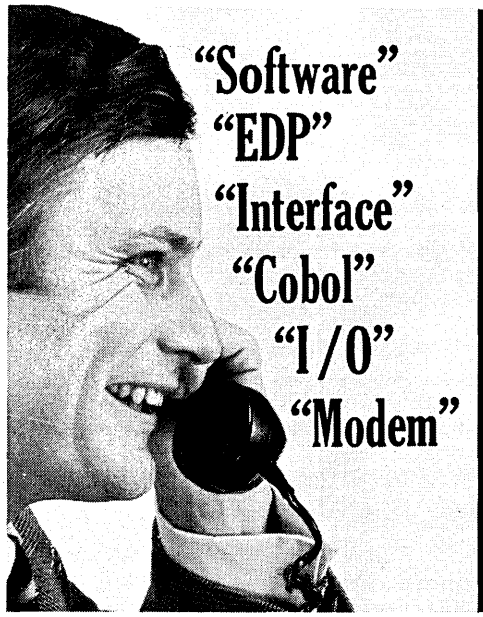

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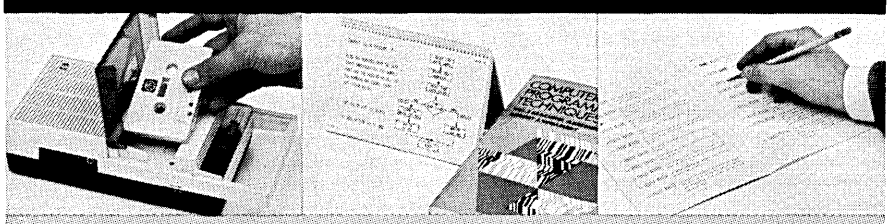

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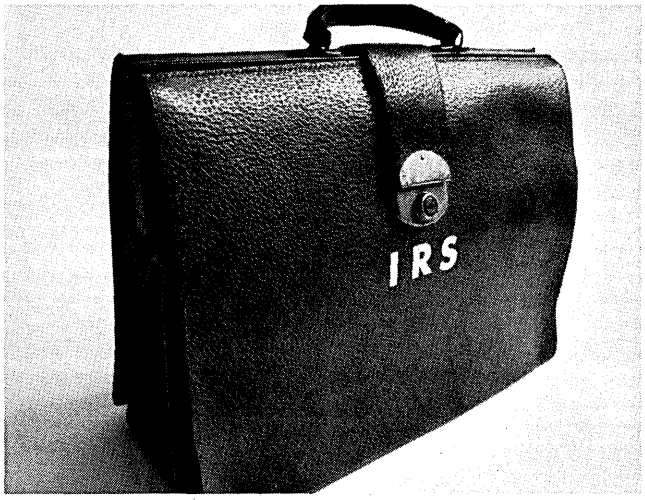

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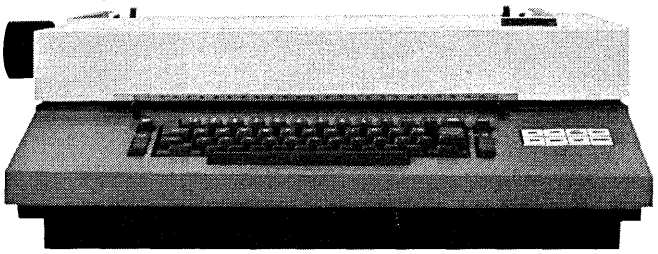

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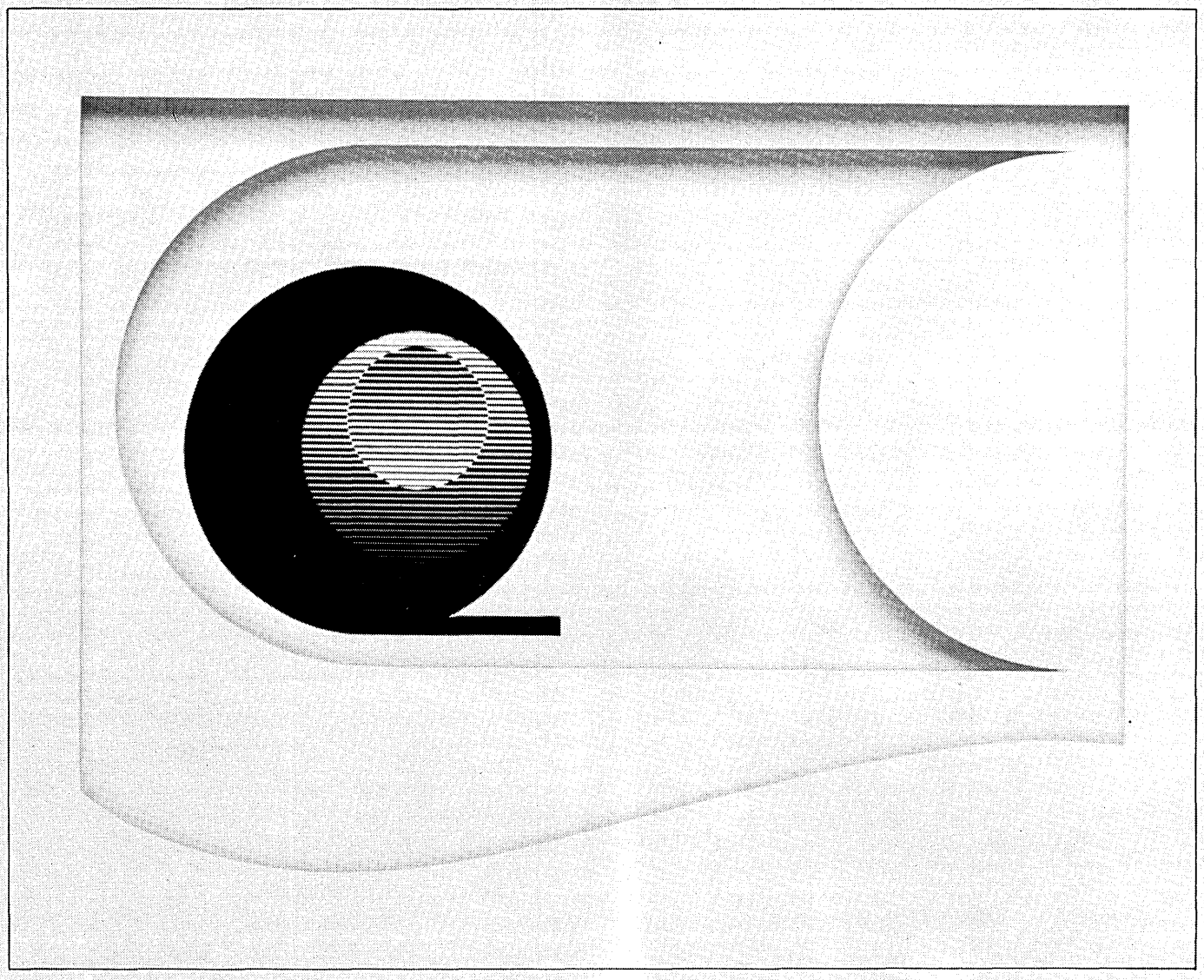

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THE FORUM

Decentralization Again

When I wrote The Forum in May with a negative view of Dr. Solomon's March article on the economies of scale, there was no intention to get into a long term debate on the subject of centralization versus decentralization. However, with Dr. Solomon's rebuttal (June, p. 293), some answer is due. I doubt in the end whether I will change his interpretation of management principles as applied to edp organization nor will he change mine. However, we agree on very many of the more important conceptual aspects of edp organization although we disagree on many of the conclusions on how to apply these broad principles in actual practice.

To emphasize the positive, we both agree on the need for stronger management of data processing. Weak management pervades the computer scene. Thus, the subject of our debate is a critical one. Yet there is really not enough said in the literature regarding centralization versus decentralization of edp even though the subject has been thoroughly explored in regards to the total corporation (with the same divisiveness of conclusions that separates the good doctor and myself). If Dr. Solomon or myself have an easily applied answer to solving the problem of poor edp management, I am willing to split 50-50 the million dollars a year we can make supplying the answers to those firms that are in trouble. However, since the answers lie with the lack of understanding of top management of individual firms, I guess our fortune will be nothing more than unearned potential.

One point Dr. Solomon's original article did not make clear because of its emphasis on the cost savings feature of centralization was that he agreed with the necessity, where justified, of remote systems staff. If centralization is so managed, indeed, some of my strongest arguments are disarmed, as service to district management needs are satisfied. In practice, however, many centralized installations do not allow this. Service to the users suffers to the detriment of both the division and parent company. If you must be centralized, this must be an option. We agree that the giant monolithic structure is undesirable. Flexibility in organization is required — I suggest well organized and managed decentralization; Dr. Solomon suggests well organized and managed centralization. Let us inspect Dr. Solomon's rebuttal to each of my complaints.

1. Centralized data processing is a giant monolithic structure. We both agree this is disastrous. I submit that in too many installations that have not analyzed the concepts of centralization as Dr. Solomon has, this in fact exists.

2. Centralization ignores the need of the users. Dr. Solomon says it doesn't. I agree it shouldn't. In most cases it does ignore geographically distant users. This misapplication of the proper principles championed by Dr. Solomon destroys the value of the computer.

3. With centralization, the user has a weak voice. Dr. Solomon says that if this means the user cannot automate applications without justification, then hurrah for centralization. May I add as a corollary, if the user cannot automate applications *with* justification, then a full round chorus of hisses for centralization. We both agree good management will dictate careful evaluation of project proposals regardless of how organized.

4. Under centralization the user will not have available analysts familiar with his applications. We both agree that analysts and programmers should not "run" departments, defining the problems and making critical policy decisions. This is independent of the question of organization. As long as centralization does not preclude the concepts of teams on location or resident analysts, we have no argument on that score and I misinterpreted the original article. He states that the permanent department analyst implies that any task required in this department is of high priority, and of course this does not make sense. Here I am talking of economy of scale. Of course the $150 million division of a billion dollar corporation should have its own analysts. Of course the division credit department shouldn't. Perhaps the credit department of a giant department store chain should consider it. Whether or not intimate familiarity with an area reduces the probability of documentation being performed is not germane to our debate. Only poor management accounts for that. It can happen centralized as well as decentralized.

6. With decentralization, systems development is often less massive and less prone to serious problems if broken down into manageable chunks. Dr. Solomon's answer is that topnotch management solves these kinds of problems. I couldn't agree more. However, as is too often the case, when there are failures in topnotch management, the larger the edp unit, the larger the failure.

7. If salary levels are competitive and hiring standards are high, there is much greater job satisfaction for the computer professional with a small or medium size system staff. Dr. Solomon says nonsense to me. I say, same to you fellow. Seriously, here we are at opposite poles. I have seen the 200-plus size staffs at major insurance and aerospace firms and personally am not impressed with them as a place for the good computer professional to pursue his goals. The best people in these places escape to form small consulting firms. The average and mediocre stay on to form the experienced core.

8. I say it is possible for proper standards to be maintained under a properly managed decentralized organization. Dr. Solomon disagrees. We both agree to the necessity. Please, I am no more for improperly run decentralization than he is for improperly run centralization. The above also holds for personnel performance standards and evaluation. We agree these areas are poorly han-

dled in too many installations. I suggest good management solves the issue regardless of organization patterns.

9. Regarding turnover and scarcity of staff, we are in agreement to the problem. I'll admit that with the larger department a better job of staff training can be performed. But please, when I speak of decentralization I do not argue for dozens of fragmented four- and five-man staffs around the country.

10. Decentralized staff in no way invalidates the concept of central control. Dr. Solomon answers yes, in the same way you can control someone else's employees. Let us look externally at management itself. Shouldn't the division president have the same control over his processing as he has over his division; in other words, management authority within tight parent company standards? Shouldn't edp be organized in the same manner as the rest of the organization? Surely General Motors Chevrolet division shouldn't have decentralized management except for centralized edp.

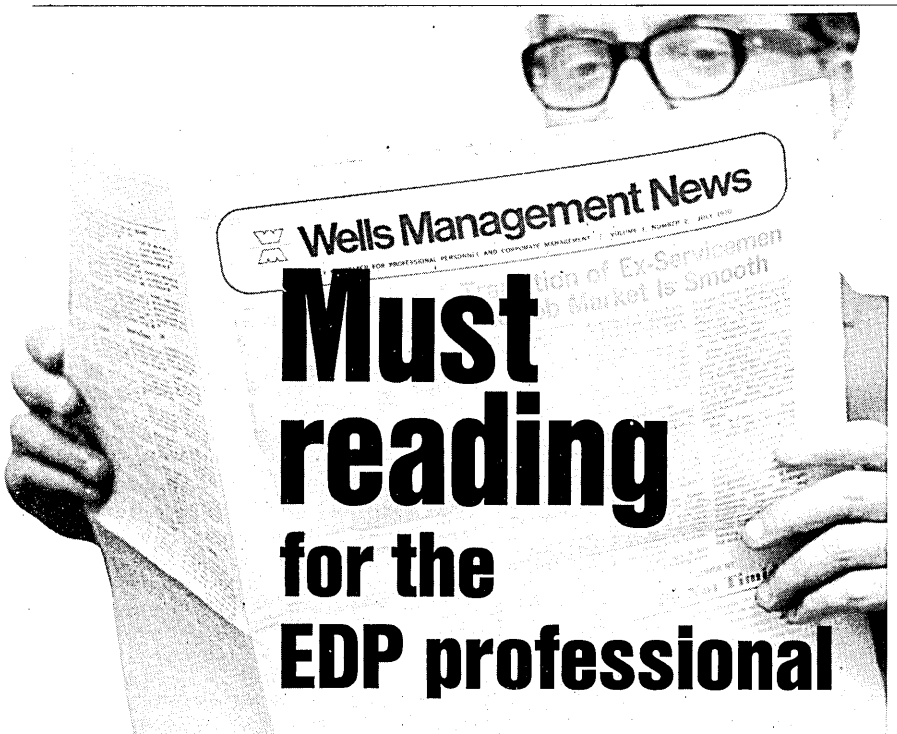
Beyond Dr. Solomon's answers to my 14 points (condensed to 10 above to hold any continuing debate to the size of The Forum), he includes some additional arguments for centralization. Decentralization is no good, he says, if project control standards are not applied, if a non-data processing manager is employed, if poor design and programming are overpowered by applying the solution of faster hardware, if no justification is required for project approval, and if no one forces us to document. But come on Martin, is centralization so good if the above practices are adopted? Of course not! However greatly we disagree as to the best organization of edp, please do not make me a proponent of poor management.

I am glad that Dr. Solomon's rebuttal was based on the argument that centralization means better management. Fiscal economy of scale, while not to be ignored, should not be the basis for centralization. Any dollar savings are insignificant compared to the total computer investment.

In summary, well managed decentralization beats poorly managed centralization. Well managed centralization beats poorly managed decentralization. We disagree on which is better when well managed, but agree on the crying need for good management. I submit that for the large corporation, organization of edp management should be in line with the organization of the rest of the corporation.

While there is no one answer suitable for everyone, I suspect this debate is a good thing. There have been too few rational decisions regarding the organization of the computer. Too often edp organization just happens without analysis as to how best to fit the power of the computer to serve the corporation. When this happens, chaos is usually just around the corner.

—Peter Berman



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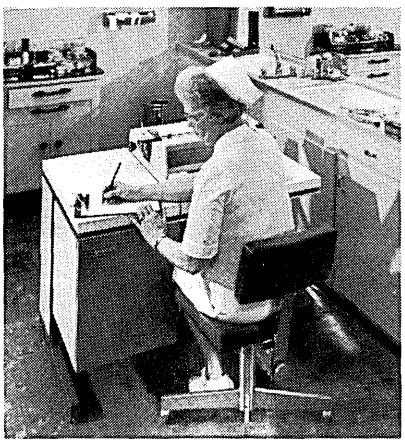

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4. Time-sharing control is built in with hardware. So no expensive executive software is needed.
5. System Ten uses simple assembler-language programming. Anyone can do it.

6. Data communications capability to interface System Ten with other on-site or remote computers.
7. Total modularity, leading to remarkable cost economies. Total flexibility of size and configuration now, expandability for the future. For a new application, just add a new workstation.

In addition to these functional advantages, System Ten hardware needs only minimal environmental control. And the simple two-wire connections eliminate the need for expensive false-flooring to conceal heavy cable.

Find out more about the computer system of the decade. Call where the System Ten people are, your nearest Friden office. Or write: Friden Division, The Singer Company, San Leandro, California 94577.

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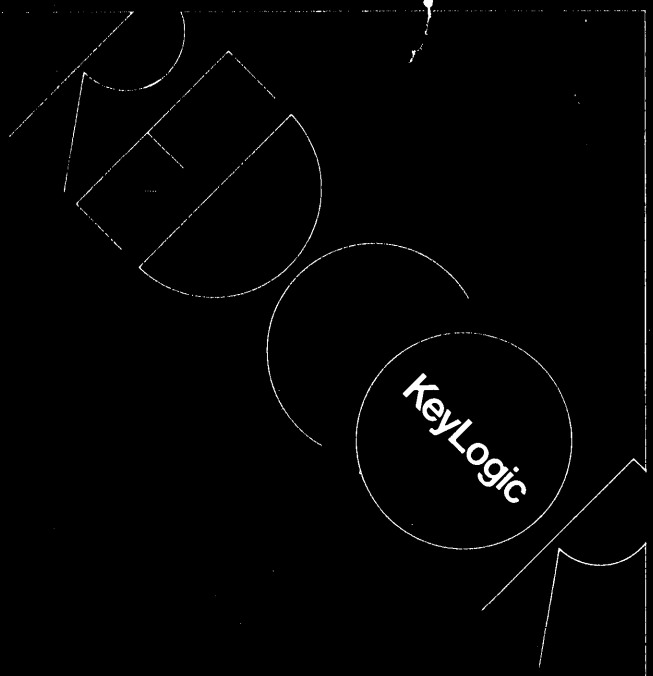
CIRCLE 85 ON READER CARD



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- value range check
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