DATAMATION '72 ®
November

FJCC 1972

communications planning...a presi dent's view of mis...psychology of programming groups...

It takes architectural flexibility to get the most out of a 330 nsec mini.

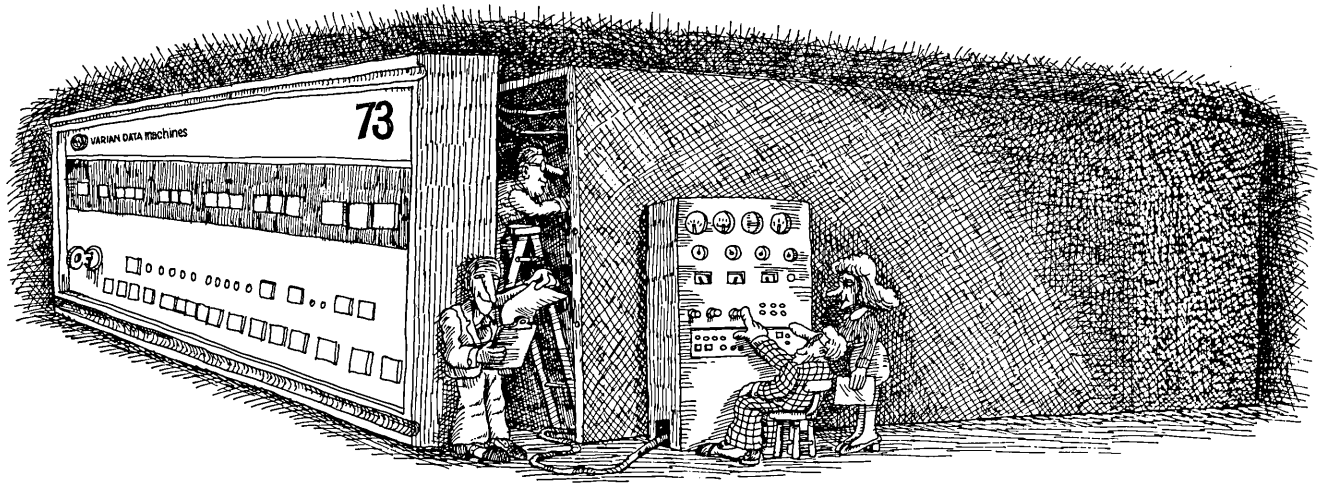
Introducing the user microprogrammable VARIAN 73.

Microprogramming you can get your hands on, coupled with the speed to make a big difference in computing power. That's the VARIAN 73. An all new approach to minicomputer design and performance. It starts with architecture. Extendable. Multiple processors interleaved for incredibly large capacities and speeds. With expandable memory and multiple busses.

But even for openers, VARIAN 73 is loaded. Extremely compact, a complete 32K system in a seven inch chassis. And fast. 330 nsec full memory cycle using the latest semiconductor technology and you can even get a walloping 660 nsec in a core option for less money. I/O data transfers to memory at rates exceeding 3 million words per second. And a 64-bit control word gives maximum speed and flexibility.

We've built in a dual asynchronous memory bus with a total information bandwidth of over one hundred million bits per second. Configure a system by connecting processors and dualport memories to the multibus and you've got a giant multiprocessor. The software package which is available right from the moment of introduction of the VARIAN 73 is enough to make most other minis look naked. Peripherals? VARIAN 73 has every option in the book. Send for the book. Varian Data Machines, 2722 Michelson Drive, Irvine, California 92664 (714) 833-2400.

varian data machines



CIRCLE 1 ON READER CARD

"TALLY GIVES YOU MORE BANG FOR THE BAUD!"

Because of Tally's exclusive data compression system, the Tally Datascribe will dramatically increase throughput using your existing modems. In fact, the Datascribe far outperforms any other terminal on the market. Using 200 character records, compare these average throughputs to what you're getting now:

150 records per minute with 1200 Baud Modems
200 records per minute with 1800 Baud Modems
300 records per minute with 3600 Baud Modems
400 records per minute with 4800 Baud Modems

But that's only part of the story. Because Tally now offers three different line printers, you can mix and match printers to get the most cost-effective package for each individual terminal in your system:

Tally's 100 lpm printer for small volume terminals.
Tally's 200 lpm printer for medium volume terminals.
Tally's 600 lpm printer for large volume terminals.

Knowledge is power. You owe it to yourself to get the whole story now.

Call your Tally man today.

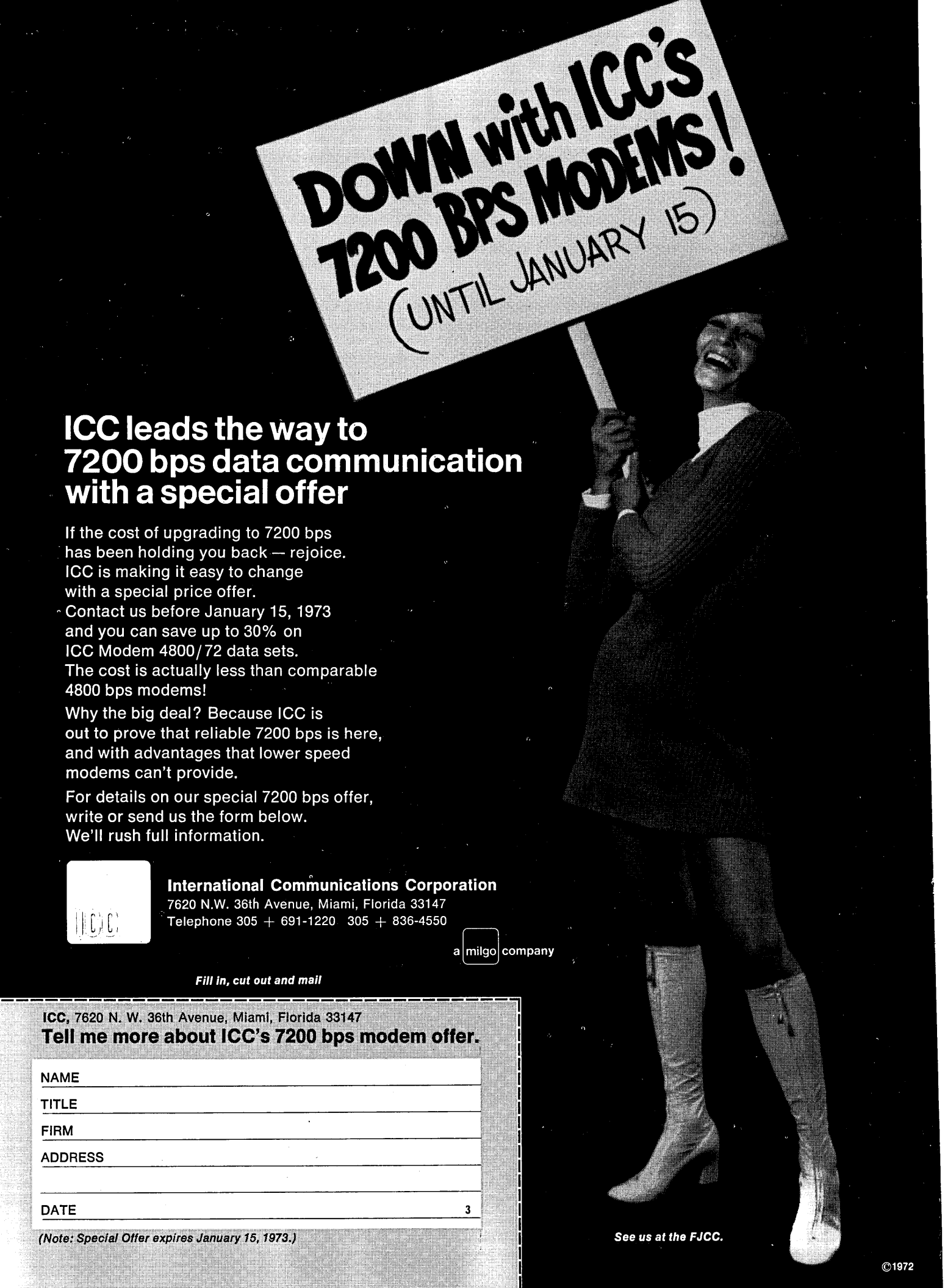
TALLY

Tally Corporation. 8301 South 180th Street, Kent, Washington 98031. Phone (206) 251-5500. In New York, (212) 490-2430; Chicago, (312) 298-6710; Atlanta, (404) 633-1991; Los Angeles, (714) 542-1196; San Francisco, (415) 989-5375.

Data Terminals • Printers • Disc Memories • Card Reader Terminals • Paper Tape Peripherals

CIRCLE 4 ON READER CARD

See us at the FJCC booth 1530



ICC leads the way to 7200 bps data communication with a special offer

If the cost of upgrading to 7200 bps has been holding you back — rejoice. ICC is making it easy to change with a special price offer.

Contact us before January 15, 1973 and you can save up to 30% on ICC Modem 4800/72 data sets. The cost is actually less than comparable 4800 bps modems!

Why the big deal? Because ICC is out to prove that reliable 7200 bps is here, and with advantages that lower speed modems can't provide.

For details on our special 7200 bps offer, write or send us the form below. We'll rush full information.

ICC

International Communications Corporation
7620 N.W. 36th Avenue, Miami, Florida 33147
Telephone 305 + 691-1220 305 + 836-4550

a milgo company

Fill in, cut out and mail

ICC, 7620 N. W. 36th Avenue, Miami, Florida 33147
Tell me more about ICC's 7200 bps modem offer.

NAME

TITLE

FIRM

ADDRESS

DATE 3

(Note: Special Offer expires January 15, 1973.)

See us at the FJCC.

DATAMATION 72®

NOVEMBER, 1972
volume 18 number 11
This issue 123,000 copies

departments

DATAMATION

EDITORIAL STAFF

Editor	Robert B. Forest
Senior Associate Editors	William J. Rolph Tom McCusker
Associate Editors	Richard A. McLaughlin Edith D. Myers
Copy Editor	Janet Eyler
Assistant Editor	Michael William Cashman
Editorial Assistants	Alma O'Steen Mary Ellen McCoy
International Editor	Angeline Pantages
Western Editor	Edward K. Yasaki
New England Editor	W. David Gardner
Washington Editor	Phil Hirsch
Southwestern Editor	Robert F. Alexander
Minneapolis Correspondent	James K. Johnson
European Editor	Pearce Wright
Australian Editor	Frederick A. Bland
Contributing Editors	Howard Bromberg, Phillip H. Dorn, Louis B. Marienthal, F. G. Withington, Paul Armer, Milton R. Wessel.
Editorial Advisor	Robert L. Patrick
Technical Consultant	Lowell Amdahl

EDITORIAL OFFICES

Headquarters: 94 S. Los Robles Ave., Pasadena, CA 91101. Phone (213) 681-8486. **Eastern:** 35 Mason St., Greenwich, CT 06830, (203) 661-5400. 19 Marlborough St., Boston, MA 02116, (617) 267-9414. 9805 Singleton Dr., Bethesda, MD 20034, (301) 530-7271. **Southwestern:** 2711 Cedar Springs, Dallas, TX 75201, (214) 744-0161. **Western:** 61 Renato Ct., Redwood City, CA 94061, (415) 364-3171. **Foreign:** 65, Hill Road, Chelmsford, Essex, England. 322, Park Regis, Park St., Sydney, NSW 2000, Australia.

GRAPHIC DESIGN & PRODUCTION

Art & Production Director	Cleve Marie Boutell
Production Manager	Marilee Pitman

CIRCULATION

35 Mason Street, Greenwich, CT 06830

Circulation Director	Suzanne A. Ryan
Circulation Manager	Mae Van Rennes
Marketing Research Director	Douglas De Carlo
Publisher	James M. Morris

Circulation audited by Business Publications Audit BPA

Member, American Business Press, Inc.

DATAMATION is published monthly on or about the first day of every month by Technical Publishing Company, 1301 South Grove Ave., Barrington, Illinois 60010; Arthur L. Rice, Jr., President; Gardner F. Landon, Executive Vice President. Executive, Circulation and Advertising offices, 35 Mason Street, Greenwich, CT 06830, (203) 661-5400. Editorial offices, 94 So. Los Robles Avenue, Pasadena, CA 91101. Published at Chicago, Ill.

DATAMATION is circulated without charge by name and title to certain qualified individuals who are employed by companies involved with automatic information handling equipment. Available to others by subscription at the rate of $18 annually in the U.S. and Canada. Reduced rate for qualified students. Foreign subscriptions are on a paid basis only at a rate of £12.50 annually. Sole agent for all subscriptions outside the U.S.A. and Canada is J. B. Tratsart, Ltd. 154 A Greenford Road, Harrow, Middlesex HA13QT, England. No subscription agency is authorized by us to solicit or take orders for subscriptions. Controlled circulation paid at Columbus, OH and Form 3579 to be sent to Technical Publishing Company, P.O. Box 2000, Greenwich, CT 06830.

Microfilm copies of DATAMATION may be obtained from University Microfilms, A Xerox Company, 300 No. Zeeb Road, Ann Arbor, Michigan 48106. Printed by Beslow Associates, Inc.

WITH OUR NEW 370/STOR, YOU HAVE NO MORE REASONS TO BUY IBM MAIN MEMORY.

370/STOR is the new add-on and replacement main memory for IBM System/370 Model 155. From Cambridge Memories.

We designed it with one goal in mind: to convince even the most cautious buyer that 370/STOR is far superior to any alternative 370/155 main memory. Judge for yourself.

FIRST, IT'S "FAIL-SAFE."

In 370/STOR, if a sector of memory fails, it is reassigned immediately to the highest address level, and the rest of the memory keeps running. That means almost zero downtime due to memory failure. No other memory has such a feature.

FACT #2. IT IS EXTREMELY COMPACT.

One 370/STOR unit has the capacity of four IBM memory cabinets. We store up to two megabytes in the same space that IBM stores 512 kilobytes. That saves floor space, machine room changes, and time during upgrade. No other memory has such a feature.

FACT #3. IT IS FIELD-EXPANDABLE.

After you install a minimum 370/STOR module, we can expand it up to an additional 1.75 megabytes *by simply plugging cards* into your installed unit. As a rule of thumb, figure that we can add about 512K bytes in about two hours. It's as easy as opening two cabinet doors. No other memory has such a feature.

FACT #4. NO COSTLY CENTRAL PROCESSOR MODIFICATIONS.

To add IBM memory to your Model 155 requires processor modifications. These cost from $12,000 to $125,000, depending upon the number of "ports" your memory uses. 370/STOR uses only one port per two megabytes, so there is absolutely no requirement for processor upgrade. That alone can be a huge savings. No one else offers such a feature.

FACT #5. WE'LL GUARANTEE 72-HOUR EXPANSION.

Once you install a 370/STOR memory, we will upgrade it within 72 hours after contract approval if you desire. Our experience as one of the largest suppliers of add-on core for System/360 taught us that when a user wants more memory, he wants it fast. And let's face it, we want to make a point: no one else could possibly offer such a service.

FACT #6. THE PRICE STORY.

We saved the best for last. 370/STOR saves you from 30 to 60 per cent, not including the substantial processor savings that you'll enjoy. To convert that to dollars: two megabytes of memory from IBM costs approximately $1,000,000. From Cambridge, it costs $480,000. You save over a half a million dollars. Our lease terms are just as attractive.

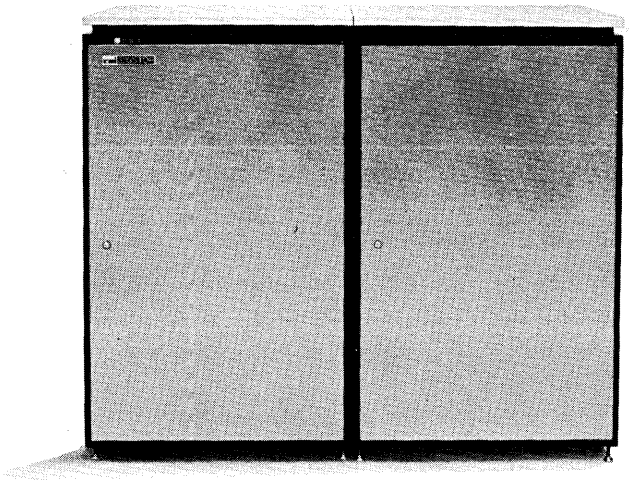
370/STOR is completely hardware and software compatible with any of the seven models of the 370/155, in case you had that concern. And although its unique operator console makes maintenance a breeze, we service 370/STOR from over 150 locations in the U.S. So you can put that issue aside.

That's our story. Since you're probably a cautious buyer, call our local sales office and make us prove our pitch.

If you don't buy what we say, call anyway. We want to know what else you'd like your memory system to be.

CAMBRIDGE.

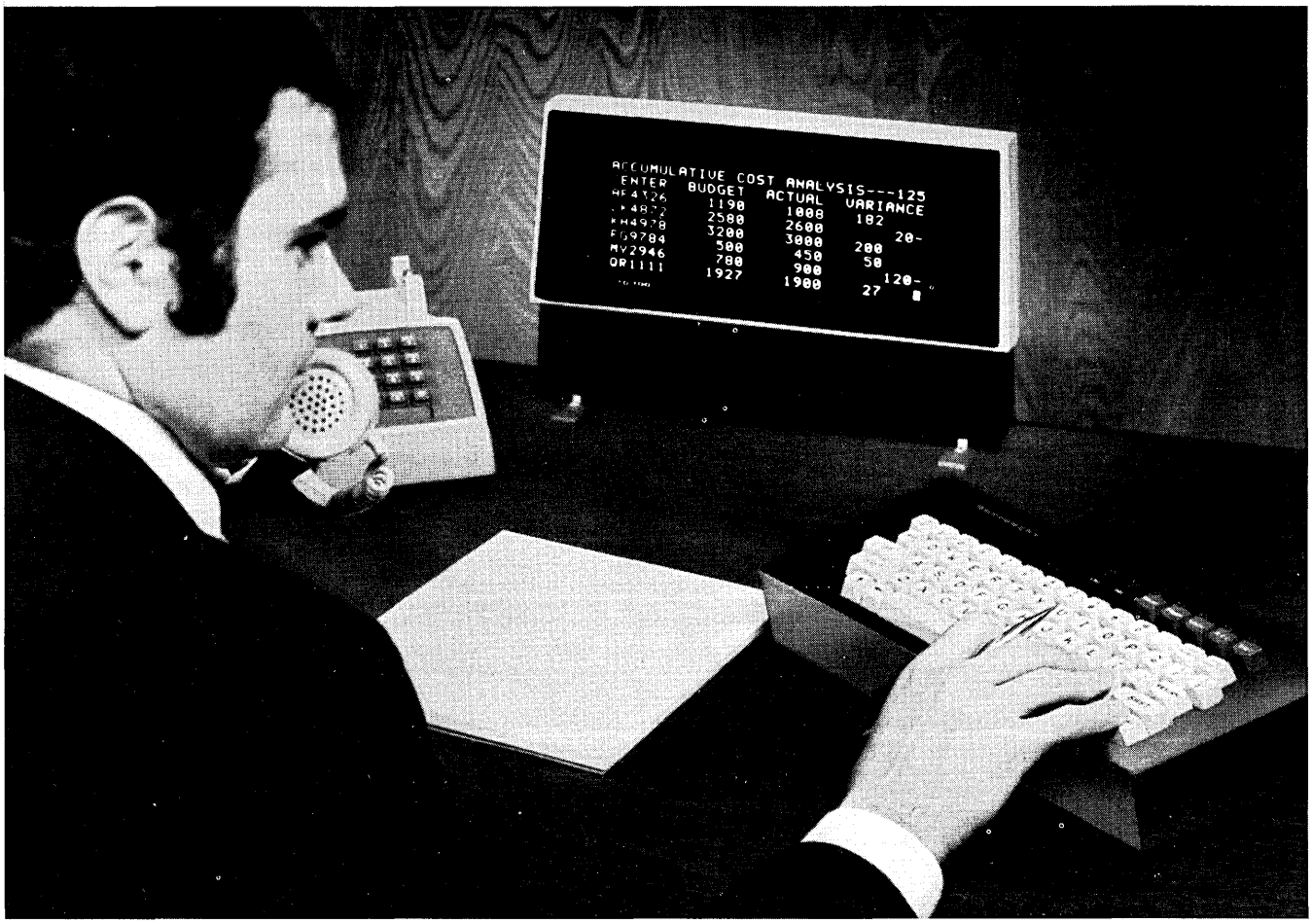
A good place to put your information.



CAMBRIDGE MEMORIES, INC., 285 Newtonville Avenue
Newton, Mass. 02160, 617-969-0050 Telex: 92-2405

Boston (617-969-0050)
Chicago (312-341-0480)
Hartford (203-247-4500)
Atlanta (404-256-4565)
New York (212-868-4936)
Dayton (DPS) (513-275-6781)
Detroit (DPS) (313-557-3164)
North New Jersey (201-947-0184)
Pittsburgh (DPS) (412-922-6219)
Toledo (DPS) (419-472-0111)
Minneapolis (612-890-6810)
Rochester, N.Y. (716-244-1430)
Philadelphia (609-227-2203)
Louisville (DPS) (502-897-5881)
Los Angeles (213-281-4844)
San Francisco (415-692-4806)
D.C. Metropolitan Area (301-657-9105/6)
Indianapolis (DPS) (317-251-6471)
Houston (ACS) (713-461-1333)
Cincinnati (DPS) (513-961-0776)
Cleveland (DPS) (216-886-2090)
Columbus (DPS) (614-224-4081)

Extend the power of your computer to the people who need it...



with Burroughs TD 700 Input and Display System.

The new TD 700 is as easy on the eyes as it is on the budget.

It uses Burroughs SELF-SCAN® technology to display data in large, clear characters that are easy to read—even from a distance.

It's low in cost. TD 700 economy, compact size and modularity open up new areas of application in hospitals, financial institutions, hotels and motels, manufacturing plants, order entry departments, credit authorization departments, remote data entry departments, and even executive offices.

The TD 700 also introduces new flexibility in data input and display systems—

- Because it's compact and modular, it can be installed almost anywhere.
- A broad choice of optional features lets you "build" the input and display system that fits your particular requirements best.
- It can be mixed with other Burroughs terminal systems because it utilizes common data communication procedures. The TD 700 also offers data transmission speeds from 75 to 9600 bps.

For more details about this exciting new development in on-line data input and inquiry display, call your local Burroughs office today.

Burroughs

Look Ahead

HOW WOULD IBM BE BROKEN UP?

"How would IBM be broken up" is everybody's guessing game in the wake of widespread attention the Justice Dept.'s antitrust case received Oct. 16. Dan McGurk, president of the Computer Industry Assn., says Justice lawyers want to see the company split by computer product lines (i.e., one fully integrated company for the 360/40 and 370/145 lines, offering software, services, and peripherals internationally) with the firm's non-computer activities spun off into a conglomerate. McGurk, who bases his comments on talks he's had with the lawyers, says "with this, you'd have viable companies in the range of $500 million to $1 billion a year in revenues."

Others see IBM accepting a plan under which it's regulated as utilities are. And there are other opinions that a breakup should reflect growth areas of the future, with IBM's terminals, education, and services spun off into separate entities. On one point there is total agreement: IBM will fight to prolong any litigation to restructure the company.

McGurk, former president of Xerox Data Systems, met in late October with the heads of some 45 independent computer companies to explain the antitrust case and soon intends to publish a 100-page book tracing IBM antitrust litigation back to 1913. His four-month-old association still has only its original eight founding members, but McGurk hopes to boost this figure to 20 to help the association pursue its campaign for a "competitive computer industry."

LEARSON SAYS IT "WILL NEVER HAPPEN"

No one has ever accused IBM's chairman T. Vincent Learson of being talkative, but the IBM chief executive was downright loquacious recently with a Wall Street Journal reporter about the antitrust suit. The Journal headlined the story: "IBM Chairman Asserts Breakup by Justice Units 'Will Never Happen.'" Learson went on to discuss the case further with the reporter. There have been some red faces over the incident, however. IBM has been successful in pushing through a press gag order on the case, forbidding Justice Dept. and IBM officials from discussing the case with the press. Chairman Learson, however, is presumably safe from any contempt of court proceedings: IBM is the only party uptight about anyone discussing the case with the press and no one really expects IBM to institute proceedings against its own chief executive officer.

FIVE PROSPECTS FOR PRESIDENT

Although it's long been thought that IBM's T. Vincent Learson would have a short tenure as chairman (see Nov. 1, 1971, p. 26), the industry was shocked when the announcement came--along with the new policy of executive retirement at age 60. Naturally, IBM watchers are asking if Learson, who will remain a director of the company and a member of the executive and finance committees, might not continue to be the "power behind the throne."

Many are wondering, too, if IBM will choose to give Frank T. Cary, 51, a partner by appointing another man president after Cary becomes chairman at the end of the year. Two who are most mentioned as candidates are John Opel, 47, senior vice president

and group executive for Data Processing Products, and Gilbert Jones, chairman of IBM World Trade. Although Jones is 55, he has been appointed to the corporate office to replace Learson. His record with World Trade, which outshined domestic business during the tough 1970-71 period, "deserves reward," some say. Other mentioned candidates: Paul J. Rizzo, 44, corporate finance and planning vice president; George Beitzel, 44, senior vice president and a "dark horse, perhaps after more seasoning"; and Jacques Maisonrouge, World Trade president, now firmly in control of that company, having been made chief executive officer with Jones' shift to corporate office.

ICL REJECTS SUITORS, EYES OWN CANDIDATES

Although ICL has soundly rejected cooperation with the new European entente of Siemens-Philips-CII, the big, beleagured British manufacturer has not ruled out foreign ties. Eyeing the Continent, ICL would "love to fill the gap" in the combined Nixdorf-AEG Telefunken line, and may propose a joint R&D effort with Hitachi, the only unwed Japanese computer maker.

Although ICL rather rudely slapped the hand of suitor Burroughs ("They were only after our customer base"), rumor has it that Mr. Big in the U.K. is strongly interested in going steady with some U.S. firm. Most likely candidate, we'd bet, is DEC. But don't rule out a data entry firm. Larger mainframers are also a possibility; ICL's managing director Geoffrey Cross came from Univac. Lack of long-term British government support can be seen as one means of pressuring ICL to speed up attempts to find foreign firms willing to share expenses.

MORE ON TELETYPE'S CRT TERMINAL

General Mills in Minneapolis and Goodyear in Akron are final testing what AT&T is calling "the teletypewriter of the future." Made by Teletype Corp., it consists of keyboard, crt, and high-speed impact printer. The initial version of the "Dataspeed 40," to be introduced next year, will transmit/receive at 1,050 wpm, a later version at 3,000 wpm. The terminal will operate on dial-up as well as private lines. It will offer ASCII plus "other" code formats. AT&T won't disclose price information, although earlier reports mentioned $3K (see July, p. 7). General Mills and Goodyear are using it to handle inventory control and order processing messages.

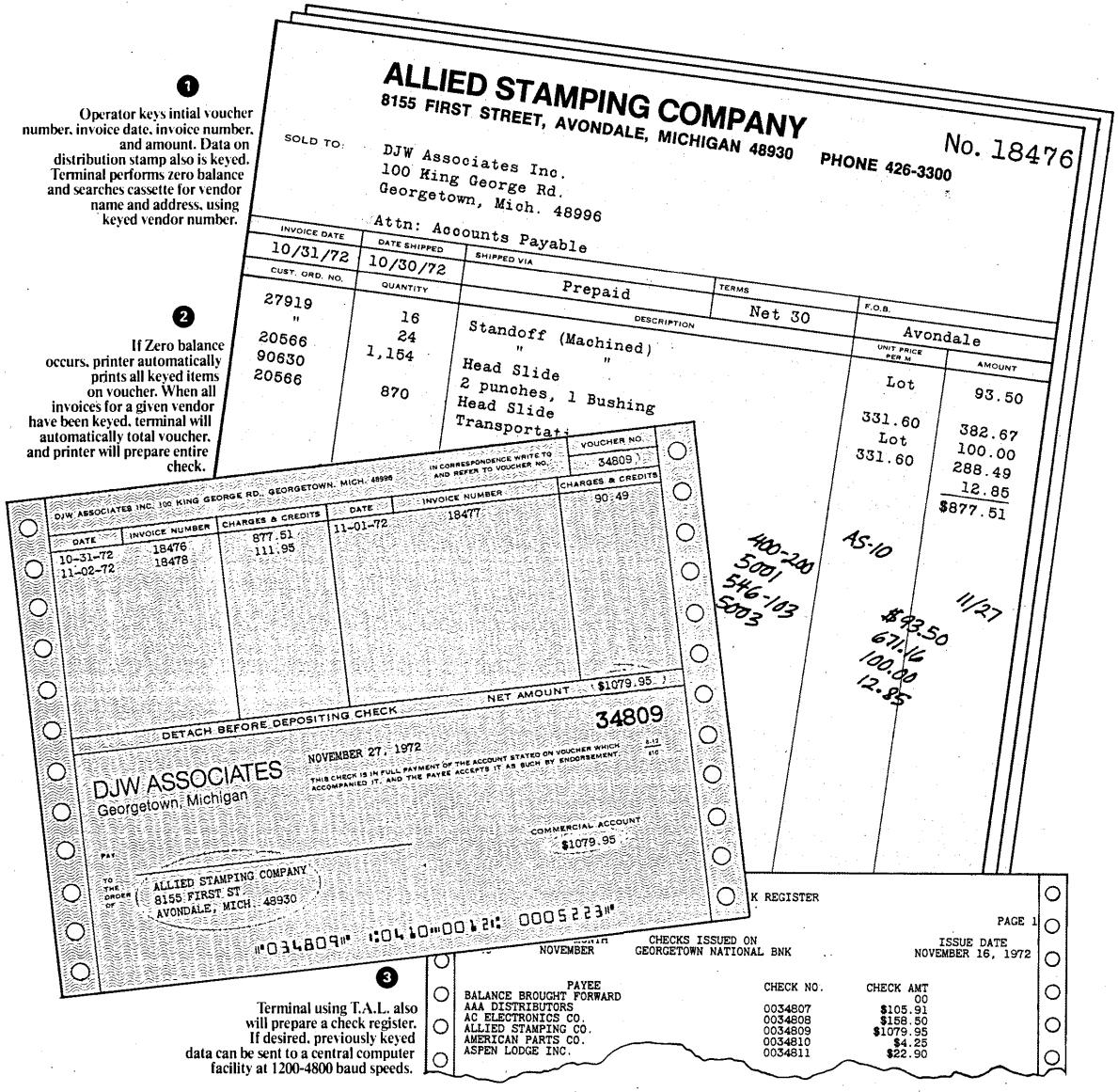
SOFTWARE TAXES IN CALIFORNIA: DEFINED CONFUSION

California's precedent-setting legislation on the subjectability of software to property tax (see July, p. 92) has been further defined to the confusion of all concerned. An industry-supported bill signed into law by Gov. Ronald Reagan in late June limited the assessability of most software to the value of the raw materials--the cards or tapes--for a two-year period.

The exception was to be "basic operational programs." Industry groups who supported the measure contend the state legislature meant to create a two-year moritorium on software taxation, limiting assessment of software to only that which had been taxed in the past. But a rule drafted by the state Board of Equalization to define "basic operational programs" specifically includes in-house produced programs which haven't

(Continued on page 215)

THE BEST THING ABOUT OUR ACCOUNTING MACHINE IS THAT IT ISN'T ONE.



It's Sycor's Model 340 Terminal—the most widely used intelligent order-entry terminal in the world. But in addition to providing error-free order-entry, it can be equally effective in many accounting applications—like the accounts payable example above.

In fact, Sycor's 340 terminal is superior to conventional accounting machines in a number of ways.

It is much easier to program because of Sycor's powerful Terminal Application Language (T.A.L.). Its cassette tapes write at 1000 cps (100 times faster than some paper tape devices) and perform an automatic read-after-write check. And the 340 also has a CRT for visual verification and correction of keyed data.

Sycor's 340 can also be equipped with a wide variety of peripherals—three types of printers (30 cps, 165 cps, and 200 lpm), 7 or 9 track magnetic tape drives, a card reader, and binary synchronous communications (1200-4800 baud).

To find out more about the versatile 340 and all it can do, simply write or call for our free brochure.

SYCOR INC

100 Phoenix Dr.
Ann Arbor, Michigan 48104
(313) 971-0900

The Sycor 340 Intelligent Communications Terminal.

If you're using more than a single data terminal, you need a centralized terminal support system.

How else can you know the status of your entire system?

And that's one of the key jobs of Termicare—to detect system problems and inform you of them. We do it by monitoring all your terminals in one place, our Termicare Center (shown below).

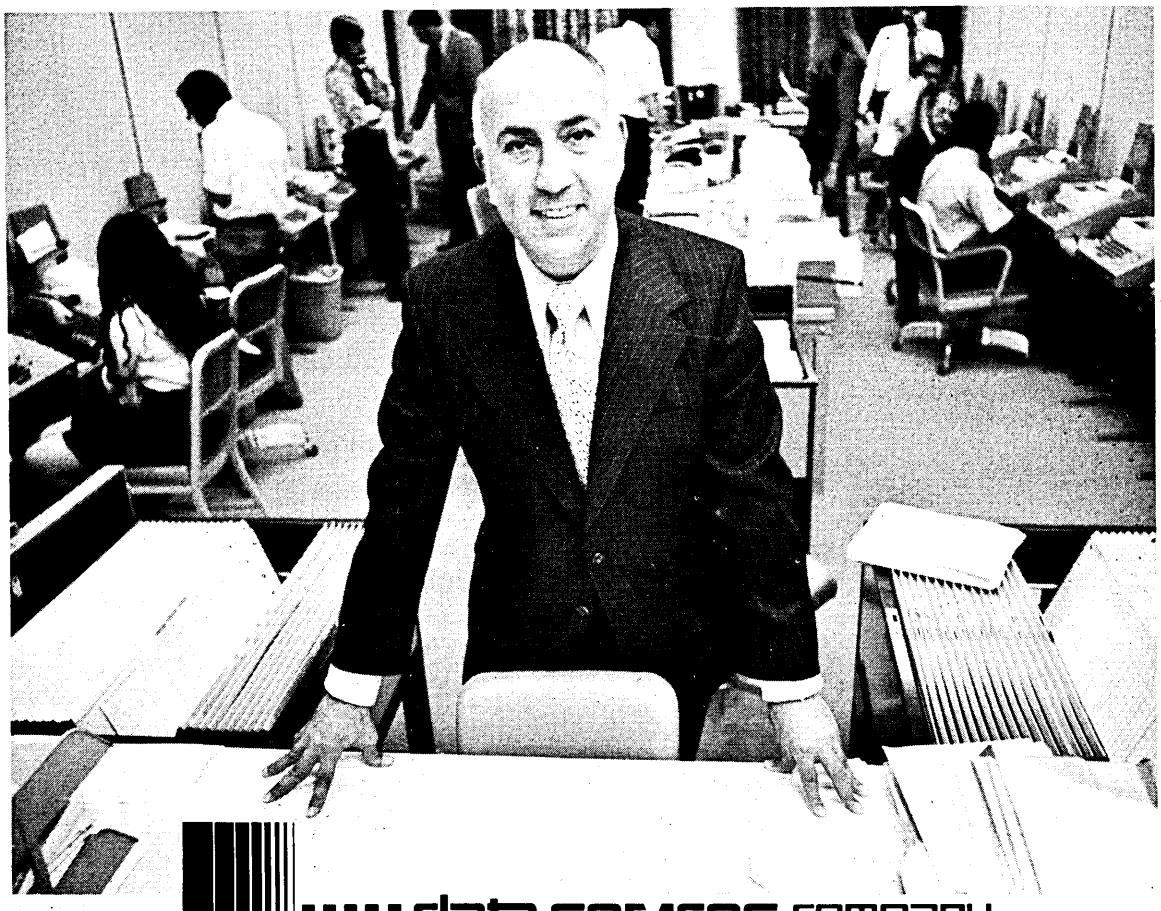
At the Center we maintain files on all terminals leased from us. So when you call in we know who you are and what equipment you have. A pool of experts is on hand to test your terminals and diagnose problems.

We can dispatch field technicians from 457 service locations. And from our Center we follow up each service call. And because we have centralized record-keeping we're able to analyze terminal performance and use this information to improve terminals.

Termicare is just one aspect of the services we offer for your terminal system. And your system is our major concern. We do everything we can to support it. We make certain you get the optimum terminals, out of our selection of 62 models with 112 options. And we install them right by testing them at our Termicare Center.

So if you are a multi-terminal user, we can be your single terminal source. Find out by contacting me at 800-631-7050 (N.J. 201-529-1170) or write to 16 McKee Drive, Mahwah, N.J. 07430.

"And we have it for you with our Termicare system."
Z. V. Zakarian, president



western union data services company

Everybody promises to save you money on your data communications line costs.

If you can answer yes to one question, we will probably guarantee a minimum of 20% savings on your Data Communications line cost, and if our experience is a guide, that percentage will be a lot higher. These are the questions.

Do you now rent three or more separate low speed private data-grade lines from a phone company?

Do you now rent three or more low to medium speed phone company data sets for remote terminal dial access from the same general area?

Do you now rent a single low speed data channel to a remote location that also requires a higher speed data channel for remote job entry?

Do you plan to convert to on-line data entry from three or more intrastate locations?

If your answer is yes to any one question, we can save you money. We can assemble a DataPak Communications System to guarantee at least that 20%. And probably more. We'll use our Dataplan Computer analysis to come up with the best configuration to meet your needs, furnish the equipment, install it, maintain it, and save you money. **Guaranteed.**

In addition, we'll make you a *second* guarantee. Your DataPak equipment will pay for itself in 18 months. And it's likely to be way less than that. Don't be surprised if your annual savings come to $30,000 or more.

To get us both started on your Dataplan, please write or call Mr. James Corless, Data Products, Stelma Telecommunications, 17 Amelia Place, Stamford, Conn. 06902. (203) 325-4161. **We put our reputation on the line.**

we guarantee it. **At least 20%, even for 3-line systems.**

DATA PRODUCTS

stelma telecommunications

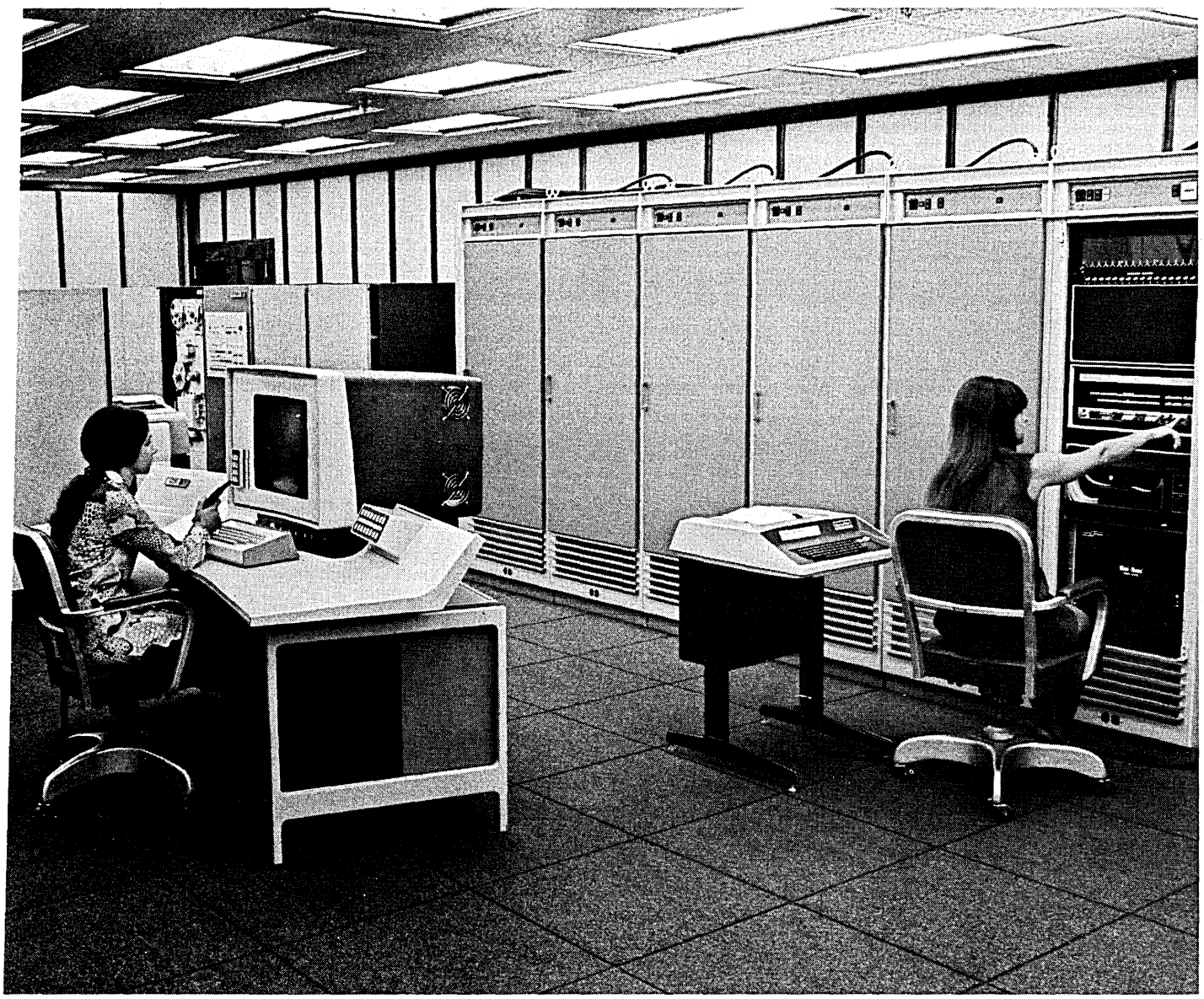
Test-drive Staran™

At our new Evaluation and Training your high-data-rate problems with a custom-

We've established a new Staran Evaluation and Training Facility, complete with all necessary peripheral equipment, at our Akron, Ohio, plant. Both hardware and software are adaptable to a wide range of potential users' data handling needs.

Here, our computer engineers and program experts will actually demonstrate for you how Staran can handle your specific data processing problems. And you can evaluate its performance in terms of your own hands-on experience.

Because Staran is like thousands of conventional computers operating simultaneously, it can achieve execution rates up to several hundred million operations per second. And input/output rates up to several billion bits per second. It is especially cost-effective for such high data volume applications as air traffic control. Weather prediction. Ballistic missile defense. Surveillance and control



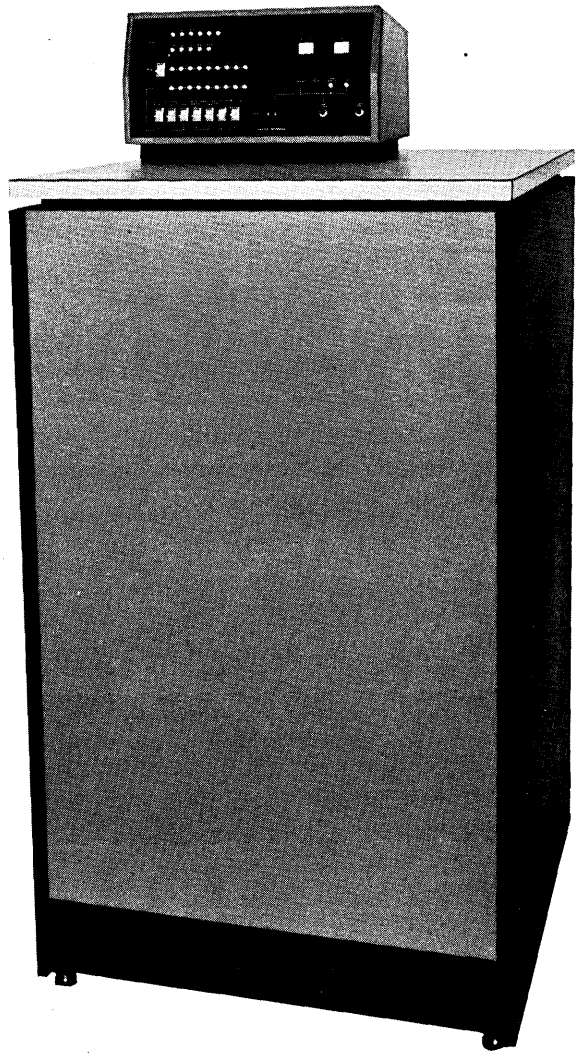
Facility, we'll show you how to solve designed associative array processing system

systems. Electronic warfare. Intelligence data processing.

An evaluation of Staran is definitely indicated if your applications involve: a large, dynamic data base; extremely rapid response to unanticipated inquiries; many similar items in a data file that must be simultaneously active. Because Staran is not just a new generation—it's a whole new way of thinking.

For more information about our Staran Evaluation and Training Facility, or to plan a showing, write: Wayne Brubaker, Manager, Digital Systems Marketing, Dept. 920, Goodyear Aerospace Corporation, Akron, Ohio 44315. Or call him at (216) 794-3631.

GOODYEAR AEROSPACE



REMOTE YOUR 1403 WITH PIX!

PARADYNE ANNOUNCES PIX—the revolutionary communications product that allows any 360 or 370 to talk to remote I/O devices as though they were in your computer room.

PIX extends standard IBM line printers, card readers, card punches, or computers to remote sites and drives them with standard IBM unit record software.

PIX eliminates conventional teleprocessing hardware and software including modems, terminals, BTAM and 270X.

PIX supports remote processing on your system regardless of configuration or core size.

Watch PIX extend a multiplexor channel from a 360 in Florida to a 1403 in the Paradyne booth at the FJCC. Or if you can't wait to see it, call or write for immediate information.

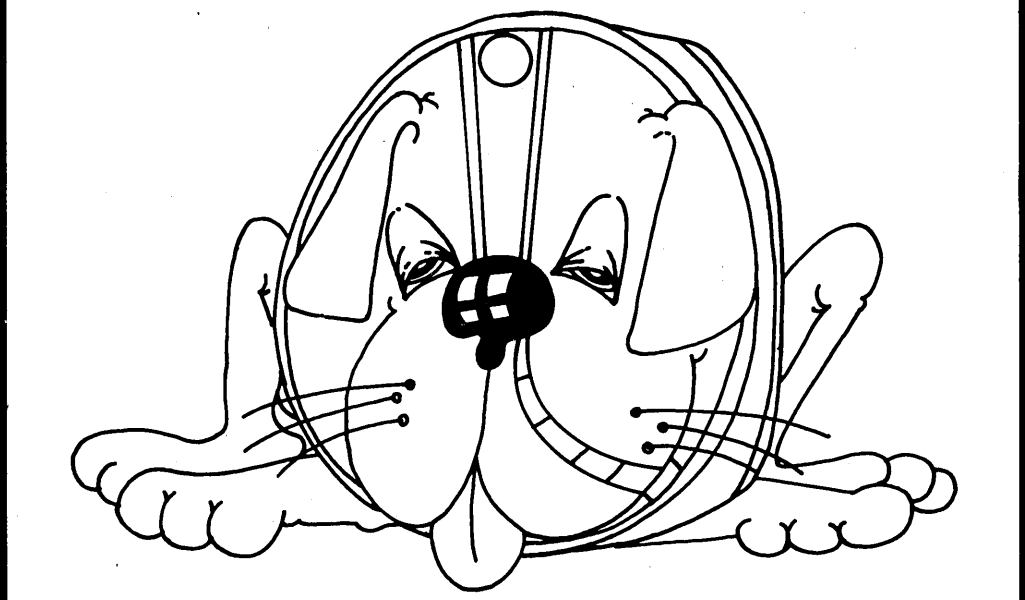
paradyne

PARADYNE CORP., 8550 ULMERTON ROAD
LARGO, FLORIDA 33540 (813) 536-4771

CIRCLE 47 ON READER CARD

Calendar

EVENT/SPONSOR	DATE	LOCATION	CONTACT	COST
	NOVEMBER			
IEEE 6th Asilomar Conference on Circuits and Systems	**15-17**	Pacific Grove, CA	S. G. Chan Naval Postgraduate School Monterey, CA	$20
DPMA Empire Div. Conference '72	**16-17**	New York City	P.O. Box 1926 Grand Central Sta. New York, NY 10017	$65, members $75, others
Information Processing Assn. of Israel 8th Data Processing Conference	**20-21**	Tel Aviv	8th Data Processing Conference in Israel P.O. Box 16271 Tel Aviv, Israel	$22
4th Annual ADP Symposium Defense Activities	**28-30**	Camp Hill, PA	LCDR Carl G. Wolf FMSO (9627) Mechanicsburg, PA 17055	$30, federal, state, local gov't. empl.
OCR User Assn. Meeting	**29–Dec. 1**	New Orleans	OCR User Assn. 9415 S. Western Ave. Chicago, IL 60620	$100
	DECEMBER			
IEEE National Telecommunications Conference	**4-6**	Houston	NTC '72 Registration P.O. Box 58354 Houston, TX 77058	$22, IEEE $25, others
Computer '72	**4-8**	London	Business Equip. Trade Assn. 109 Kingsway London WC2B 6PU, England	$8/session $1.50, exhibits
Transportation Data Coordinating Committee 1972 Transportation Data Systems Forum	**5-6**	Washington, DC	TDCC 1101 17th St., N.W. Washington, DC 20036	$65
Fall Joint Computer Conference	**5-7**	Anaheim, CA	AFIPS 210 Summit Ave. Montvale, NJ 07645	After 11/17: $35, members $50, others
Society for Information Display Technical Conference: Display Update '73	**8**	San Diego	Harold P. Field Gamma Scientific Inc. 3777 Ruffin Road San Diego, CA 92123	$15
4th International Symposium on Computer and Information Science	**14-16**	Miami Beach	COINS-72 Center for Informatics Res. 339 Larsen Hall Univ. of Florida Gainesville, FL 32601	$50
	JANUARY			
College and University Systems Exchange Educational Seminar on Administrative Data Processing Management	**8-10**	Tampa	CAUSE 737 29th St. Boulder, CO 80303	$150, members $300, others



Introducing TMS. The computer tape watchdog.

Meet the new Tape Management Software (TMS) from University Computing Company (UCC).

It leads you right to the facts about every tape you own, trapping the kind of information you need to protect your data and manage tapes wisely.

TMS acts like a watchdog everytime your operators hang a tape. It automatically checks the mounted tape against the Tape Management Catalog, preventing valuable data from being clobbered, even by the most persistent clobberer.

It snoops out tapes to be scratched, so you don't carry them unnecessarily on a high-retention list.

And, it keeps a watchful eye on tapes that have left the premises, reporting everything dutifully.

Then, it works like a Retriever, gathering vital information *automatically* so that you always have current management information with the ability to access that information *on-line.*

TMS also adds capability in areas that OS is deficient. Like no-label tapes and Remote Job Entry. It also provides your programmers with useful de-bugging information.

If you have an OS operation, let us tell you how TMS can work for you. It's tape management's best friend.

For more information call me, Sterling Williams, Product Manager—Special Products, at (214) 637-5010. Or mail this coupon.

Dear Mr. Williams:
Please give me more information about TMS.
☐ Send me the facts
☐ Have someone call on me

Name_____

Title/Company_____

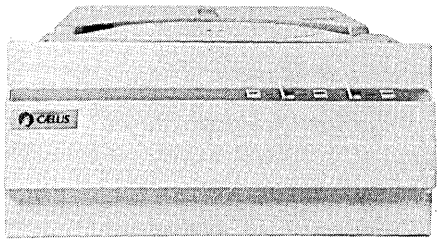
Address_____

City/State/Zip_____

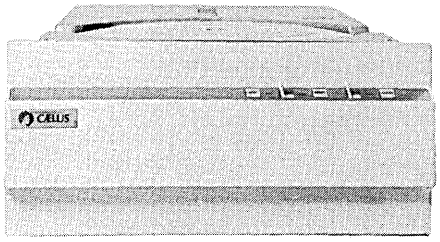
Phone_____

UCC
UNIVERSITY COMPUTING COMPANY
800 UCC Tower, P.O. Box 47911
Dallas, Texas 75247

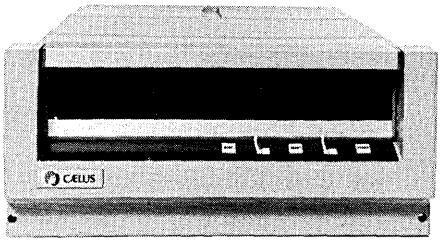
Can you spot the new models?



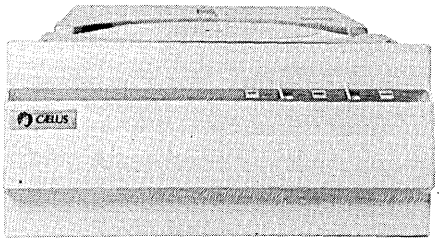
MODEL 306/1 48 megabit
one removeable cartridge
200 TPI, 2200 BPI



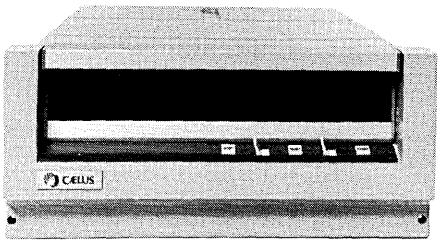
MODEL 303/1 24 megabit
one removeable cartridge
100 TPI, 2200 BPI



MODEL 206/2 96 megabit
one fixed, one removeable cartridge
200 TPI, 2200 BPI



MODEL 303/2 48 megabit
one fixed, one removeable cartridge
100 TPI, 2200 BPI



MODEL 203/1 24 megabit
one removeable cartridge
100 TPI, 2200 BPI

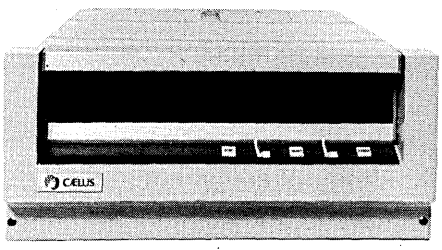
See them? The first and third on the left. The first and second on the right. With the others, they make up the most complete family of micro-mini disk drives in the world. Whatever your requirement, there's a Caelus drive for you: 24, 48, or 96 megabit models.

Maximum height is 8¾ inches. All offer universal interface and accept standard media. Each contains its own power supply plus the largest air filtration system of any mini drive.

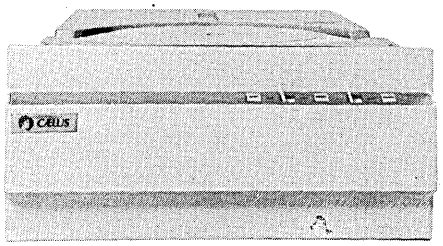
For full details and pleasant price news call (408) 298-7080, or write Caelus Memories, Inc., Box 6297, San Jose, Calif. 95150.

Caelus

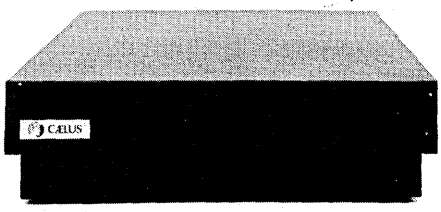
Reliability through innovation.



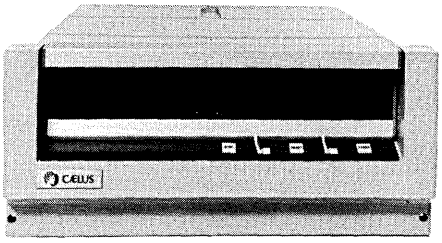
MODEL 206/1 48 megabit
one removeable cartridge
200 TPI, 2200 BPI



MODEL 306/2 96 megabit
one fixed, one removeable cartridge
200 TPI, 2200 BPI



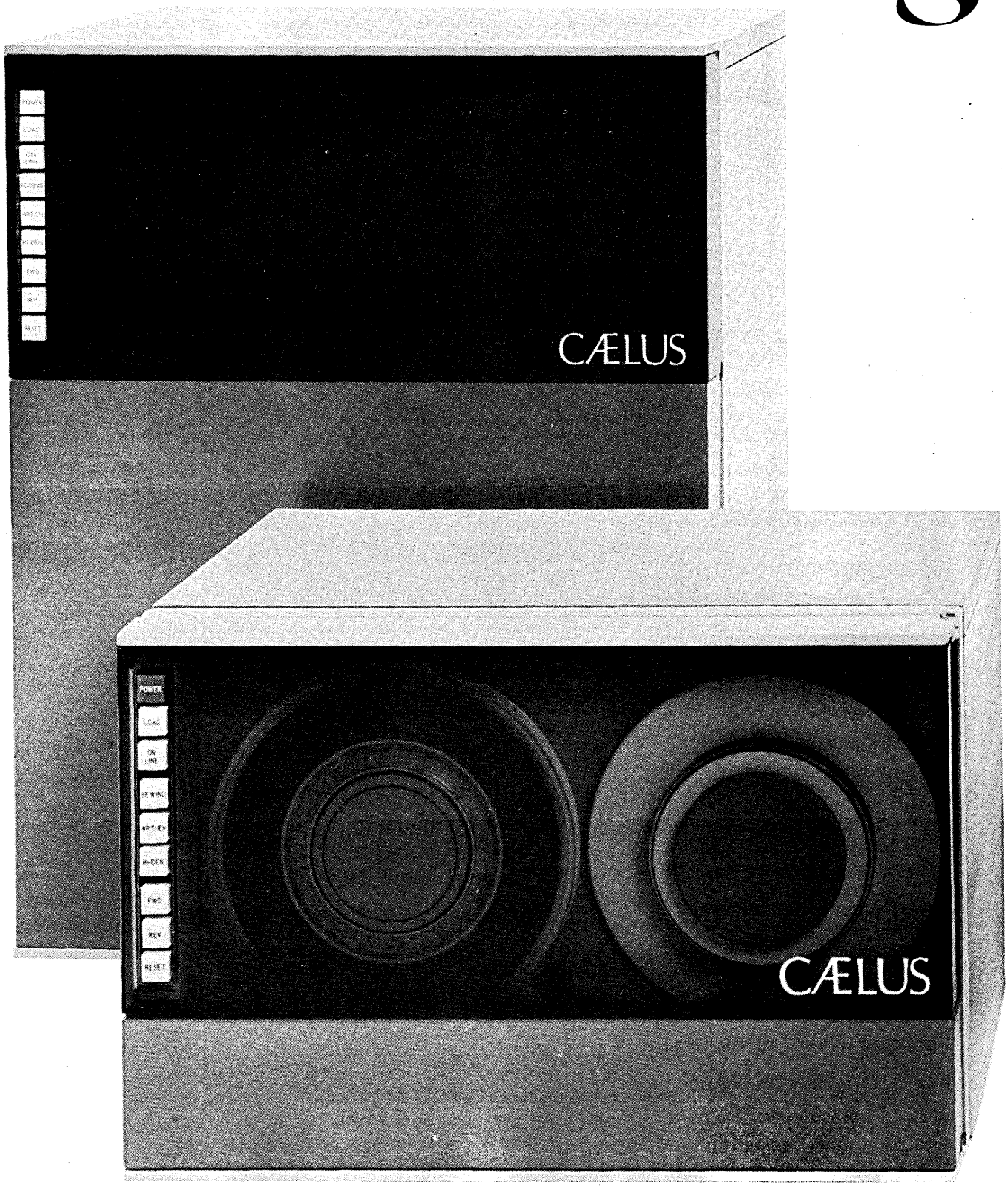
MODEL 103 24 megabit
one fixed sealed disk
100 TPI, 2200 BPI



MODEL 203/2 48 megabit
one fixed, one removeable cartridge
100 TPI, 2200 BPI

Products of Electronic Memories & Magnetics Corp. EMM

We're rounding



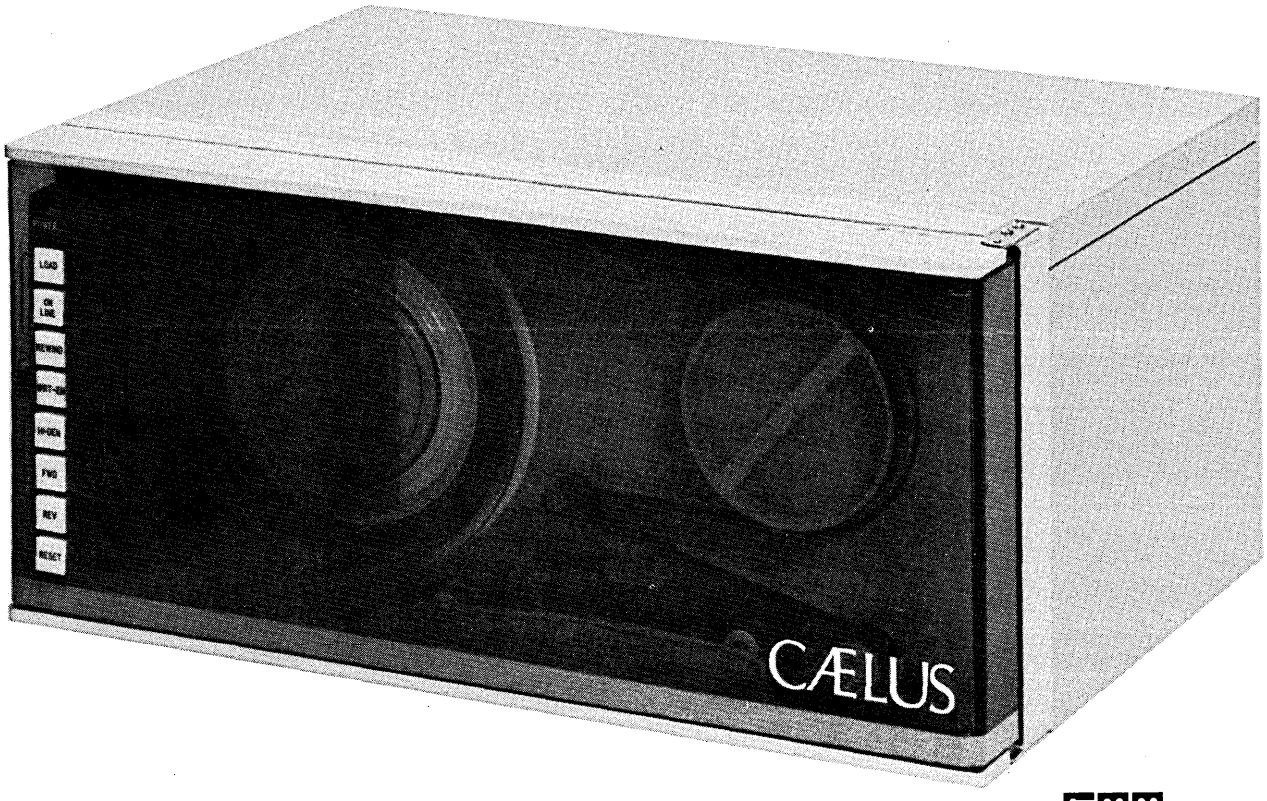
out the family.

We've come up with a family of more reliable tape drives at very competitive prices. To do it, we didn't re-invent the wheel. We took the best features of existing machines, avoided their flaws, then added refinements of our own. Result? Data error rates are 1 bit in 10^8. Instantaneous speed variation is plus or minus one per cent. Mean time between failure is 4,000 hours. Head life is 7,000 hours. And a standard three level reading threshold finds data you thought gone forever.

Three models: 7 inch (12.5 ips), 8½ inch (12.5, 25 ips), 10½ inch (12.5, 25, 37.5, 45, 50 ips). All in standard seven or nine track versions. For a demo or more information, call (408) 298-7080, or write Caelus Memories, Inc., Box 6297, San Jose, Calif. 95150.

Caelus

Reliability through innovation.

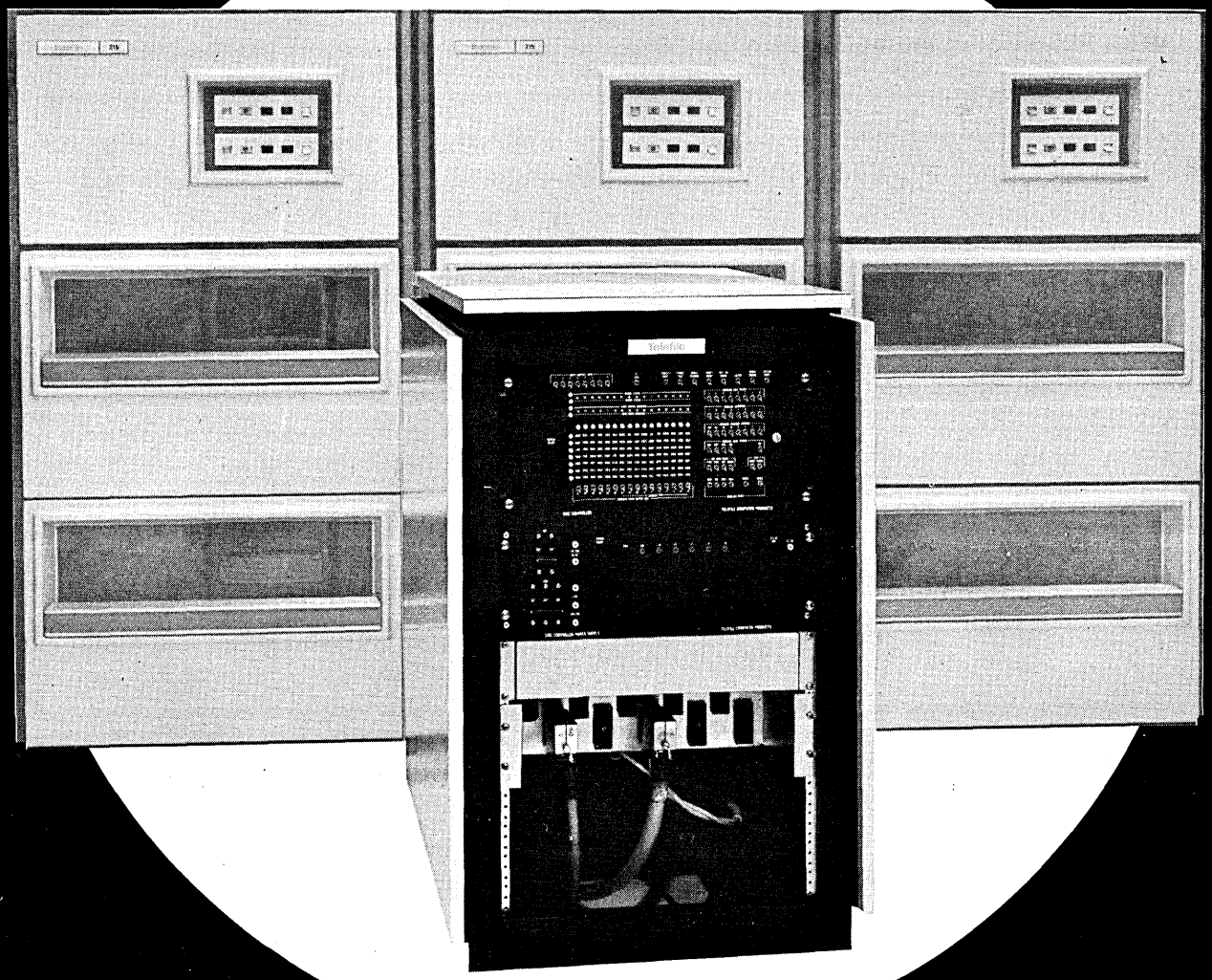


Products of Electronic Memories & Magnetics Corp. EMM

Telefile

MEANS

IMMEDIATE DELIVERY OF DOUBLE DENSITY DISC SYSTEMS FOR SIGMA 3, 5, 7 and 9's



- Compatible with XDS operational software.
- Controls up to 8 disc drives.
- Low core requirements.
- Simultaneous seek capability.
- Interrupts for seek complete, channel end, unusual end, and zero byte count.
- Media compatible.
- Hardware verification of track location.
- Extensive maintenance provisions.
- Diagnostic software supplied.
- Simple programming with 10 commands.
- Multiple - record read/write with one command.
- Command chaining capability.

Telefile

COMPUTER PRODUCTS, INC.

17795 SKY PARK CIRCLE • IRVINE, CALIFORNIA 92664 • (714) 557-6660

Compare Cost And Capability

Feature	IBM 2848/2260	Wyle 8000
1920 Character CRT	No	Yes
CRT's Per Controller	8 or 16	16
Non-Destructive Cursor	Optional	Standard
Colon Seeking Tab	Optional	Standard
Line Address	Optional	Standard
Character Address	No	Standard
Character Insert	No	Standard
Character Delete	No	Standard
Erase Display	Standard	Standard
Erase End Of Line	Optional	Standard
Erase End Of Screen	Optional	Standard
Repeat Key (All Char)	No	Standard
Printer (Optional)	15 cps	15 or 100 cps
Columnar Tab	No	Optional
Lower Case Alphabet	No	Optional
Function Keys	No	Optional
Numeric Pad	No	Optional

A quick look at the above chart proves that Wyle's Series 8000 CRT display system has far more capability than IBM's 2260/2848.

In fact, it offers many of the features of IBM's 3270 display system. Except the 18 month wait.

Which makes Wyle the logical replacement.

It's easy to phase in, being plug-to-plug and software compatible with 360's & 370's. You can even use existing IBM cables.

And when you decide on your Wyle system, you'll begin saving money from day one.

How much?

Up to 40% depending on the configuration. Plus a substantial reduction in electrical and air conditioning costs because of our solid state design.

You'll also gain in operator efficiency, due to the many editing features and special options available on our 8000 system.

Plus, you have the assurance of dealing with a financially sound company who has had years of experience building CRT terminals for the computer industry.

And our products are sold by Genesis One, one of the country's largest and most experienced EDP end-user marketing organizations, with offices in 40 cities. Backed up by nationwide service for full customer support.

So get the whole story of the Wyle 8000. Write for our brochure or phone the local office of GENESIS ONE COMPUTER CORPORATION

WYLE COMPUTER PRODUCTS, INC.

A Subsidiary of Wyle Laboratories

128 Maryland St., El Segundo, CA 90245 (213) 678-4251

CIRCLE 83 ON READER CARD

COM FOR PEOPLE WHO NEED A LITTLE LESS THAN COM.

Bell & Howell Inter/COM.

Sophisticated cathode-ray COM systems are sensational. They are also whoppingly expensive to own.

So Bell & Howell set out to provide computer output on microfilm capabilities without high-cost cathode-ray tubes.

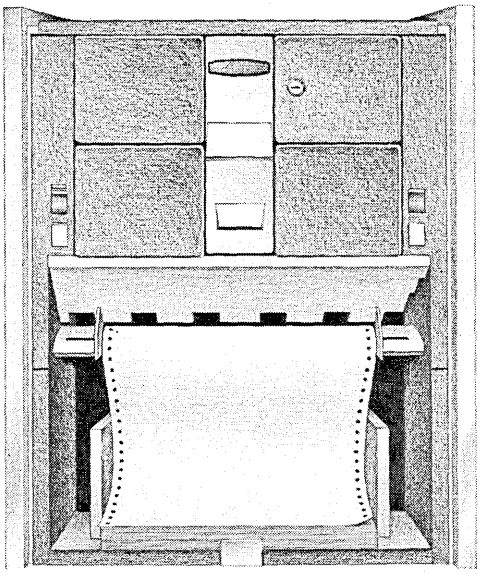
Inter/COM prints microfilm directly from data print-out sheets at 11,000 characters per second. No cathode-ray tubes required.

And while it may not have the blinding speed of cathode-ray COM systems, Inter/COM can give you all the benefits of microfilm, right now.

You can store your computer output data in less space. And distribute it with greater speed and efficiency. All at realistic cost.

Ask your Bell & Howell representative for full information. Or write: Bell & Howell, Business Equipment Group, 6800 McCormick Road, Chicago, Illinois 60645.

At Bell & Howell we draw on our leadership in electronics, training and education and photography to find better ways to make business equipment better.



Before you buy anything, ask to see Bell & Howell.

BUSINESS EQUIPMENT GROUP

BELL & HOWELL

CIRCLE 16 ON READER CARD

Letters

Flip flop

Mr. Nyal McMullin in The Forum in your September issue (p. 179) did an injustice to flexible disc file technology. He stated that manufacturers of "floppy" disc devices were quoting prices of $2000 and up, implying a lack of price competition with tape cassettes. Mr. McMullin should be informed, and your readers assured, that flexible disc files do indeed price compete with tape cassettes, and at much higher performance.

ALAN F. SHUGART
President
MRX Engineering and Development Corporation
Santa Clara, California

No-no

In the July issue (p. 82), an article appeared entitled "Embattled CODASYL Group Now Sees Support for Data Language Report." It discussed the status of the acceptance of the DBTG report. In the article it was stated that "Xerox has since in effect reversed its 'no' . . . " The "no" refers to a vote cast at the CODASYL meeting of May 12, 1971. I would like to take issue with the statement inasmuch as it implies:

1. Xerox was originally philosophically opposed to the DBTG recommendation. (It was not.)
2. Xerox has now changed its mind. (It has not.)

At that meeting there were several motions relating to DBTG activities; I cast a dissenting vote on only one—the following: "Moved that PLC finds the report of the DBTG meets the PLC requirements for a data base facility and directs that the description of the functions (Subschema and DML) described in the DBTG report be converted to a form conforming to that specified in the publications guideline regarding proposals to the CODASYL COBOL Journal of Development."

The essence of the motion was agreement or disagreement as to the status of the *completion* of the DBTG activities, *not* the philosophy.

My negative vote was cast primarily because I felt that the level of complexity of the proposed data base language was considerably greater than that of COBOL and I believed it should be reduced. Since the intent is to ultimately incorporate the DBTG language into COBOL, this presents a potential inconsistency with present levels of expertise required to use COBOL.

I do not and did not disagree with the fundamental philosophy, but still believe that the prime requisite for incorporation into COBOL is its ultimate simplification.

The statement that Xerox changed its mind about its original "no" is clearly based upon a misunderstanding of the original motion.

I hope that this can clarify the issue and place the Xerox position in its proper perspective.

ROBERT L. BRASS
Representative to the CODASYL Committee from Xerox
Stamford, Connecticut

You'd better believe it

Three cheers for Paul Rau! ("Evaluating the EDP Function," Sept., p. 72) His basic equation—Benefits minus Cost equals Effect on Profit—should be painted on the entrance to every computer installation.

It is certainly a well-accepted fact in many installations. But to many computer people it's a startling thought (and I've met a few who don't believe it's true).

EUGENE H. JACOBS
Los Angeles, California

Quantifying intangibles

I read with some interest Mr. Rau's article in the September issue. I was particularly interested in his first of several questions: Where can the information on cost, potential cost saving, benefits, and projected benefits be found? His answer was to consult a textbook to find the tools and methods.

In my opinion the major problem in evaluating the edp function is not using or understanding the formulas described by Mr. Rau (formulas, by the way, that have been known for many years by the military or specialists). The major problem is developing tools and methods to measure costs and benefits.

In theory, costs should be measurable. In practice, however, some development costs are at best "questimates." For instance, the various methods of determining programming costs will yield estimates that can vary by a factor of two. This I have concluded by using various fairly well-known formulas (e.g., Brandon, IBM standards, etc.). When looking at measuring the benefits, the situation is worse. Out-of-pocket savings can be measured, but quantifying intangibles is another story. For instance, how to measure better service to customers, more decision-making information, is difficult if not impossible; and recent textbooks that I have read on the subject do not provide practical solutions.

As to his conclusions, I would not say they are revealing—we know the facts described—what we do not know, I'm afraid, is how to quantitatively evaluate the edp function in terms of its effectiveness. It all comes down to what you answer to the president of the company who asks: "How effective is my edp function given over expenditure of x dollars?"

JAMES CADIEUX
Montreal, Quebec

Unsigned letters will not be published. However, we will withhold a writer's name or address upon request with sufficient reason. Readers are also welcome to correspond on a not-for-publication basis.

Impossible to improve

Mr. Rau gives a good start to discussion about how to evaluate the edp function. He says that the only measure of the effectiveness must be in dollars, not in percentage of computer utilization. That was well said, but his final measure is $M=R1/R2$, where $R1=B1/C1=$ benefits per costs in dollars for the existing edp systems during a given time period and $R2=B2/C2=$benefits per costs for the same edp systems after maximal improvements.

But that is wrong! By looking at a simple example, you see why. If $B1=200K\$$, $B2=220K\$$, $C1=100K\$$, and $C2=110K\$$, then $R1=R2=2$ and so $M=1$. Mr. Rau would conclude that it is impossible to improve the existing systems, although the optimal systems give 10K$ more profit: $(B2-C2)-(B1-C1)=10K\$$.

I suggest as a better measure: $M\$=(B1-C1)/(B2-C2)$, which really measures money and not relations. In the above case, $M\$=(200-100)/(220-110)=0.909$.

AIMO KUKKASJARVI
Helsinki, Finland

Mr. Rau replies: Mr. Kukkasjarvi is correct; there is an error in my analysis. Many thanks for bringing this to my attention.

Ignorance perpetuated

I have read with interest the Look Ahead news item (Sept., p. 8) concerning the assessment of the ASCII standard. A concern for increasing the standard's user appeal and for greater compliance is indeed needed.

Although describing a different ANSI standard, I believe Dr. Chapin (p. 53 of the same issue) very accurately describes the fundamental problem:

"This ignorance of the Standard is perpetuated by the very high cost per page ANSI asks for the copies of the Standard, by the severe restrictions ANSI places upon reprinting the Standard's words or figures in a publication . . . and by the failure thus far of professional associations (such as ACM, DPMA, AFIPS) and periodicals (such as DATAMATION) to require all of their authors to use the Standard."

DALE W. ZOBRIST
Pittsburgh, Pennsylvania

You'll never have to watch your language again.

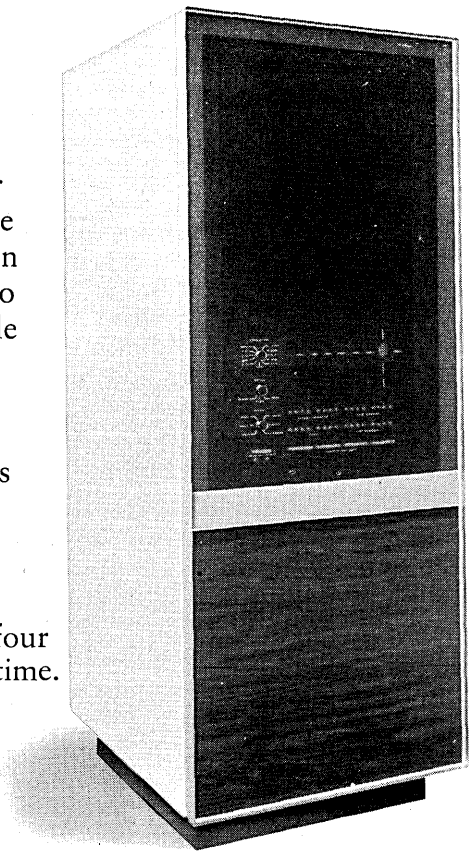
Our CT/90 Programmable Communications Processor has been called "the Rosetta Stone for Data Communications" by a national magazine.

That just about sums up the unique contribution it's making. It means that you no longer have to worry whether your computers, terminals and other peripherals will be able to talk to each other. Because the CT/90 is the ultimate translator. Even when one party is an inexpensive CRT and the other is an IBM 370.

It's the only processor with the software to handle this kind of communication problem. You don't have to change hard wiring or settle for an expensive bundled system. Just plug in the CT/90 and start talking.

Here are some reasons it can do what no other processor can. It has:

A multi-host interface—it works with as many as four computers at the same time.



Automatic Terminal and Speed Recognition—it recognizes any terminal and ties in automatically.

Communications Oriented Operating System—to maintain complete flexibility.

Modular Throughput Enhancement—a high speed option to increase capacity.

Expendability in stages up to 256 lines.

Error control and recovery features.

270X Emulation gives complete compatibility with host software.

One standard interface for many different terminals.

A choice of peripherals.

A proven record of reliability, and full service and support.

All this in one convenient package. So if you want to save your company time and money, call or write for complete information. Or ask any of our customers. It's your first step towards simpler communications.

Comtec
DATA SYSTEMS, INC.
A subsidiary of
American Micro-Systems, Inc.

Head Office: 12701 South Van Ness Avenue, Hawthorne CA 90250 • Phone: (213) 757-9211
New York Office: 275 Madison Avenue, New York NY 10017 • Phone: (212) 889-6690

letters

Noncommissioned digitizers

I am writing in reference to Phil Hirsch's article, "What's Wrong with the Air Traffic Control System?" (Aug., p. 48). Having been involved in the area of air traffic control for the past eight years, I have a strong interest in the topic.

In one area of the article, a factual error has led Mr. Hirsch to an erroneous conclusion. In referring to the equipment required to digitize primary radar, the Burroughs "Common Digitizer," the article states that installation will not be completed until 1982. This is in error. All equipment deliveries and installations of the 120 FAA digitizers will be complete by December 1972.

Because of the misinformation on delivery, Mr. Hirsch questioned the effectiveness of digitized primary radar data. Here, again, it should be noted that digitized primary radar data has been used by the military for many years, and the common digitizer is presently being used to control air traffic in three foreign countries.

HERMAN NATANBLUT
Project Engineer
Air Traffic Control Command and Control Programs
Burroughs Corporation
Paoli, Pennsylvania

Mr. Hirsch replies: According to a chart on p. 35 of FAA's "Ten Year Plan, 1973-82," the agency plans to commission a total of 120 long-range radars by 1982. Of this number, 91 were installed and commissioned as of Dec. 31, 1971; four more were to be commissioned this year, and the rest were scheduled for commissioning between the end of this year and 1982. One Burroughs common digitizer computer is needed with each of these facilities; hence, my statement that "a total of 120 common digitizers are to be installed by 1982."

If Mr. Natanblut will reread my story, he will find that I didn't question the effectiveness of digitized primary radar data per se; rather, I questioned the effectiveness of the IBM and Raytheon systems being procured to utilize that data. I also suggested that FAA's heavy investment in digitized radar has been a mistake—partly because the agency, by its own admission, plans to rely on a completely different system (secondary radar) within a few years, and partly because present needs could be met far more effectively, and economically, by upgrading the existing analog radar system, as indicated by the experiment at Indianapolis and Atlanta which is described in the story.

Great leap forward

As a footnote to your article on our ALWAC computer (Sept., p. 86), since firing up the 704 we have enjoyed (and been spoiled by) the benefits of using a large, fast machine, and we are now contemplating a leap into the second generation. We recently bought an IBM 7090 and as soon as we find a busted one (for spare parts) we expect to phase out the 704. Not that the 704 isn't fine--just that we expect to save enough on our power bill to pay for the "new" machine in a short time.

EUGENE USDIN
Southwestern Computing Service, Inc.
Tulsa, Oklahoma

Nine out of ten

The September issue carries an article on the "Canadian Computer Show and Conference" (p. 95) by Mr. W. David Gardner.

The article mentions that independent observers of the Canadian computer scene have been able to pinpoint no more than 10 installed ICCL systems.

May I point out that in my installation alone, I have 9 ICCL systems.

ALAIN DOMPIERRE
General Director
Planification, Research and Development
Department of Revenue
Government of Quebec

Mr. Gardner replies: We don't know exactly how many systems ICCL has installed in Canada; but we do know that the company has only a few Canadian installations, which is what we meant to say.

Fancy schmancy

I have often questioned the true effectiveness of report program generators and similar "high level" software such as that described in Mr. Hicks' article ("Using the COBOL Report Writer," Sept., p. 84). Faced, at last, with a simple test case, I decided to code the same problem in the relatively simple Super BASIC language running on the Tymshare system.

The BASIC program uses only 26 lines of code to perform the entire job, including opening and closing files, etc. Mr. Hicks' example uses 21 lines of

code in the Report Section alone; the remaining Procedure Division chews up another 12 lines for a total of 33! Furthermore, I would guess that several job control cards and/or other appendages are required to actually run the job.

Somehow I feel vindicated in my long-held suspicions that these "fancy" report generating packages are not all that time saving or simple and that a reasonably proficient programmer (I am not a professional) can often do an equal, if not better, job using a language such as BASIC, PL/I, or FORTRAN.

CHARLES T. TUCKER
Anaheim, California

Mr. Hicks replies: Mr. Tucker evidently equates effectiveness with minimum program coding time. I believe that most commercial data processing installations are concerned with minimizing total program development and maintenance time, not just coding time alone. For these installations, COBOL Report Writer is more effective than BASIC and other procedural languages (including plain COBOL) because it does not require the programmer to invent, debug, and maintain report-producing procedures. These procedures are usually much more complex than those of my sample problem, and only problem-oriented facilities like Report Writer produce them automatically. It is this automation which makes Report Writer effective in minimizing total programmer effort, not the number of lines required to code it.

Zinger

It is understandable that Mr. Brian D. Cunningham's remarks concerning IBM Corp. and Mr. T. V. Learson in the August Letters (p. 19) are intemperate, since he is an attorney. That they are inaccurate, however, is inexcusable.

Mr. Cunningham demonstrates an almost total ignorance of what World War II was about, and what we were fighting. To speak of "Gestapo exterminations" taking place at the "San Jose ovens," and to refer to "Herr Learson" and the "Wehrmacht" illustrates this.

The Wermacht was the German army, which had little, if any, contact with the Gestapo, which was the Secret State Police. The "ovens" were not run by the Gestapo, but by the SS, in particular the Totenkopf Kommando; the SS also had infantry and armor regiments, and, in effect, were elite Nazi party troops, generally not under the control of the army. In this case, I trust there are no current parallel organizations in the U.S.

I do not write to defend IBM or the former German political and military machine—neither requires it, and, possibly, neither is worthy of it—but I do find Mr. Cunningham's protestations somewhat sickening. To anyone who has seen even photos of the ovens and concentration camps, and who has a modicum of social awareness, there is little parallel to the amusing spectacle of overprotected now-ex-IBMers screaming because some of the tactics they helped foster externally have now been applied to them internally.

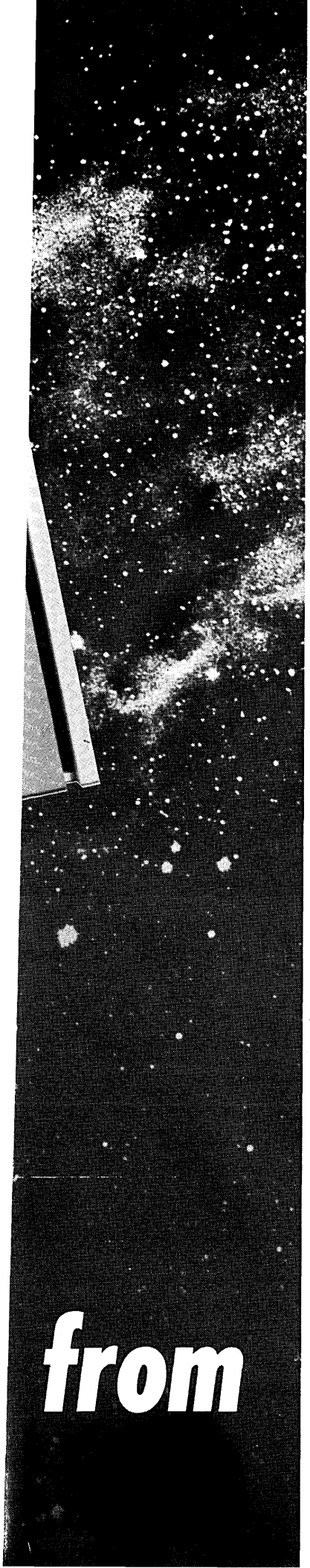
Perhaps "de Debbil made him do it," but Mr. Cunningham and his confreres were well employed for a long time by IBM, and must plead either sublime ignorance or incredible stupid-

(Continued on page 211)

Twice the capacity . . . twice the speed, with the new WANGCO Series-F Disc Drive. And it fits into the same space as the Diablo Model 31, uses the same interface, and doubles your disc storage capacity.

Make your own breakthrough in system performance, using your existing disc space, without changing a thing, except the drive.

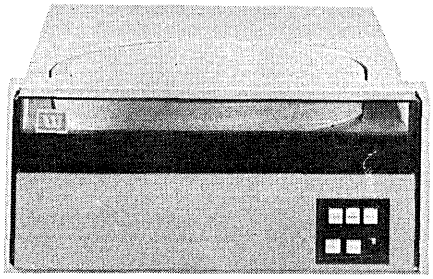
SPACE BREAKTHROUGH



from

IF YOU NEED A TOP-LOADER

the WANGCO Series-T provides the same advantages as the Series-F.

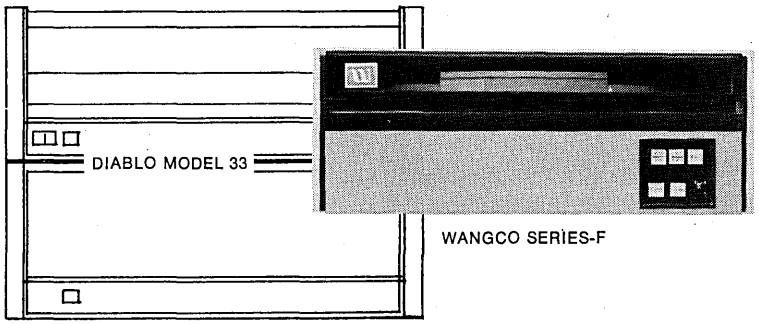


They both give you:

- Small size: 2 discs in 7″ height with Series-F. Only 7¾″ with Series-T.
- Fast access.
- Low price: $3200 in OEM quantities, with power supply.
- Ease of interface: same as Diablo, Iomec, Caleus, Pertec.
- Power supply built-in.
- Daisy-chain capability with front-mounted unit select switch.
- Easy maintenance with plug-in functional modules.
- Full filtration with .3 micron air filter.
- Designed-in reliability: 5000 hours MTBF.

QUICK COMPARISON	WANGCO SERIES-F	DIABLO MODEL 31
Rack Height (19″ rack)	7″	7″
Depth	22″	22⅞″
Capacity, Megabits	24	12
Capacity, Megabits (high density)	48	24
Access Time (track-to-track)	8 msec.	15 msec.
Head Positioner	Voice coil	Motor driven
Built-in Power Supply	Yes	No
Unit Select Switch	Yes	No
Disc RPM	1500 or 2400	1500

IBM 2315-type cartridge: Series-F
IBM 5440-type cartridge: Series-T



In half the space of the Diablo Model 32 or 33, the WANGCO Series-F provides the same storage capacity.

Achieve your own space breakthrough . . . our new Disc Drive Data Package shows the way.

WANGCO

SETTING THE PACE IN PERIPHERALS

2400 BROADWAY • SANTA MONICA, CALIF. 90404 • (213) 828-5565

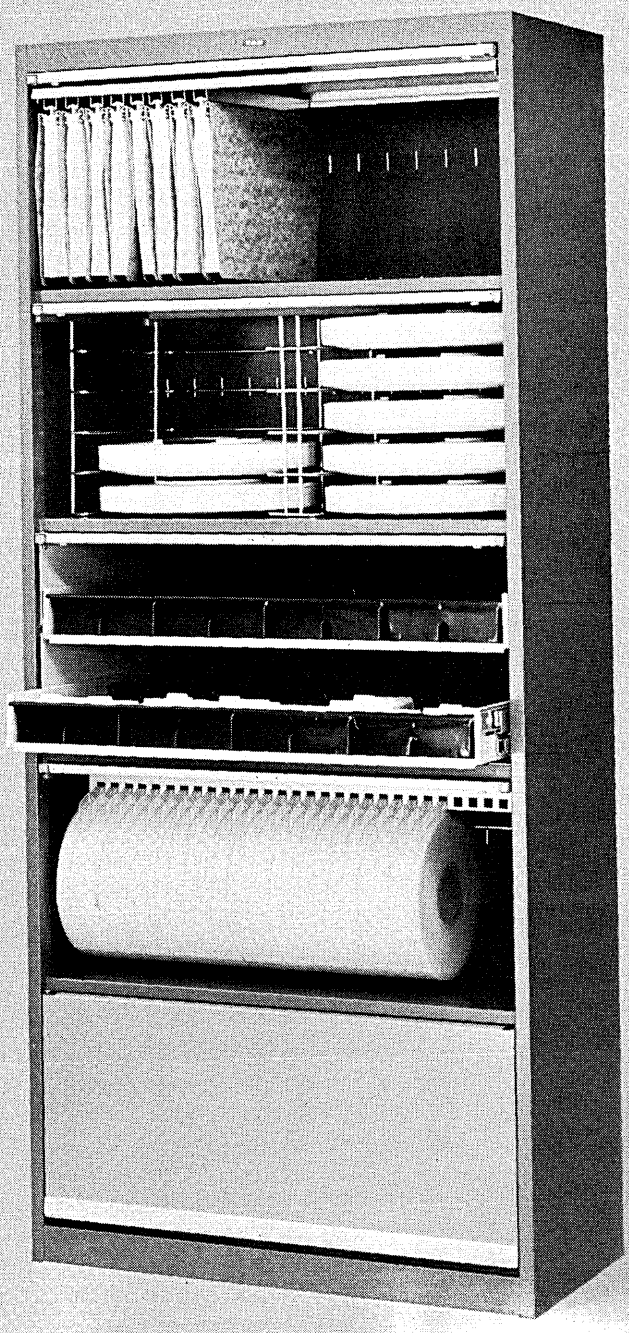
See the new WANGCO disc drives and magnetic tape drives at FJCC—Booths 2020-22

CIRCLE 84 ON READER CARD

Orderly, Safe Storage In Minimal Space —that's proven Tab Data Media Cabinets. Versatility was born into these cabinets. They have been designed to accommodate hanging printout binders, disk packs and racked or hanging magnetic tape. They are even ideal for storing cards. Tab Data Media Cabinets can be ordered with roll-out shelves that bring data media right to your fingertips.

And, if storing miscellaneous office paraphernalia is a problem, forget it. Just tuck it away in the generously-sized Data Media compartments and close the stylish TrimLine doors. Neat. For complete information, colors and prices for Tab 2, 3, 4 and 5 high Data Media Cabinets, call your local Tab representative. Tab Products Company, 2690 Hanover Street, Palo Alto, California 94304.

Tab System/3 Organizer



TAB
PRODUCTS CO.

CIRCLE 77 ON READER CARD

MEDIUM, WELL DONE.

By now, you should expect it.

When Data General goes to work with a new medium, we do it well.

Our new Nova Cassette is the most innovative and reliable on the market.

Essentially, we've solved a lot of the reliability problems that have plagued cassettes in the past by relying on electronics, not mechanical systems, to handle the hairy jobs.

Most cassettes have a complicated system of capstans and pinch rollers to move the tape past the heads at constant speed.

The Nova Cassette uses read/write electronics smart enough to disregard variations in tape speed. It's a simpler, less expensive, much more reliable solution.

Similarly, we finessed the tricky tape guidance problem by recording data on one track across the whole width of the tape, and reading from only the inner 80% of the tape.

A little skew (or a little edge wear, or a little dust) just doesn't get in the way. And you can write on one Nova Cassette transport and read on another. Reliably.

We use a read-after-write head configuration that automatically verifies the data you're writing, without backtracking and reading over. That saves your tape and your time.

Average capacity is 100,000 bytes per cassette. Data transfers at 1660 bytes per second (through Direct Memory Access channel, so it doesn't have to interrupt the processor). Average speed is 30 inches per second. One, two, or three transports, power supply, and drive electronics fit in 7 inches vertical. A control for eight transports mounts on one p.c. board.

One drive is $2,000. The second and third are $750 each. A control for eight is $1,500. Software is free.

If you're an OEM, take up to 40% off everything.

When Data General does a job, we do it well.

These days, that's rare.

DATA GENERAL
Southboro, Massachusetts 01772

CIRCLE 93 ON READER CARD

Now PDP-15 does it At the same time,

There are already over 600 PDP-15's hard at work in medicine, science, industry and business. Doing laboratory automation, process control, information retrieval, batch processing, multi-programming and interactive graphics.

And that was before we gave it the RSX PLUS operating system that will do them all at the same time.

That was before we brought in new hardware that drops the prices as much as 20% or more.

But with both these advancements, you still get the same heavy-duty computer power.

And $3,000,000 worth of software.

Like 5 complete operating systems for whatever jobs you want done.

Like eight programmed application packages to put you on line right away.

Like loads of system software, utility packages and program development tools.

all at the same time. it's now 20% less.

And a selection of peripherals that just won't quit. Discs, magtape units, card readers, printers, terminals, graphic processors, interactive displays.

And industrial and laboratory subsystems that will let you interface virtually anything.

And it's the only system in its class that handles up to four interactive graphic scopes.

PDP-15 does it all.

There's hardly anything left for you to do.

Except write for the literature and figure out what you need.

Call (617) 897-5111, Ext. 3998, PDP-15 Group, Digital Equipment Corporation, 146 Main St., Maynard, Mass. 01754. European headquarters: 81 route de l'Aire, 1211 Geneva 26. Tel.: 42 79 50.

digital

CIRCLE 27 ON READER CARD

a computerized property information system blending modern computer technology with the experience of property record consultants

The Uni-Group software package is available in COBOL source statement format for either ANS or COBOL-D. (Minimum 24K core required — 44K version available.)

This package is designed to provide management with accurate, up-to-date, timely facts about plant property and equipment from a single flexible data base. The system provides information for the following corporate needs:

- book and tax depreciation (including ADR's)
- investment tax credit
- insurance placement and proof of loss
- real and personal property tax
- physical control and other matters related to fixed assets

Assisting corporate decision makers is our business.
For more information, write for Brochure 35.

AMERICAN APPRAISAL®

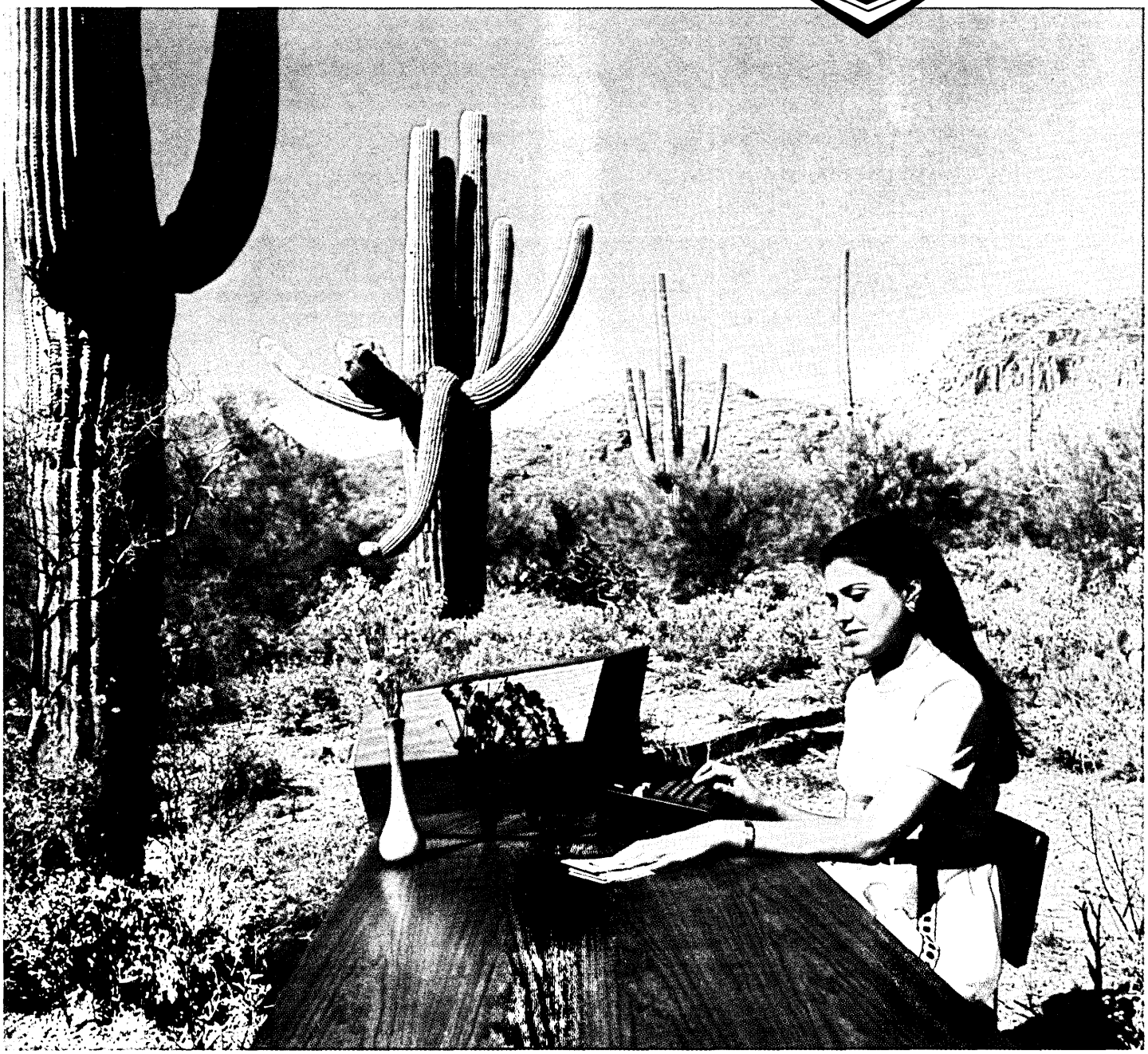
The American Appraisal Company, Inc. / An American Appraisal Associates Company • *Headquarters:* 525 E. Michigan Street, Milwaukee, Wis. 53201 • *International Office:* New York City • *Regional Offices:* Atlanta, Chicago, Cleveland, Los Angeles, New York • *District Offices* in other principal cities • *Other Offices:* Manila, Singapore, Rio de Janeiro, San Paulo, Mexico City, Paris and Milan.

CIRCLE 101 ON READER CARD

Series 400

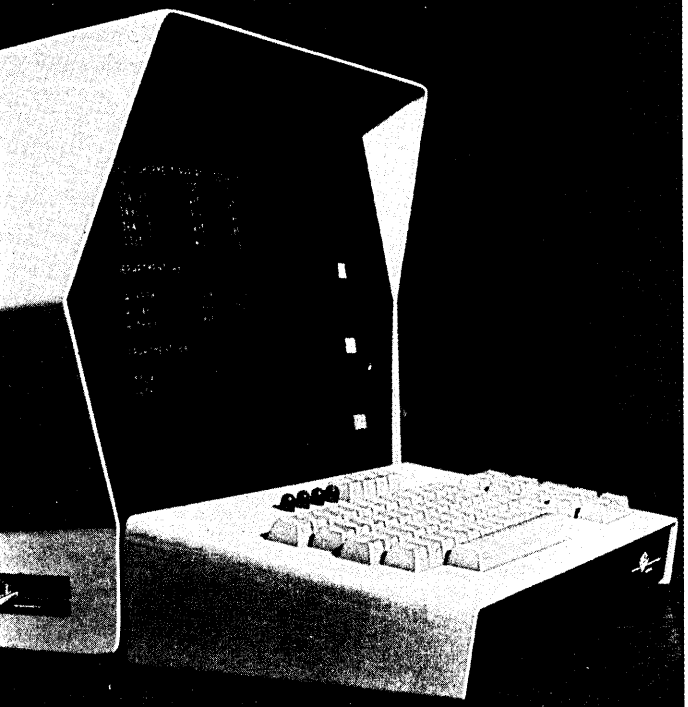
DATA-SCREEN™ TERMINALS

TEC® INCORPORATED



Series 400

DATA-SCREEN™ TERMINALS



- FOUR BASIC INTERFACES
  - *High Speed Parallel*
  - *Message Oriented Serial*
  - *Conversational Serial*
  - *TTY Replacement*
- 40, 50, 72, 80 CHARACTERS PER LINE; 20, 24 LINES
- FULL EDIT *with blink, protect and field tab*
- DISPLAYS 64 ALPHANUMERIC CHARACTERS
- SHARP 5 x 7 DOT MATRIX CHARACTERS
- SEPARATE KEYBOARD
- SOFTWARE ACTUATED FIXED MESSAGE DISPLAYS
- HARD COPY CONNECTOR

FEATURES

Flexible, high speed interactive communications between man and computer are provided by DATA-SCREEN Terminals. These versatile peripherals permit operators to accurately compose and edit data prior to entry in the computer. Similarly, data displayed on the screen from the computer's memory can be quickly reviewed and updated.

Ten models meet the varied interface and formatting requirements of data communications and data processing systems in any application. Operating at the computer (at speeds to 900,000 characters per second) or remotely, via telephone links, Series 400 DATA-SCREEN Terminals provide full alphanumeric communications at lowest overall cost.

Data entry and modification requires a full compliment of edit controls to insert and delete lines and characters and move the cursor rapidly to specified field positions. "Field Tab," "Blink" and "Protect" are vital, no extra cost terminal features required in efficient man-machine communications.

Four configurations — desk top and rack mount, with or without integral monitor — meet requirements for office, factory or special installations. Coaxial connectors for additional monitors of any size are provided in every model.

Electronically sophisticated, DATA-SCREEN Terminals use solid state design for maximum reliability. Should a component fail, TEC offers a printed circuit board "exchange" plan that puts a replacement PCB in the mail within 24 hours. Keeping a set of spare PCB's on site can reduce terminal downtime to less than five minutes.

Printed circuit boards of DATA-SCREEN Terminals are equipped with switch selectable options that permit easy, on-the-spot customization. Special terminal requirements for OEM's are a welcome challenge for TEC's engineers.

MODULARITY SIMPLIFIED

Only three subassemblies . . . TV display monitor . . . power supply . . . printed circuit card cage . . . make up the Series 400. Five basic printed circuit boards provide timing and character generation, MOS memory and control logic. Additional PCB's added to the card cage for various models provide interface and optional logic functions.

Because of design simplicity, maintenance of DATA-SCREEN Terminals is extremely easy. Logic cards, for example, are accessible by removing only the rear panel (secured by three ¼-turn fasteners).

The DATA•PANEL® Display, a software actuated fixed message display option, is a separate, plug-in module with its own lamp driver circuits. Control signals for this display come from the computer via the interface logic cards.

An all metal base, top enclosure and back panel house the terminal for desk top use. A rack mounting option incorporates monitor and logic in a standard 19″ rack assembly. Enclosures, rack panels and keyboards are finished in 3M Brand Nextel Suede coating to achieve a soft appearing, yet durable finish suitable for any environment. When a remote monitor is preferred, logic and power supply are housed in desk top or rack mount options. Custom styled enclosures and finishes are available.

Series 400 DATA-SCREEN Terminals feature a black Plexiglas panel which covers the entire front – CRT screen and DATA•PANEL Display. A separate keyboard is designed to be located at, or up to two feet from the terminal. An extension cable is available for remote keyboard operation.

APPLICATION

Wherever man and machine communicate, data must be relayed back and forth quickly and accurately. A terminal — be it simple keyboard, teleprinter or CRT — forms this man-machine interface link. Because the best operator can be no better than his terminal, TEC has incorporated important operator oriented features into its terminals. And to allow the computer to effectively display its output on the screen — talk to the operator — vital computer controlled features are included.

TEC's terminals are used in a variety of computer oriented applications:

Off-line buffered data entry permits the operator to compose, verify and edit data prior to transmission to the CPU.

On-line conversational data entry allows man and machine to talk via the terminal. Error inducing second hand data entry (from cards or tape) is avoided.

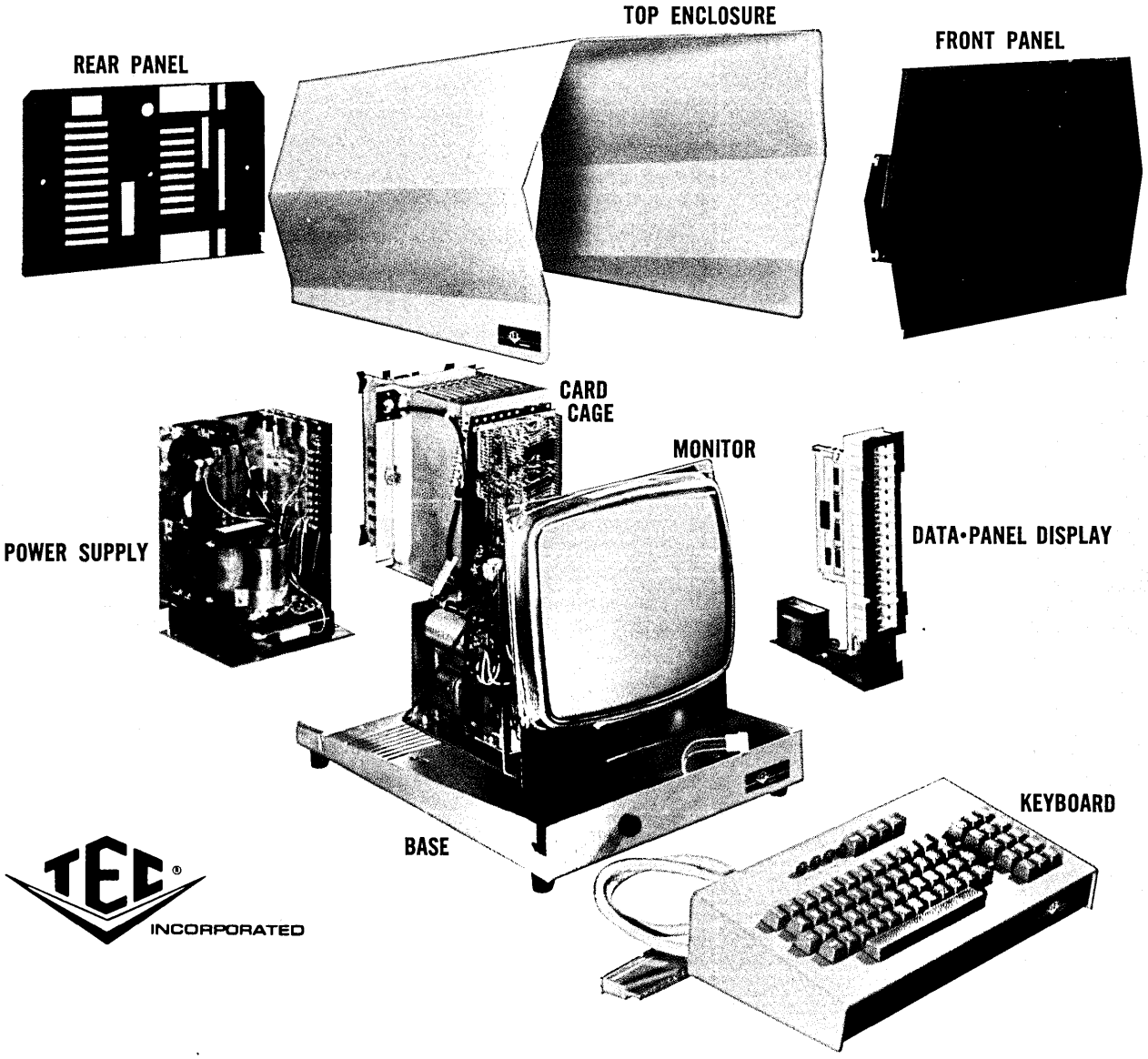
Data retrieval — re-entry application allows the operator to request that a specific block of data from CPU memory be displayed before him on the screen. Data thus presented is reviewed, updated and then the corrected data block returned to CPU memory instantly. Only the data modified need be entered by the operator.

INTERFACE FLEXIBILITY

DATA-SCREEN Terminals interface with most computers — mini or maxi — and are also used with specialized industrial control systems. TEC's design goal: to best meet the user's CRT application and provide the easiest connection to his CPU.

Interface flexibility is achieved in parallel I/O models by providing CPU controlled data rates with the terminal operating as fast or as slow as the CPU dictates. Simplified software requirements for parallel models result from DATA-SCREEN Terminal's reply and acknowledge (ready-resume) interface control. The terminal's conventional signal levels and low impedance, long line drivers match the signal requirements of most systems.

In serial I/O models, DATA-SCREEN Terminals operate at RS-232, TTL or current loop interface levels. Message oriented models offer data rates from 110 to 9600 baud. TTY replacement models operate at 110 to 2400 baud. These terminals can be connected locally without modems, or remotely via communications lines and modems.



HIGH SPEED, PARALLEL I/O, BUFFERED, MESSAGE ORIENTED DATA-SCREEN TERMINALS

Data Transfer Rates to 900,000 characters per second
TTL Compatible Interface with Optional Line Drivers
Full Message Editing Capability

Model 410 — 1000 character display, 50 characters/line, 20 lines
Model 415 — 1920 character display, 80 characters/line, 24 lines
Model 416 — 960 character display, 40 characters/line, 24 lines

These DATA-SCREEN Terminals are designed expressly to operate locally with multiplexor, batch terminal or CPU and their high speed data rates allow transmission or reception of data at the maximum speed of many computers.

More efficient use of CPU time is achieved because these models have a reply-acknowledge feature which allows the computer to control the data transfer rate between the terminal and CPU. As a result the terminals will operate as fast as the CPU can transmit or receive data — or if the computer is simultaneously involved with other peripherals, at slower speeds.

Terminal/CPU communication is further improved by such features as cursor address readout to the CPU and ability of the CPU to position the terminal's cursor by line and by column.

Full edit capability allows message composition and correction on the screen prior to transmission or for verification and updating of computer stored data displayed before the operator.

SERIAL, POLLING, BUFFERED, MESSAGE ORIENTED DATA-SCREEN TERMINALS

RS-232 or TTL Interface
Transfer Rates to 9600 Baud
63 Terminal Address Capability

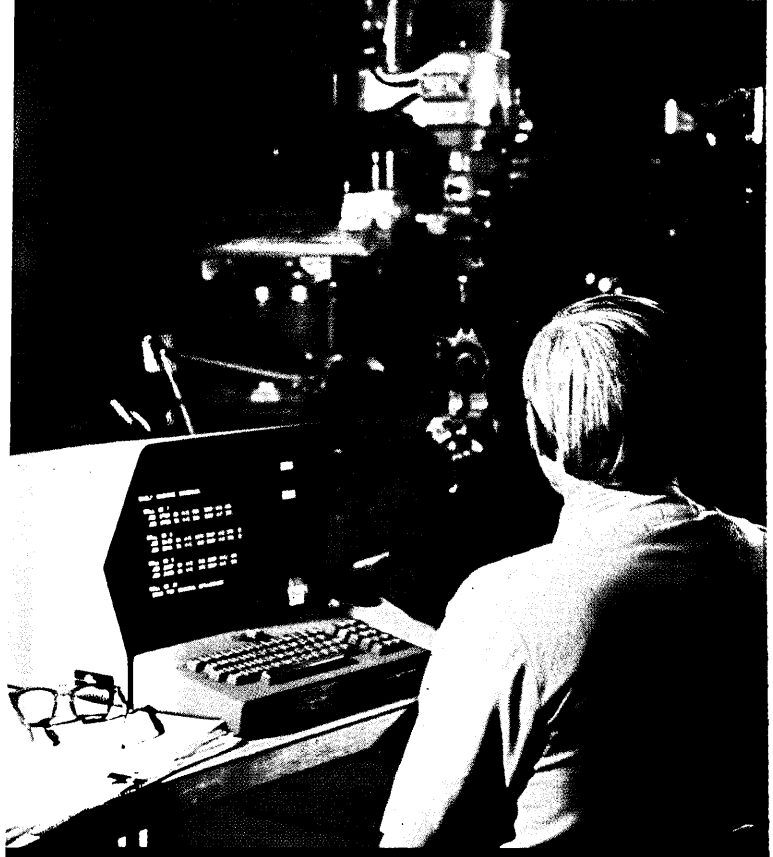
Model 420 — 1000 character display, 50 characters/line, 20 lines
Model 425 — 1920 character display, 80 characters/line, 24 lines
Model 426 — 960 character display, 40 characters/line, 24 lines

Multiple station data entry by as many as 63 terminals operating from one serial I/O channel is a feature of these models. The CPU can address one or more terminals at random and, additionally, poll them individually to determine if a message is complete and ready to be transmitted to the CPU.

In single station applications, use of the transmit key optionally causes transmission of an entire message or a single "message ready" code to the CPU.

Transfer of data may be in full or half duplex, 10 or 11-bit start/stop format to be compatible with existing hardware and software. Transfer rate can be specified from 110 to 9600 baud.

Message oriented, buffered operation allows the operator to compose, edit and correct messages (either operator originated or transmitted from the CPU) off-line, then return data to the CPU at maximum serial speeds from remotely located terminals. On-line time is further reduced by the terminal's cursor address readout to the CPU and the CPU's ability to position the terminal's cursor by line and column.



TELETYPEWRITER COMPATIBLE, CONVERSATIONAL MODE DATA-SCREEN TERMINALS

RS-232, TTL, Current Loop Interface
Cursor Positioning by CPU
Transfer Rates to 2400 Baud

Model 430 — 1000 character display, 50 characters/line, 20 lines
Model 435 — 1920 character display, 80 characters/line, 24 lines
Model 436 — 960 character display, 40 characters/line, 24 lines

These models connect directly to TTY interface ports provided on most CPU's. They provide computer controlled cursor positioning directly to any point on the screen to speed CPU data readout and reduce on-line time. Data transfer rate of 2400 baud also reduces on-line time. Current loop interface limits data rate to 300 baud. For on-line editing using the terminal's editing features, function command codes are transfered from the terminal's keyboard to the CPU.

Switch selectable options include automatic line feed and automatic roll up (scroll). With roll-up and a full screen, additional data is entered on the bottom line. Full (echoplex) or half duplex operation is also switch selectable.

Used without keyboards these models function ideally as read-only terminals due to their data display rates that are up to 24 times faster than TTY's.

TELETYPEWRITER REPLACEMENT, CONVERSATIONAL MODE DATA-SCREEN TERMINALS

RS-232, 20 or 60ma Current Loop or TTL Interface
Transmits and Receives Data at Speeds to 2400 Baud
Transmits Data at One Speed — Receives at Another

72 or 80 character line, 24 lines, offers 1728 or 1920 character display.

Plug-for-plug TTY replacement is quiet, solid state reliable — offers features not available in the mechanical device. Designed specifically for time sharing and other on-line communications service, the Model 440 can transmit data at one speed and receive data at another speed. As a result, the terminal can send and/or receive data at higher speeds than the normal 110 to 300 baud rates.

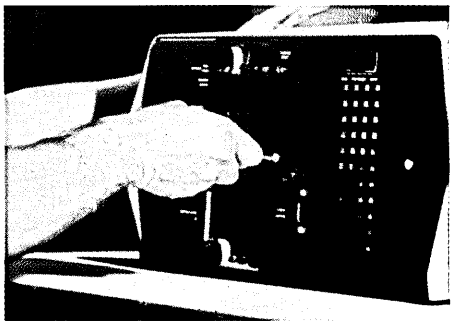
In addition to conventional bottom line data entry and line feed from the bottom, Model 440 DATA-SCREEN Terminals offer automatic carriage return and automatic line feed to eliminate end-of-line hang-ups typical of TTY's. Automatic line feed is also provided in the local mode.

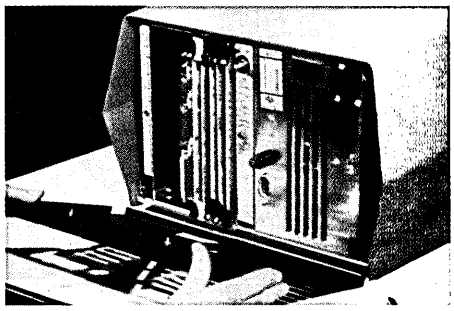
Rates of 110 to 2400 baud are switch selectable. Display of 72 or 80 character line is also switch selectable. A 9-pin connector permits use of an RO 33 on-line printer if/when hard copy is required.

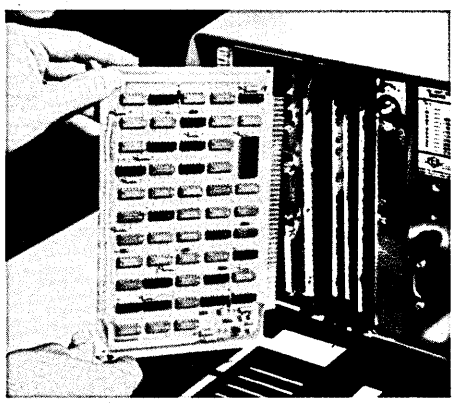
Model 440's keyboard duplicates TTY keyboard format to minimize operator orientation.

TEC® INCORPORATED

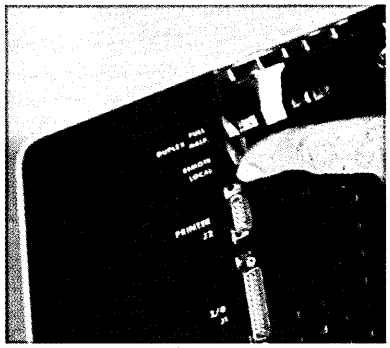
A variety of special finishes are offered so that DATA-SCREEN Terminals are not obtrusive in office or factory. Inset above shows controller for remote monitor.





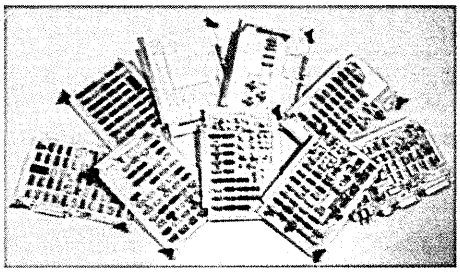


Three ¼ turn fasteners release rear panel, permit PCB change in 60 seconds, or less. With replacement PCB's on hand, DATA-SCREEN Terminal downtime is cut to minutes.

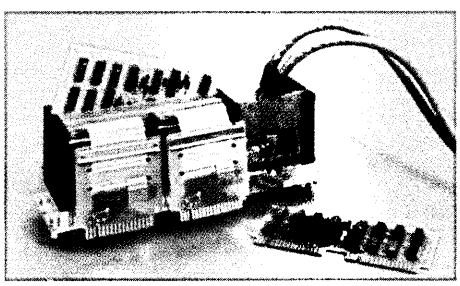


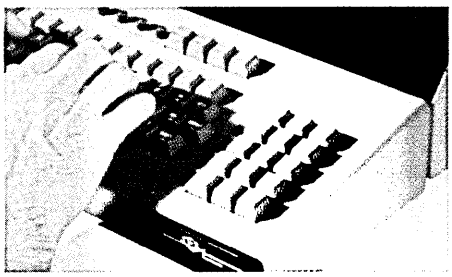
Switch options (external and on PCB's) permit field selection of modes, data rates, stop bits, parity, auto roll-up and line feed, display or non-display of cursor & carriage return symbol.

Interfaces, data rates, screen capacities, etc. can be field changed by changing PCB's — avoids DATA-SCREEN Terminal obsolesence when systems are updated.



This Honeywell H316/516 module is typical of the terminal/CPU interface packages designed by TEC for specific computers.





A full complement of editing and cursor controls plus "blink" and "protect" formatting features are standard in all except Model 440.

SPECIFICATIONS: *DATA-SCREEN TERMINALS BY MODEL*

	410	415	416	420	425	426	430	435	436	440
DISPLAY										
SCREEN CAPACITY, CHARACTERS	1000	1920	960	1000	1920	960	1000	1920	960	1728/1920
CHARACTERS/LINE, NO LINES	50/20	80/24	40/24	50/20	80/24	40/24	50/20	80/24	40/24	72 or 80/24
CHARACTER SIZE (H x W)	.21 x .15	.20 x .08	.21 x .15	.21 x .15	.20 x .08	.21 x .15	.21 x .15	.20 x .08	.21 x .15	.14 x .08
DISPLAYABLE CHARACTERS (inc. space)	68	68	68	68	68	68	68	68	68	64
CURSOR CONTROLS AND CURSOR POSITIONING BY CPU	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
CURSOR ADDRESS	Readable	Readable	Readable	Readable	Readable	Readable	No	No	No	No
BOTTOM LINE ENTRY	Optional	Optional	Optional	Optional	Optional	Optional	Optional	Optional	Optional	Yes
AUTOMATIC LINE FEED	Optional	Optional	Optional	Optional	Optional	Optional	Optional	Optional	Optional	Optional
EDIT CAPABILITY	Yes	Yes	Yes	Yes	Yes	Yes	Limited	Limited	Limited	No
FIELD TAB	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
"BLINK" AND "PROTECT"	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
BLACK ON WHITE DISPLAY	No	Yes	No	No	Yes	No	No	Yes	No	No
INTERFACE										
I/O ASYNCHRONOUS	—	—	—	TTL RS-232	TTL RS-232	TTL RS-232	TTL RS-232 20 ma	TTL RS-232 20 ma	TTL RS-232 20 ma	TTL RS-232 20/60 ma
SERIAL (Baud Rates — Switch Selectable)	—	—	—	110-9600	110-9600	110-9600	110-2400	110-2400	110-2400	110-2400
PARALLEL RATE (Ch/Sec)	0-1000, 10,000 - 400,000	0-1000, 10,000 - 900,000	0-1000, 10,000 - 400,000	—	—	—	—	—	—	—
TRANSMIT MODE (Switch Selectable)	—	—	—	Half/Full Duplex	Half/Full Duplex	Half/Full Duplex	Half/Full Duplex	Half/Full Duplex	Half/Full Duplex	Half/Full Duplex
PARTY LINE (Multi Station)	—	—	—	Yes	Yes	Yes	—	—	—	—
TRANSMISSION FORMAT	7-Bit Parallel	7-Bit Parallel	7-Bit Parallel	10/11 Bit Start-Stop	10/11 Bit Start-Stop	10/11 Bit Start-Stop	10/11 Bit Start-Stop	10/11 Bit Start-Stop	10/11 Bit Start-Stop	10/11 Bit Start-Stop
MEMORY										
TYPE, CHARACTER CAPACITY	MOS, 1024	MOS, 2048	MOS, 1024	MOS, 1024	MOS, 2048	MOS, 1024	MOS, 1024	MOS, 2048	MOS, 1024	MOS, 2048
OPTIONS										
DATA•PANEL® DISPLAY (with monitor)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
LONG LINE DRIVERS	Yes	Yes	Yes	No	No	No	No	No	No	No
PRINTER INTERFACE	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No
115 VAC, 50 Hz, 240 VAC, 50 Hz	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
KEYBOARD	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

SPECIFICATIONS COMMON TO ALL DATA-SCREEN TERMINAL MODELS

DISPLAY: 12" Direct view CRT, 74 sq. in. viewing area.
TV type horizontal raster scan.
P4 (white) phosphor standard. P31 (green) optional.

REFRESH RATE: 60 Hz, Crystal Controlled (50 Hz Supply produces 50HZ Refresh Rate — See Options)

CHARACTER GENERATION: 5x7 Dot Matrix.

CURSOR: Blinking underline, alternates with displayed character at 4 Hz.

INTERFACE CODE: USAS C II 7-bit.

HARD COPY OUTPUT CONNECTOR: Located on rear panel.

REMOTE MONITOR OUTPUT SOCKET (BNC): Located on rear panel.

POWER REQUIREMENTS: 115 VAC, 60 Hz, 120 watts maximum.
240 VAC, 50 Hz, 120 watts maximum (option).

TEMPERATURE RANGE: Operating, + 10°C to + 40°C; storage, — 40°C to + 65°C; both at 80% relative humidity (non condensing).

STANDARD FINISH: 3M Nextel Brand Suede Coating, Blue, 3101-H46.

DIMENSIONS AND SHIPPING WEIGHT*

Desk top with monitor: 17⅛" W x 19¾" D x 13" H; 68 pounds
Desktop without monitor: 18" W x 10" D x 11¾" H; 48 pounds
Rack mount with monitor: 19" W x 17¼" x D x 12¼" H; 65 pounds
Rack mount without monitor: 19" W x 8⅜" D x 10" H; 39 pounds

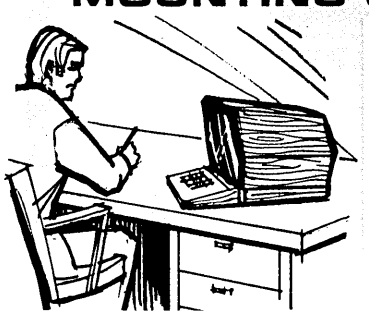
* Includes keyboard

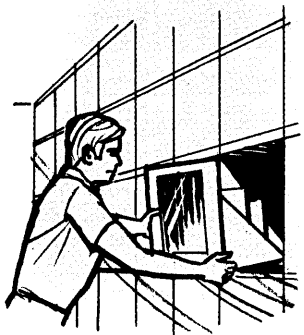
All specifications subject to change without notice.

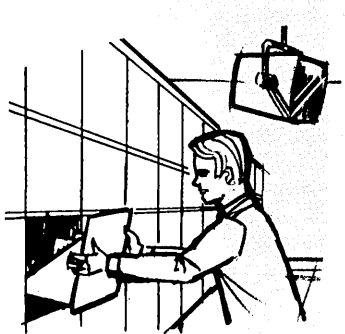
MODEL SELECTION CHART

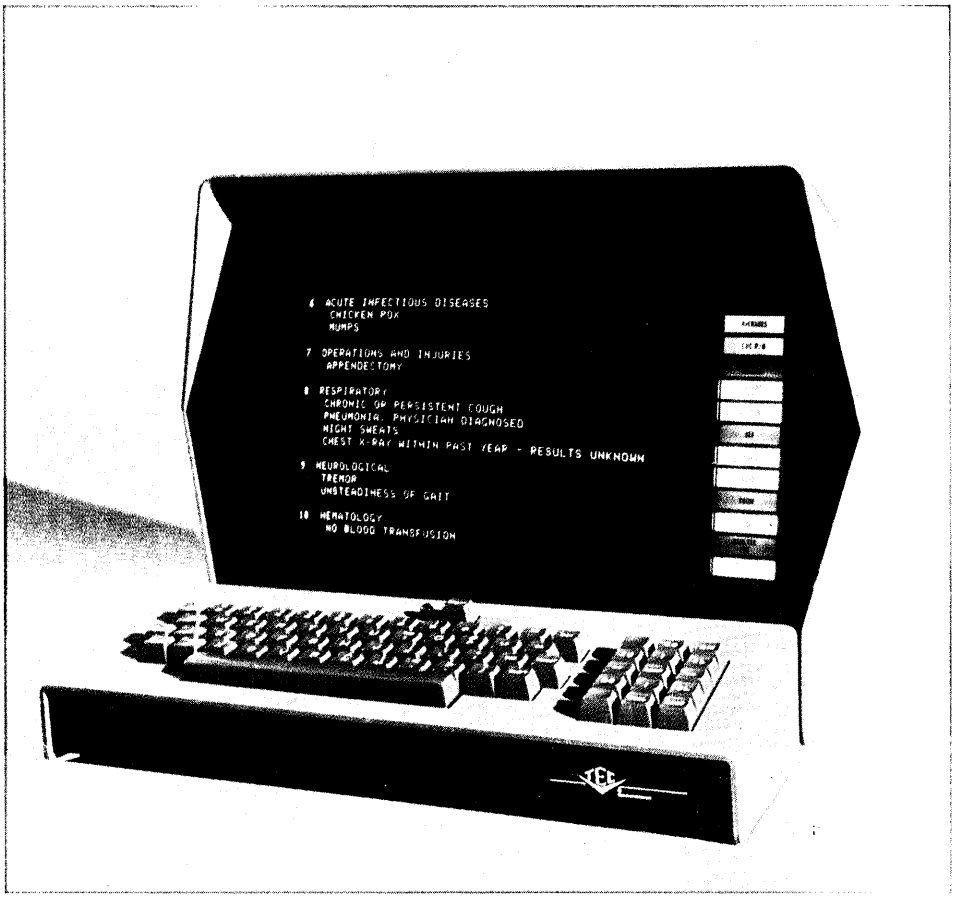
MODELS	INTERFACE: PARALLEL	INTERFACE: SERIAL (ASYNCHRONOUS)	INTERFACE: BUFFERED (MESSAGE ORIENTED)	INTERFACE: CONVERSATIONAL	OPTIONS: ADDRESSABLE	OPTIONS: CURSOR POSITIONING BY CPU	OPTIONS: CURSOR READOUT FOR CPU	OPTIONS: FULL EDITING CAPABILITY	OPTIONS: KEYBOARD	OPTIONS: FIXED MESSAGE INDICATORS	OPTIONS: HARD COPY OUTPUT
410, 415, 416	•		•			•	•	•	•	•	•
420, 425, 426		•	•		•	•	•	•	•	•	•
430, 435, 436		•		•		•		•	•	•	•
440		•		•					•		•

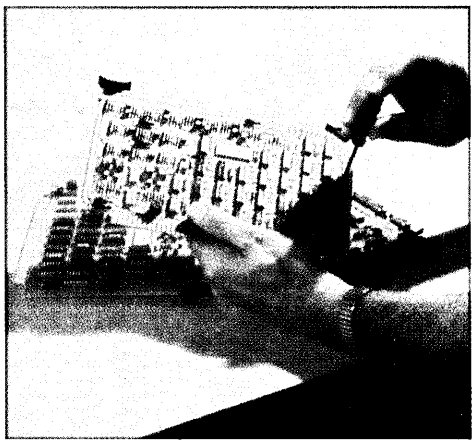
MOUNTING OPTIONS

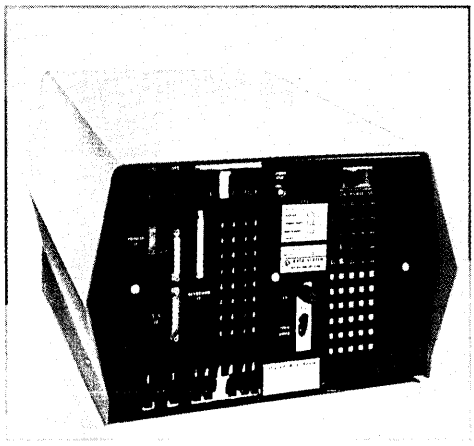


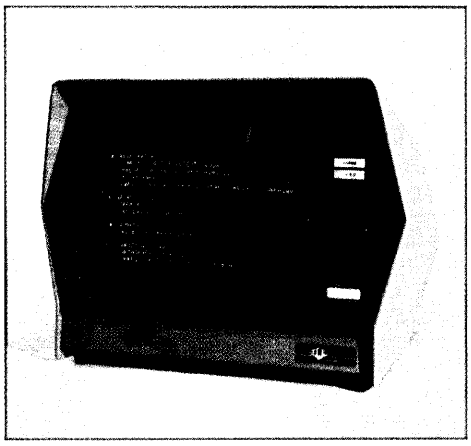












TEC® INCORPORATED

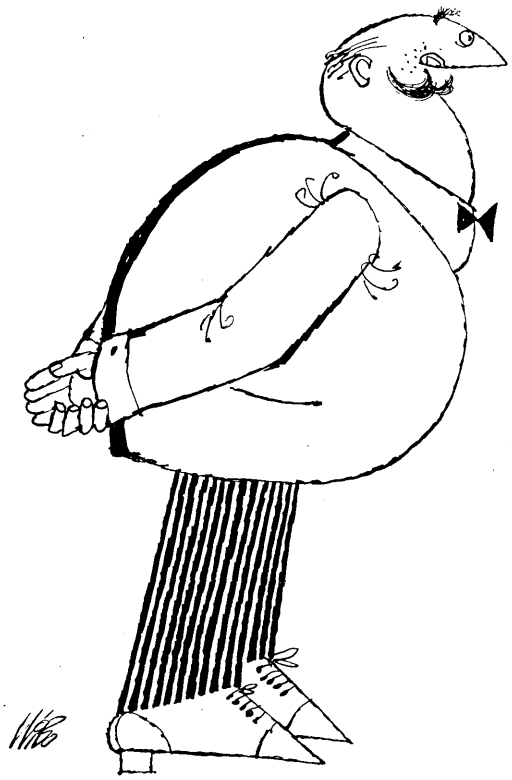
9800 North Oracle Road
Tucson, Arizona 85704

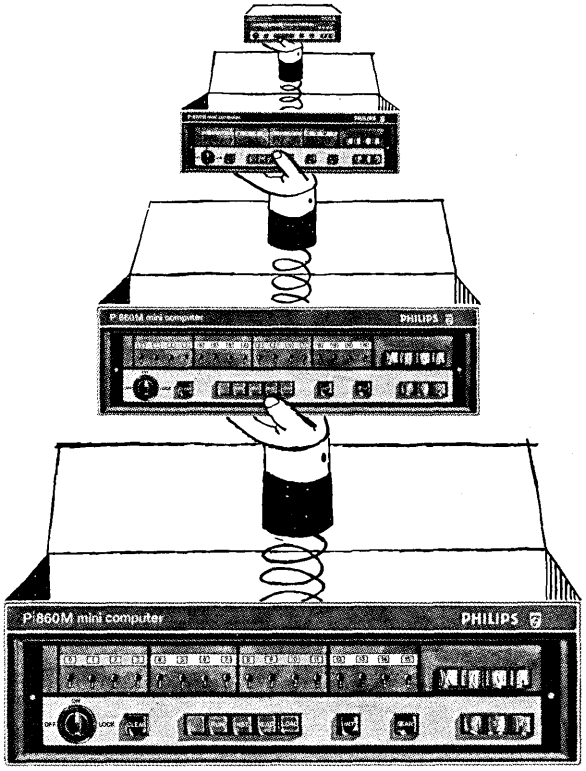
(602) 297-1111 / TWX 910-952-1377

844 3-72 Printed in U.S.A.

Philips resources:

For OEM's who want that little extra!





Everyone wants a low cost high performance machine: but at what cost?
The cost of purchase is only the beginning of the ultimate cost. And if the ultimate cost is the one you are interested in, then take a close look at Philips.

They offer that little extra, to keep the ultimate cost down.

Simple programming (easily learnt assembler)

Easy to interface (almost unique selection of I/0 channels)
Processing efficiency (16 hardware register structure)
Great interrupt capability (63 lines on 48 levels)
P850M ½k-4k with 3.2 μsec cycle time
P855M 4k-32k with 1.2 μsec cycle time
P860M 4k-32k with 840 nanoseconds cycle time
PLUS up to 41% OEM discounts.

If you believe in giving your customers extra service, you will find it easy to work with a computer manufacturer who has the resources to do the same for you.

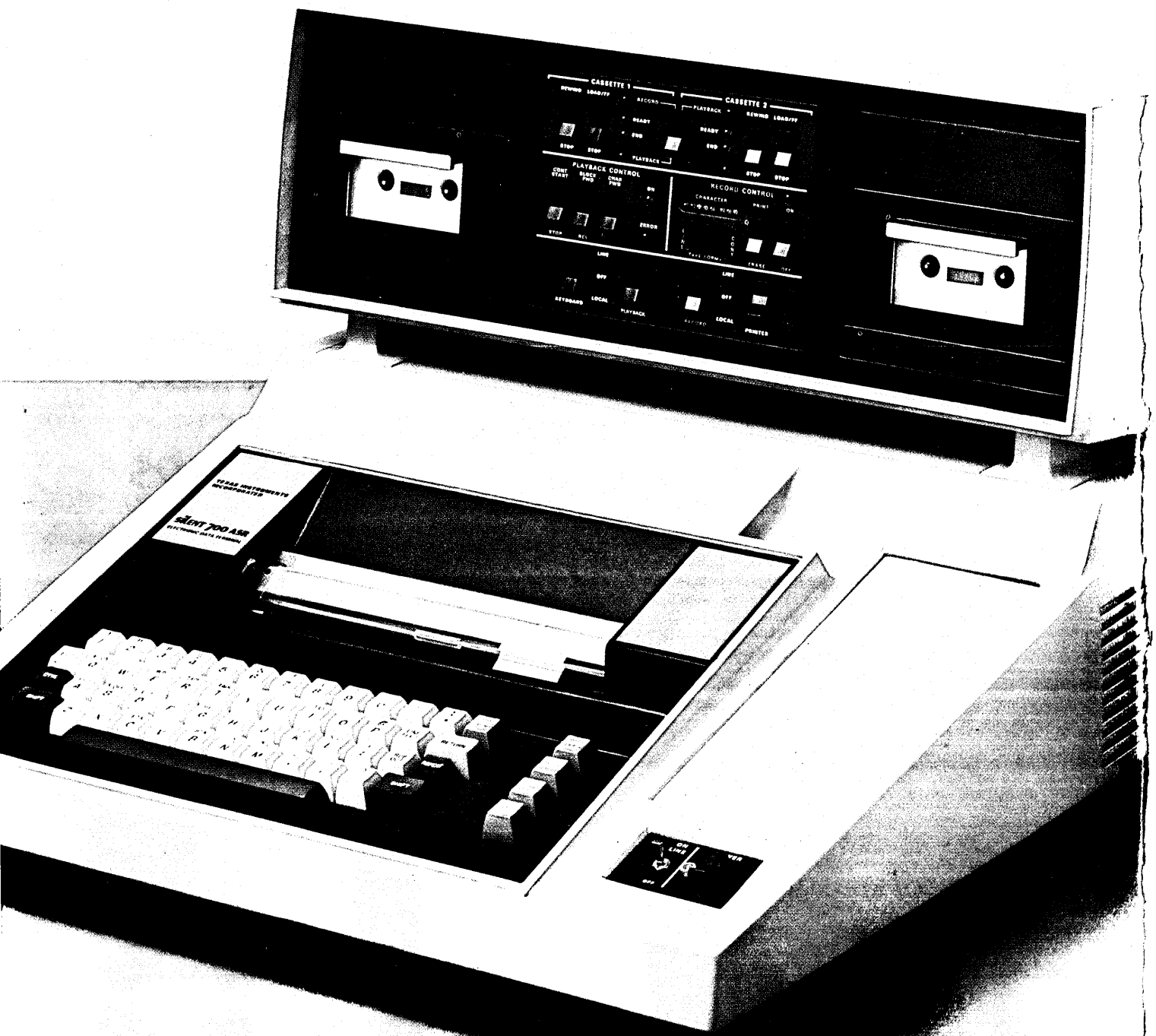
PHILIPS

NV Philips Electrologica
P.O. Box 245, Apeldoorn
The Netherlands
tel.: (0)5760 30123
telex: 49142

Please send me the full story on how to get a little extra for my systems.
Name .....
Department .....
Company .....
Address .....

silENT 700
electronic data terminals

Texas Instruments announces...



the twin-cassette "Silent 700" ASR terminal for $2,750

(KSR terminal for $1500)

Here is a powerful improvement over conventional paper-tape ASR (automatic send-receive) teletypewriters . . . at half the cost of other equipment with comparable performance.

In *Silent 700** ASR terminals, TI has combined sophisticated magnetic tape cassette data storage with the field-proven features of *Silent 700* keyboard data terminals.

Speed. Quietness. Reliability

Data transmission rates up to 120 characters-per-second can significantly reduce line charges. And quiet, 30 characters-per-second electronic printing makes the *Silent 700* acceptable to any office environment. Field operating experience has proven that *Silent 700* terminals typically require only one or two remedial service calls per year.

Communications Economy

Off-line data preparation and transmission from cassette storage reduces errors, line costs and operator time. Simultaneous transmit/receive and simultaneous on-line/off-line operation permit maximum system utilization.

Powerful Data Editing

Data is recorded in ANSI standard block format. Block or character data editing capability is combined with high-speed tape duplicating and an optional automatic record locator for fast search of cassette files.

Reliable Data Storage

Philips-type digital-grade cassettes store 800 bits-per-inch for up to 310,000 characters storage per two-track cassette. Bit-error rates are typically no more than one in 10^7.

Modular Expandability

Simplified design permits easy addition of other optional features including automatic remote control of record-playback functions, answerback memory, and built-in modems. The compact $1500 KSR (keyboard send-receive) model is easily converted to the standard $2750 ASR model by addition of the cassette module.

OEM and quantity discounts are available. Contact the nearest TI office listed below for more information on how *Silent 700* terminals can cost-effectively improve your data communications system performance. Or contact Texas Instruments Incorporated, Digital Systems Division, P.O. Box 1444, Houston, Texas 77001, phone (713) 494-5115, ext. 2126.

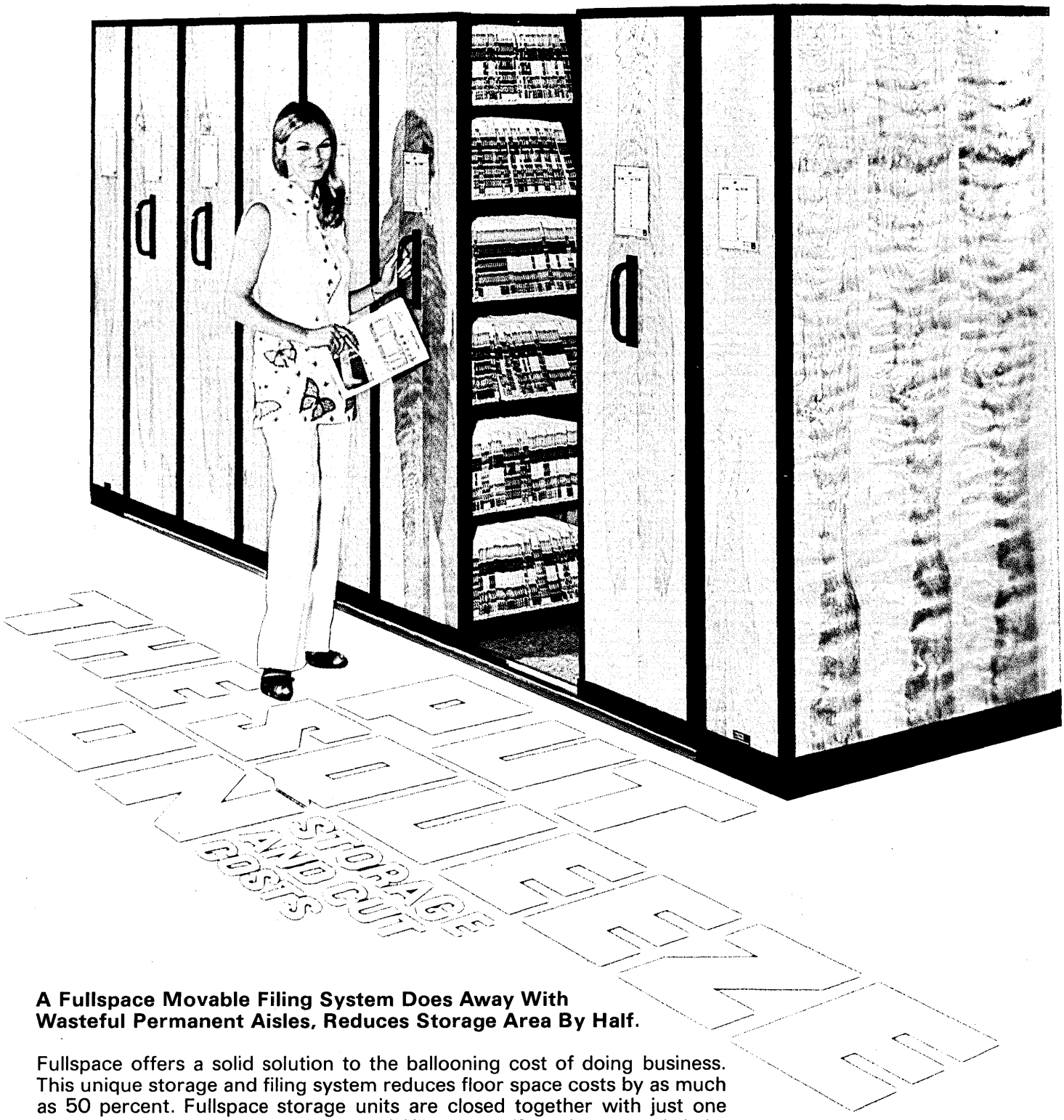
Arlington, Va. (703) 525-1444 · Atlanta, Georgia (404) 458-7791 · Chicago, Illinois (312) 593-2340 · Cleveland, Ohio (216) 464-1192 · Dallas, Texas (214) 238-3881 · Dayton, Ohio (513) 294-0774 · Denver, Colorado (303) 758-5536 · Detroit, Michigan (313) 352-5720 · Houston, Texas (713) 494-5115 ext. 2562 · Los Angeles, Calif. (213) 860-1379 · Minneapolis, Minn. (612) 941-4384 · Newark, N.J. (201) 467-2670 · Orlando, Florida (305) 644-3535 · Philadelphia, Penn. (215) 643-6450 · San Francisco, Calif. (408) 732-1840 · Waltham, Mass. (617) 890-7400 · Elizabeth, S. Australia 552066 · Bedford, England 58701 · Paris, France 6450707 · Frankfurt, Germany 726441 · Bad Godesberg, Germany 65534 · Toronto, Ontario, Canada (416) 889-7373

*Trademark of Texas Instruments, Incorporated

TEXAS INSTRUMENTS
INCORPORATED

See the new "Silent 700" ASR terminals at the FJCC, Booth 2500.

CIRCLE 39 ON READER CARD



A Fullspace Movable Filing System Does Away With Wasteful Permanent Aisles, Reduces Storage Area By Half.

Fullspace offers a solid solution to the ballooning cost of doing business. This unique storage and filing system reduces floor space costs by as much as 50 percent. Fullspace storage units are closed together with just one aisle. And one aisle is all you really need. With little effort, these wood shelving units glide on sealed roller bearings to create the aisle where you need it.

A recent survey on rental rates shows office space is expensive: $7.50 to $10.50 per square foot in San Francisco. $5 to $9.50 in Philadelphia. $5.50 to $10 in Chicago. $5 to as high as $18 in New York City. For example, empty aisles in a six unit storage bay can easily add $1000 a year to office costs. The Fullspace movable storage system can pay for itself in months.

What is your need? To reduce your storage space? Or to store more in the space you have? Fullspace helps you either way.

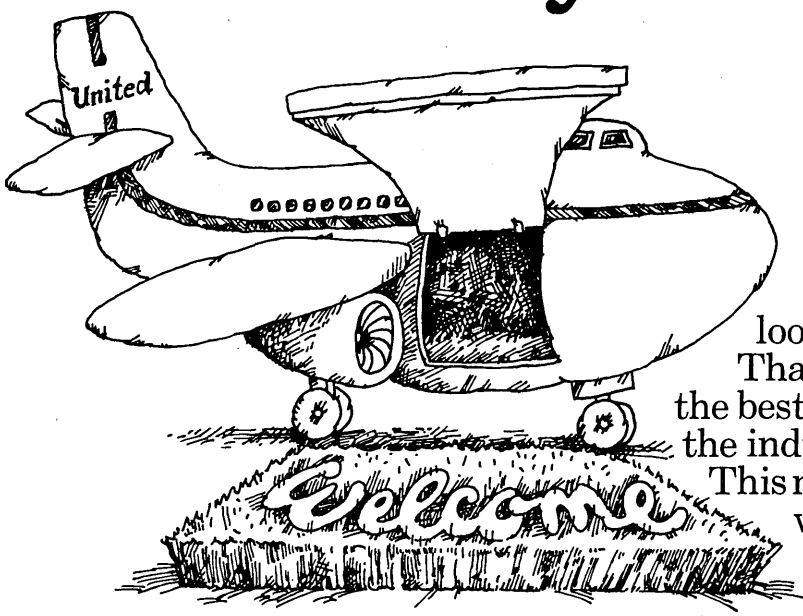
Write today for full details, including free planning, layout and estimating.

LUNDIA, MYERS INDUSTRIES, INC.
Decatur, Illinois 62525

FULLSPACE Lundia PREFABRICATED ADJUSTABLE SHELVING

CIRCLE 60 ON READER CARD

United's special treatment means your shipment has a home away from home.

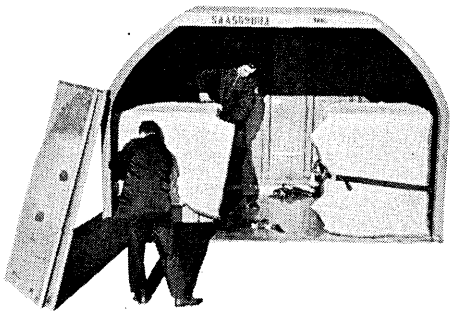


You'd expect a friend to look after your things. So we do. That's why we're the people with the best record for safe handling in the industry.

This means your shipment will get where it's going. In one piece. No matter how specialized your needs.

Our people give computers and strawberries the kid-glove treatment. Then there are race horses. Rare serums. Gold. You name it.

Talk to a friend who cares. Call United. Or write Mr. E. A. LaMarre, Director of Cargo Sales and Services, P.O. Box 66100, Chicago, Ill. 60666.

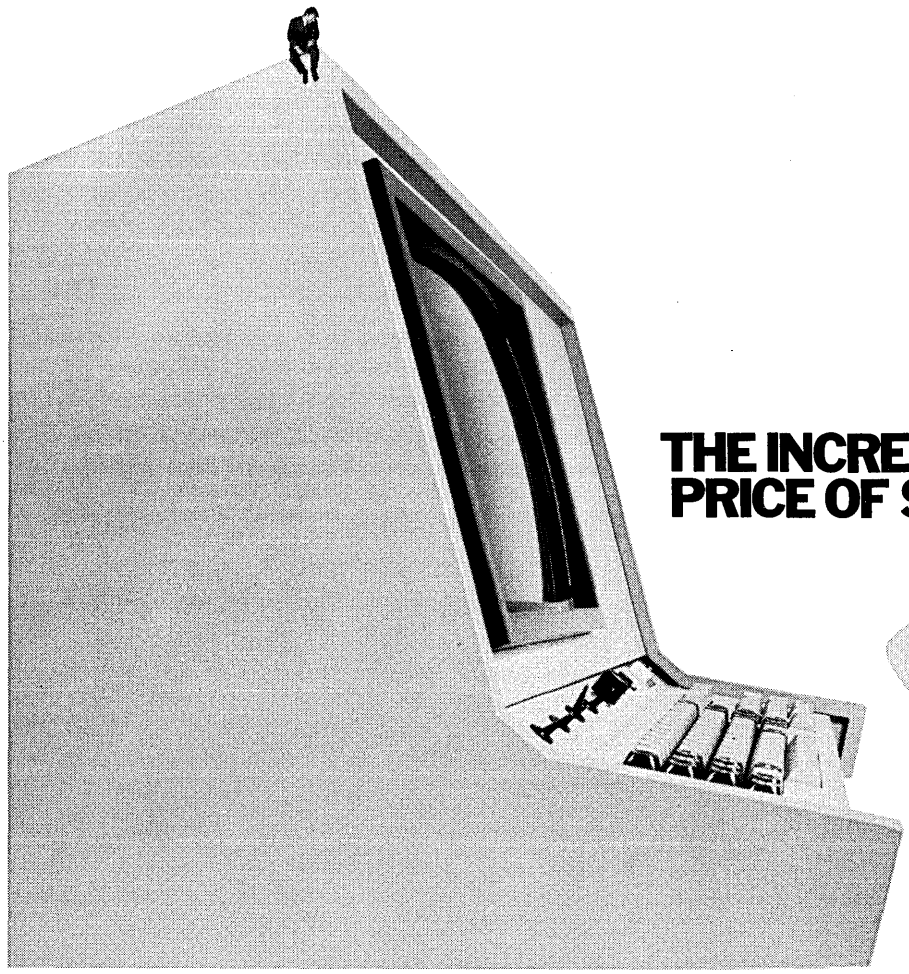


We coddle computers with our "Soft Touch" container system. It's damage-free delivery for any delicate equipment you want to ship.

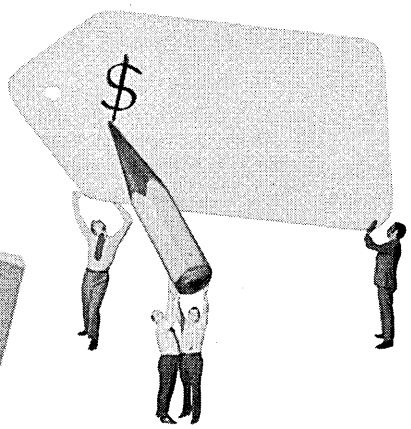
We bird-dog your shipment from the moment you call. That's how our people can fly more freight with less loss and damage than anybody.

We guard your high-value and in-bond shipments in our special Security Rooms.

United Air Lines
Jet Freight *No. 1 in the U.S. sky*



THE INCREDIBLE SHRINKING PRICE OF SYS DISPLAYS.



The reputation of the incredible shrinking men from SYS keeps growing by leaps and bounds.

Because while our terminals are known to be among the least expensive you can buy, we have figured out a way to save you even more money.

The incredible shrinking price.

It makes our prices almost as incredible as our terminals. Because it allows you to lower the cost per unit by dividing your capability requirements.

For example, you can buy a two 960-character CRT system for only $430 more than a single 1920-character CRT system. Instead of paying $3,430 for a system with one display station, you can pay $3,860 for a system with two display stations.

In that way, you would get two independent keyboards, two independent TV sets and two times the programmable efficiency for less than $2,000 per unit.

As you can see from the price chart, buying less can save you more.

Everybody knows that SYS terminals are the most flexible you can buy. And the most intelligent. And the most reliable.

Only now we have applied our shrinking style to the price.

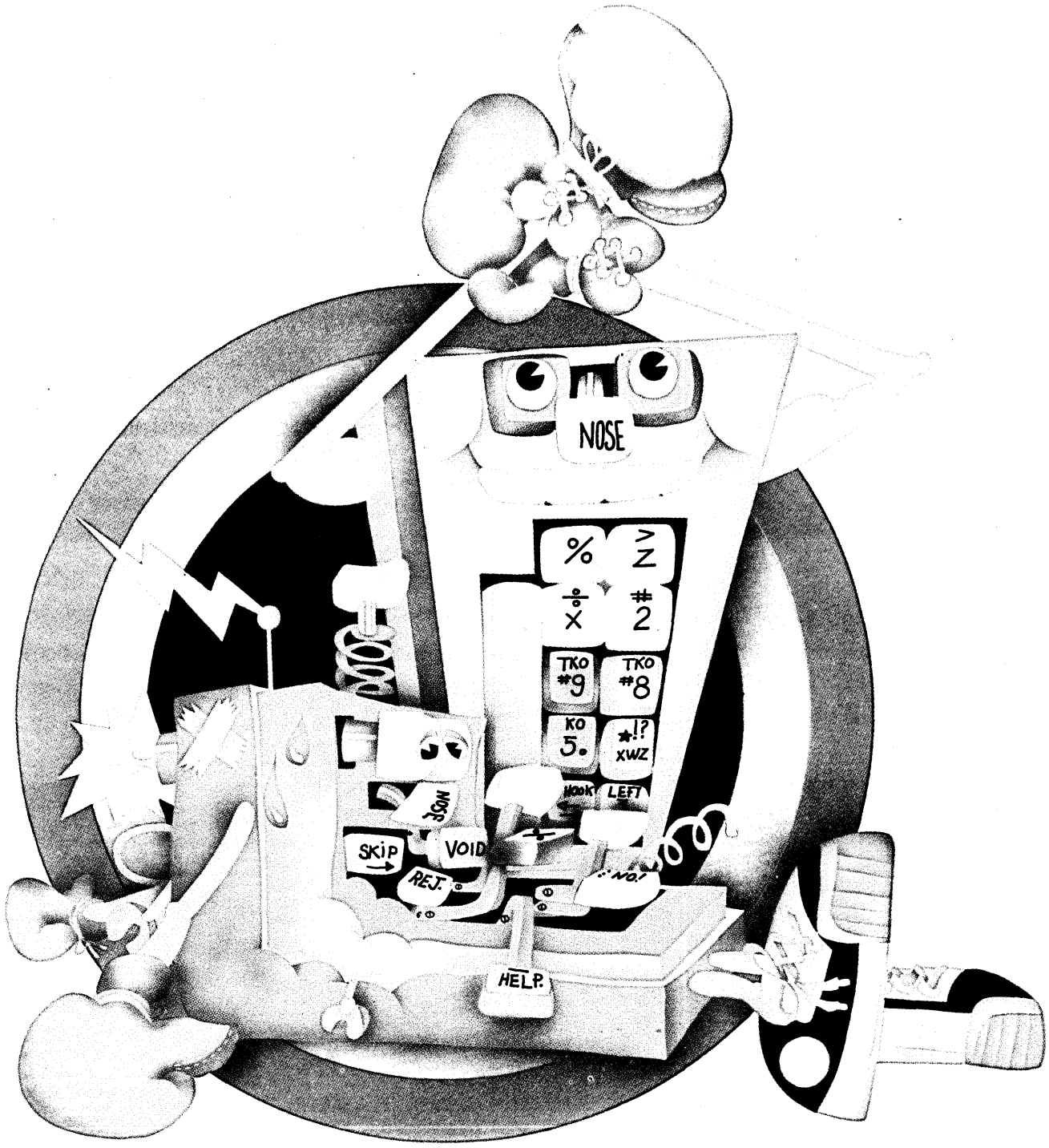
But the best way to see how incredible our prices are is to call Pete Polizzano, VP Marketing, 201-488-0300. Ask him to send you the new SYS brochure and a Terminal Check List.

He'll also tell you about the many SYS systems he's shipping all over the world. That Pete is no shrinking violet.

BASIC COMPONENTS	NUMBER OF DISPLAYS AND CHARACTERS DISPLAYED ON EACH						
	1x 1920		2x960		3x480		4x480
Type A controller with customer specified features from terminal specifying aid, power supply, and memory for 1920-characters	$2,995		$2,995		$2,995		$2,995
12" TV and Keyboard	435		870		1,505		1,740
Total System Price*	3,430		3,860		4,300		4,730
Cost Per Display Station	3,430		1,930		1,433		1,132
	2x1920	3x960	4x960	5x480	6x480	7x480	8x480
Type B controller with customer specified features from terminal specifying aid, power supply, and memory for 3840 characters	$3,995	$3,999	$3,995	$3,995	$3,995	$3,995	$3,995
12" TV and Keyboard	870	1,305	1,740	2,155	2,610	3,045	3,480
Total System Price*	4,865	5,300	5,735	6,150	6,605	7,040	7,475
Cost Per Display Station	2,432	1,733	1,433	1,230	1,100	1,005	930

*CABLES AND OTHER ACCESSORIES ARE EXTRA

SYS COMPUTER CORP., 17-25 DiCAROLIS COURT, HACKENSACK, NEW JERSEY 07601, AND 62 RUE DE BILLANCOURT, 92 BOULOGNE, PARIS FRANCE. TEL. 604-65-19



It's MICRO SWITCH solid state by a TKO.

MICRO SWITCH introduced the solid state keyboard in 1968. Since then, it's been virtually unbeatable.

Solid state has none of the things that normally wear out and cause service problems. For example, no moving contacts. Tests have proved our solid state keyboards to be substantially more reliable than reed-switch units.

A year later, we followed with the first solid state MOS encoded keyboard. It's more flexible (provides up to four codes per key) and more reliable (cuts the number of discrete components).

In 1970, we added "n" key rollover. Tests indicate it reduces operator error by as much as 30% over two-key rollover keyboards.

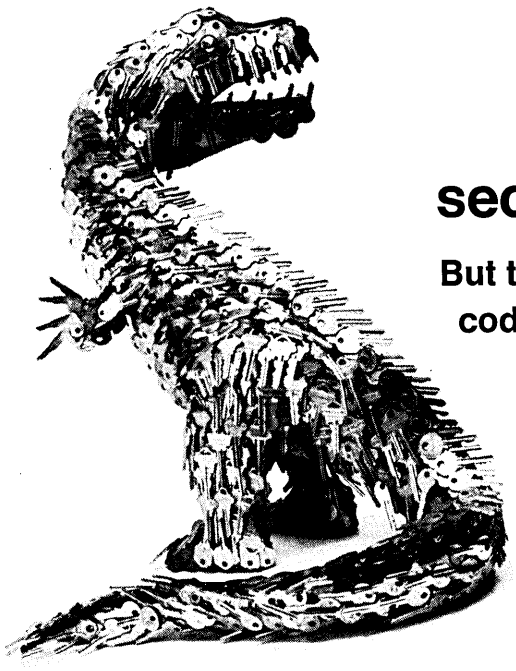
Since then, we haven't let up. The result is not only a technically superior keyboard, but one that's priced competitively with run-of-the-mill units. In fact, manufacturing and technical breakthroughs have enabled us to announce four price reductions in the past five years. The 1973 reduction will average 10%.

See your MICRO SWITCH Branch Office for more information. Or give them a call. They're just waiting for the sound of the bell.

MICRO SWITCH
FREEPORT ILLINOIS 61032
A DIVISION OF HONEYWELL

MICRO SWITCH makes your ideas work.

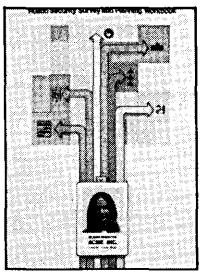
MICRO SWITCH products are available through Honeywell International.



Let's face it. Keys are B.C. solutions to A.D. security and access problems.

But there is an A.D. answer. RUSCARD™ invisibly coded electronic access control (and photo-ID) cards selectively permit or deny *(instantly cancellable from a central point)* access privileges to: Work areas; parking; computer rooms; software vaults; unissued-credit-card storage; confidential files; maximum security areas; night depositories; *ad infinitum*...on a "Need-to-Go" basis. RUSCARD™ systems also can provide hard-copy records of every entry *(in red for unauthorized entry attempts)* plus integral time-keeping functions for personnel!

START PLANNING your A.D. security system in terms of here-and-now hardware...feature by feature. RUSCO has made the task easier with the thorough *"Security Survey and Planning Workbook"*...which is free for the asking. (Perhaps you could even trade your present keys on a new RUSCARD™ system. We found an appropriate use for them!)

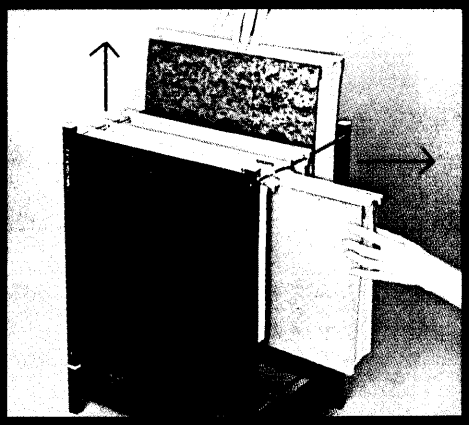


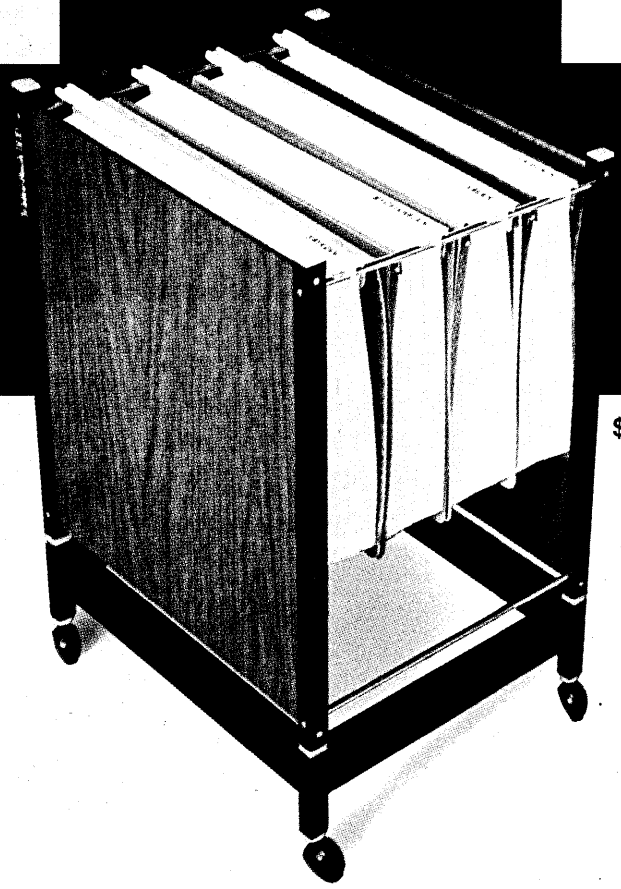
To get your Free Copy of the *"Rusco Security Survey and Planning Workbook"* call TOLL FREE: **(800) 423-4194.** (In California, dial direct or collect: **(213) 682-3691.**) Or write to:

RUSCO
ELECTRONIC SYSTEMS

A RUSCO INDUSTRIES COMPANY
P.O. BOX 2848 D, PASADENA, CALIFORNIA 91105

OTHER **RUSCO INDUSTRIES** COMPANIES: ADOHR/HILITE; LOOK/HILITE; MAJESTIC/HILITE; RUSCO DIVISION; RUSCO/CANADA; H&D; GREENWAY ALUMINUM; J.A. MELNICK; RUSCO/HILITE; HARVARD MANUFACTURING; SPERLING MANUFACTURING; PARK-O-MATIC.





$39.95*

Your personal printout caddy Wilson Jones Mini-Rack.™

The Mini-Rack holds 3 or 4 printout binders at your fingertips. It has slide-out/drop-in retrieval. And it builds into any size Maxi System. Our Mini-Rack is only $39.95.*

Keep your active printout binders by your desk. In our Mini-Rack. At night roll it into the well of your desk. Without the stand and casters, put it on a shelf or credenza. It takes up less than 1½ square feet of space.

The Mini-Rack features slide-out/drop-in retrieval. It comes with T-bars for standard vertical retrieval. Converts, in an instant, to horizontal retrieval with special T-bar channels.

CIRCLE 61 ON READER CARD

You won't need any other equipment. Or new binders.

Any time you have more binders to store, just add another rack. Mini-Racks stack up, down, all around. The Mini-Rack grows into a Maxi-System of any size and shape. Perfect for data libraries.

The Wilson Jones Mini-Rack holds 3600 printout sheets. Up to four 14⅞" x 11" binders. Burst or unburst. Vinyl side panels in walnut grain. Black, blue, tan also available.

Just see your Wilson Jones supplier, or send for more information.

*Suggested retail price for each complete unit.

Wilson Jones (WJ)™
A Division of Swingline, Inc.
6150 Touhy Avenue,
Chicago, Ill. 60648

Gentlemen:
Please send me more information about Mini-Rack.

Name_____

Title_____

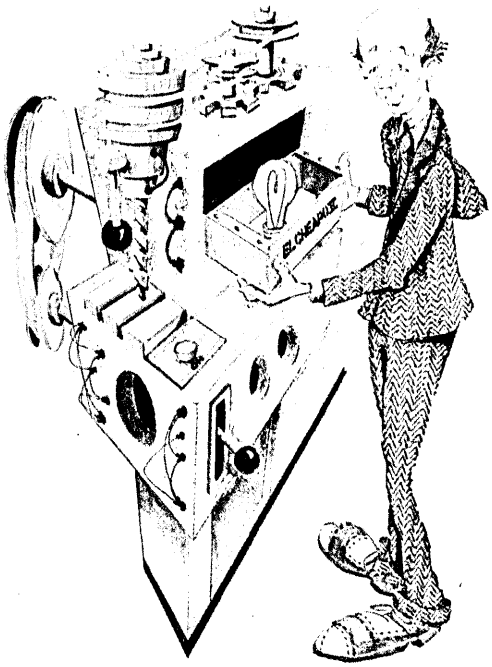
Company_____

Address_____

City_____ State_____ Zip_____

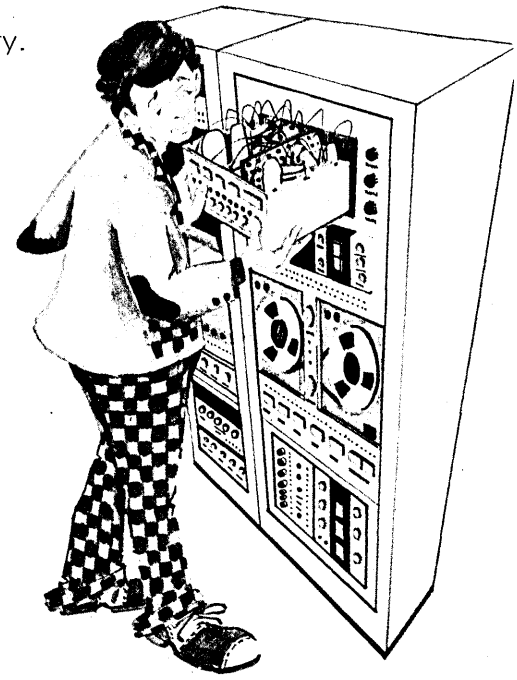
D-11

What the industry taught us about cheap OEM minicomputers.



Stripped for action.

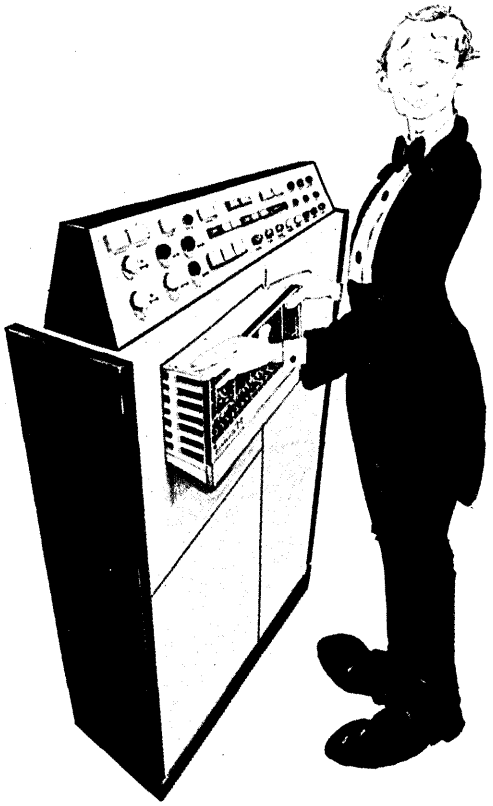
Here's a familiar approach. El Cheapo II. In reality, it's the good old Mod X stripped of all the stuff that made the old Mod X good. Instructions. Memory. I/O facilities. Everything. But it's cheap. It's really cheap. Only the hum remains.



Dressed to kill.

Here's the same machine in disguise. Now it's hiding behind all the things you have to hang on it to make it work. Like a power supply and a memory and some sort of I/O kluge so your system can talk to it.

Also hidden, of course, is the cost. And it isn't so cheap any more.



Introducing the $3600 Interdata Model 74. What you need is what you get.

Here's a new approach.

A $3600* general-purpose OEM minicomputer with the much-copied third generation architecture of the Interdata New Series family of minicomputers.

And that $3600 — lowest in its class — includes hardware multiply/divide, 16 general registers, directly addressable 8KB core expandable to 64KB, an 80-ns solid-state Read-Only-Memory and a multiplexor that provides an I/O system for communicating with up to 255 peripheral-oriented device controllers.

We've even made the display panel optional because most OEMs don't need it. And what you need is what you get.

At $3600, maybe we'll teach the industry a thing or two.

INTERDATA®

*Basic 8KB Model 74 list.
With OEM discount, quantity of 18 — $2,520.00.

2 Crescent Place, Oceanport, New Jersey 07757 (201) 229-4040. Atlanta — (404) 288-7000. Boston — (617) 890-0557. Chicago — (312) 437-5120. Dallas — (214) 238-9656. Detroit — (313) 356-5515. Houston — (713) 783-1830. Los Angeles — (213) 640-0451. Palo Alto — (415) 969-1180. Washington — (703) 525-4806. Toronto — (416) 678-1500. United Kingdom — Uxbridge 51483. Sydney — NSW 439-4155. West Germany — 0811/160031. Tokyo — 270-7711.

CIRCLE 34 ON READER CARD

GE's new Mark III. It's time-sharing. It's remote batch. It's a worldwide network.

In fact, it's the world's only integral combination of all three powerful capabilities: the response of interactive time-sharing . . . the economy of remote batch processing . . . the reach of a worldwide communications network.

The interactive time-sharing has new features and controls to make time-sharing more powerful, less expensive, and more easily managed. Yet, it is fully compatible with GE's Mark II, today's most widely used service.

Remote batch processing brings you the economies and power of large-scale data processing. With Mark III, you can save one-half or more of your processing costs just by moving your time-sharing programs into remote batch operation. Yet you still have the ease of use and the service quality that are characteristic of GE time-sharing.

The network is a system that gives local phone call access from over 250 locations in North America and Europe. No matter how you're decentralized, all your locations can share a single system, a single data base. And this information processing network can interact directly with your own computers.

General Electric introduced the first time-sharing service in 1965. In 1970, GE established the first international information processing network. And now, Mark III.

It's time to make a serious comparison of Mark III with whatever information service you now use. Phone 800-638-0971 or write us at 7735 Old Georgetown Rd., Bethesda, Md., 20014. We're ready to help.

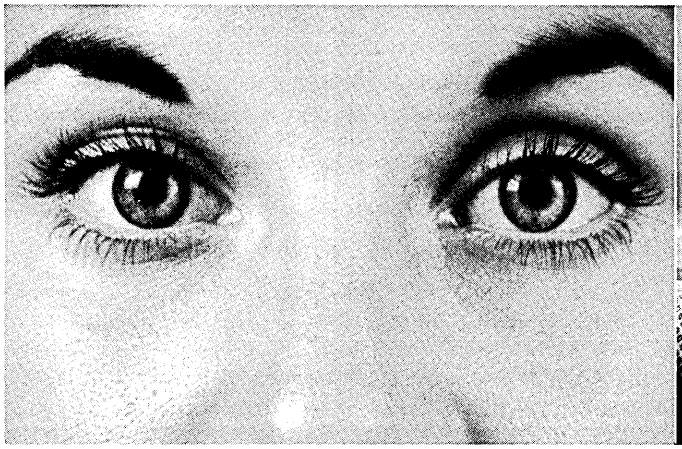
291-82

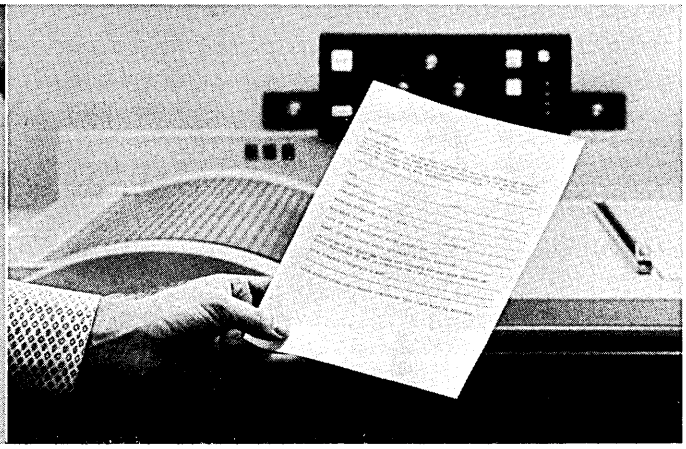
GENERAL ELECTRIC

WORLD LEADER IN INFORMATION SERVICES

CIRCLE 91 ON READER CARD

NCR Paper introduces new Deep Blue.





You see it better.

Your copier sees it better.

Our new Deep Blue image, together with a whiter sheet, gives much more contrast. This means carbonless copies that you and your copying machine can see better than ever. You'll both see crisp, clean copies that are a far sight better than fuzzy, smeary carbon copies. Seeing is believing. When you see our new Deep Blue image, you'll see more reason than ever to scrap carbon paper and go with the new NCR Paper system.

Feast your eyes on our new Deep Blue image! This is the year **NCR Paper means business!**

NCR *Paper*® Appleton Papers Inc., P.O. Box 348, Appleton, Wisconsin 54911, Subsidiary of NCR.

APPLETON

GE's new Mark III can cut your time-sharing costs by a third

What we're offering is not a miracle, but a new approach to information processing: Mark III. It's a single, unified service that combines the response of interactive time-sharing, the economy of remote batch processing, and the reach of a worldwide communications network.

Your total savings depend on your own applications, but our estimate of one-third may be conservative. For example, with Mark III you can save one-half or more of your processing costs just by moving your time-sharing programs into remote batch operation. In addition, Mark III includes new time-sharing capabilities that can lower your costs dramatically. To tie it all together, a new budget allocation and control system helps you get the most out of each computing dollar.

General Electric introduced the first time-sharing service in 1965. In 1970, GE established the first international information processing network linking over 250 locations in North America and Europe.

And now Mark III—an integrated network of nearly 100 interconnected computers. With a network this size, each computer performs that task for which it's best suited—communications, interactive time-sharing, or batch processing. The result is a service that can tackle your computing needs easily, reliably . . . and, most important, economically.

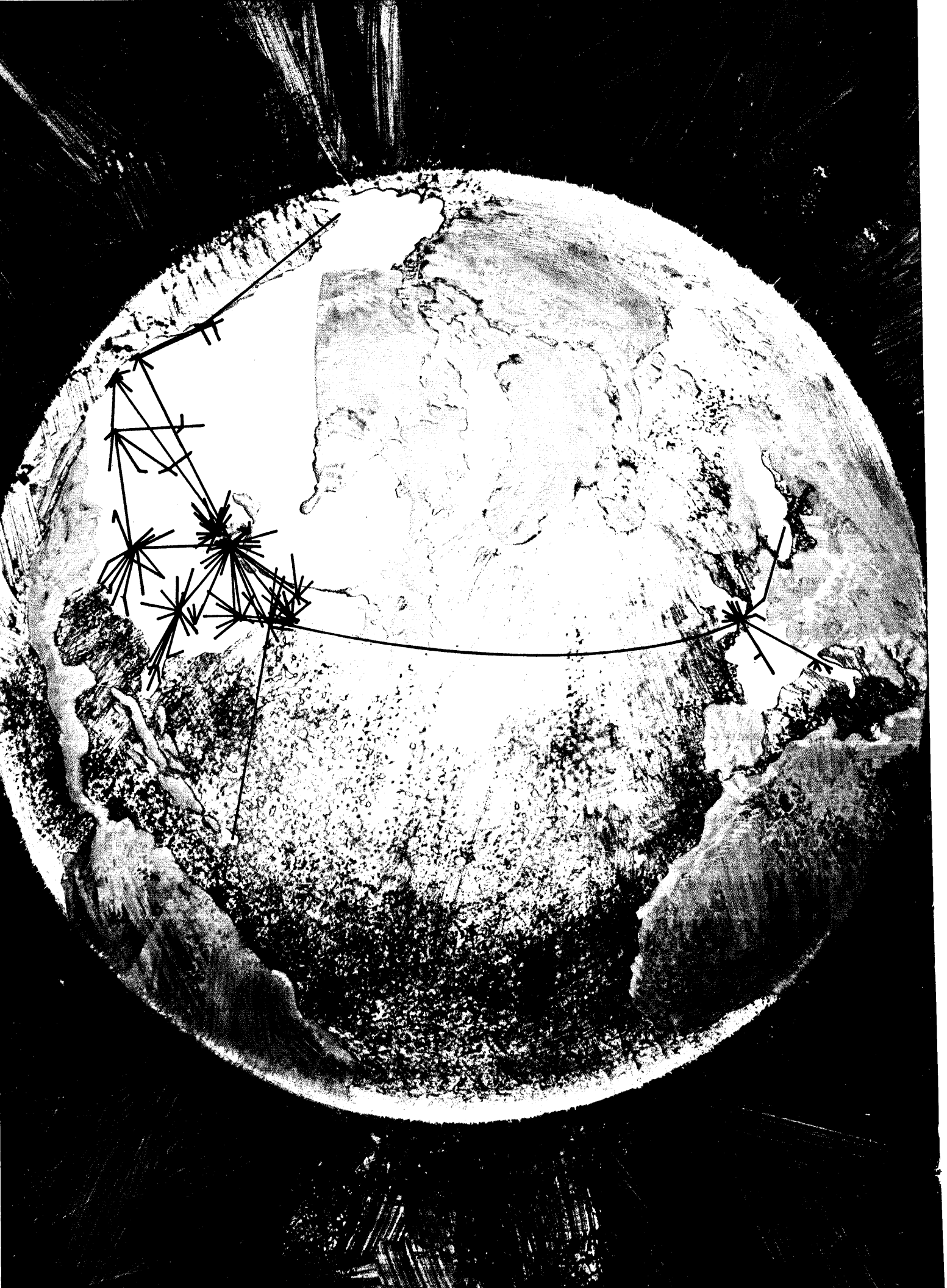
If you're a Mark II user, Mark III offers major new features and is fully compatible. If you're not, it's time to make a serious comparison of Mark III with whatever information service you now use. Phone 800-638-0971 or write us at 7735 Old Georgetown Rd., Bethesda, Md., 20014. We're ready to help.

291-83

GENERAL ELECTRIC

WORLD LEADER IN INFORMATION SERVICES

CIRCLE 92 ON READER CARD



GE's new Mark III lets you create a worldwide order processing network.

Immediately.

Computerized order entry systems are not new. What is new is a complete service that requires no capital investment. A service with local phone access available from hundreds of international locations. A service whose cost is proportional to your use.

It's called Mark III, and it's ready to become your order processing network starting today.

You can tie together your sales office, factories, and warehouses to enter orders and fill them. Many companies are already using this network. Their businesses range from food processing . . . to auto manufacturing . . . to insurance services . . . to chemical production.

Salesmen can instantly verify inventory status, check buyers' credit, place orders, and mortgage inventory. Capturing the order information in a single data base also opens up other valuable management uses, such as sales control and forecasting.

Mark III is an integrated network of nearly 100 computers, interconnected and accessible from over 250 cities in North America and Europe. This international network has been used commercially since 1970—and it is ready for you right now.

If you use GE's Mark II, Mark III offers major new features and is fully compatible. There's much more to this exciting new opportunity. For the facts, phone 800-638-0971 or write us at 7735 Old Georgetown Rd., Bethesda, Md., 20014. We're ready to help.

291-85

GENERAL ELECTRIC

WORLD LEADER IN INFORMATION SERVICES

If you haven't heard, those great Bucode high-technology tape drives have now come into the MDS family of plug-compatible peripherals.

The latest in high-speed gentleness for tape just got big company service and staying power.

In our 8420 unit, you'll find a drive that respects both tape temperament and operator temperament. Air-cushion bearings, of course. Automatic threading and the fastest unloading time around. Speeds from 75 to 200 ips.

Savings? You can figure at least 10% over the IBM counterpart. No overtime charges either. Both 360 and 370 compatible, of course.

So it's all in your favor. Price/performance, sure. And that goes for plug-compatible disc systems and printers, too. But add service.

After all, service helped make us the peripheral power. In eight short years we've become the biggest independent maker of peripheral equipment, with over 2000 sales and service people in the field.

So fair warning. We're out to win your business. You call, we'll come. Phone our nearest office or call headquarters at (315) 867-6539 or 6549.

Mohawk Data Sciences Corp., Herkimer, N.Y. 13350.

MDS

The Peripheral Power

Its newest feature is us.

Editor's Readout

IBM vs. the Press

In 1965, Attorney General Nicholas deB. Katzenbach made a policy statement that restricted the release of information to the press by Justice Dept. officials. Announced in the context of the circus-like press coverage of the aftermath of President Kennedy's assassination, the policy was limited to criminal proceedings. This year, Mr. Katzenbach, now vice president and general counsel for IBM, has watched IBM's attorneys successfully push through a court order that placed tighter press relations clamps on Justice Dept. officials than the 1965 statement, even though the court order is concerned with a civil case—the Justice Dept.'s antitrust suit against IBM. IBM calls it a "landmark order" that "could well be adopted as a model by all courts in all cases."

In effect, the order, as originally written by IBM and the Justice Dept. and approved by the court, prevents Justice Dept. officials from making any comment to the press—even innocuous factual comment—on the case. The problem for the press is this: as is common in many similar civil cases, proceedings in the IBM antitrust case are often quickly scheduled without sufficient prior notice. Thus the press doesn't know about them until after they have been held. Transcripts are filed late—often weeks after the hearings—and some documents are never filed at all. In frustration, then, the press would normally turn to the two parties involved—IBM and the Justice Dept.—to obtain information. But the IBM order blocks both from commenting, even on simple nonprejudicial matters.

Restrictions on Justice Dept. comment that could lead to prejudicial pretrial comment in criminal cases are one thing. What is not understandable are the tight restrictions IBM proposed in an antitrust case where there is no jury to influence. The case is being presided over by a federal judge.

IBM's major tactic in obtaining the order was to claim that the Justice Dept. gave "distorted and inaccurate statements" on the case to the press—namely, *Computerworld, Electronic News, The San Jose* (Calif.) *Mercury,* and the now-defunct *Washington D.C. News.* Before the press order was signed, however, the papers were not given an opportunity to defend themselves. Thus, IBM managed to get the court order by deciding itself what the truth was and convincing the judge that the articles contained "inaccurate" statements. A reading of the case transcript indicates that the Justice Dept. feebly protested the IBM request for the press gag order.

Moreover, the newspaper stories that IBM complains about reveal that Justice Dept. officials made only rather meek and innocuous background statements on the case. In fact, the Justice Dept. was merely defending itself in some cases from suggestions that it was not pursuing the case aggressively enough. (Indeed, no one has yet accused the Justice Dept. of ferocity in the case, which was filed nearly four years ago.)

As originally written, the court order on the press was broad enough that it could have been interpreted as restricting anyone even remotely connected with the computer industry from communicating with the press about the case. It was not until the Association of Data Processing Service Organizations (ADAPSO) protested the court order—ADAPSO called it an "order of secrecy"—that IBM and the Justice Dept. stated that the order restricted only their statements to the press about the case, thereby clarifying for the first time that the order did not apply to employees and consultants employed by some 3,400 companies giving depositions in another IBM antitrust suit.

As this is written, Judge David Edelstein was moving to clear the way to facilitate press coverage of the case. He has, however, turned down a move that called for the lifting of the restrictive press order.

But the whole flap raises a fundamental issue about IBM. For decades IBM has had a phobia about unorchestrated publicity. IBM is to the computer industry as Greta Garbo is to the movie industry. The elder Thomas Watson set the pattern. And until very recently it was easier to get an audience with the Pope than an interview with top IBM executives.

In the U.S., the World Trade Corp. remains a mysterious operation although it contributes more to the firm's profits than the domestic operation. U.S. reporters can't even obtain the press releases that World Trade sends out from New York to the press in Europe. Self-service copying machines have been removed in favor of manned machines and Polaroid cameras are newly forbidden. It is a world of card-key locks, secret buzzers, and snooping managers. An IBM house organ—"The Harrison News"—reveals that such steps are necessary largely because of leaks to the press. IBM just won't discuss much of consequence with the press, or with anyone else for that matter. Alan Abelson of *Barron's* perhaps summed up the IBM-press syndrome best when he wrote: "The company forthrightly admits to making computers, but meaningful communication usually stops right there."

Now all this taken together adds up to what may be the ultimate in corporate secrecy. What is considered routine news and information for stockholders and the public by other companies is guarded like atomic secrets by IBM.

The computer industry is at the heart of a technology that is revolutionizing the world, and if that computer industry is monopolized by IBM—as the Justice Dept. charges—then there is all the more reason for IBM to be open so the world can gain some knowledge about what IBM is doing to it.

Attempts by IBM to gag the press by cutting it off from its normal channels of communication can only lead to more suspicion and raise doubts on any final decision rendered in the antitrust case. Indeed, IBM could well be the chief beneficiary of extensive, fair and open press coverage of the antitrust case. —W. David Gardner

Workload leveling
and dollar savings are not the only benefits

Centralizing Computing Services at North

North American Rockwell Corp. announced its intention to centralize computing operations in June, 1970, and full centralization was achieved in August, 1972. Between those dates much blood, sweat and tears were dripped on the carpet, for an undertaking of this magnitude results in a lot of hard work and some surprises.

Through centralization the following primary goals were expected to be achieved:

1. Significant cost reduction because of the improved cost/efficiency of the large scale systems.
2. Improved overall workload performance with better service to users.
3. Broader range of computing services to the Southern California divisions.

In actual realization, not only have these goals been achieved but several other important advantages of potentially greater return have materialized.

Recent history

Two years ago North American Rockwell Corp. (NR) operated four computing centers serving its five Southern California divisions. Now there is a single center linked to the original four sites by a communication network and satellite processors.

In 1970, NR had one IBM 360/85, six 360/65s and six 360/50s in these four installations handling its engineering and commercial workloads. Two years later, two 370/165s and one 370/155 are handling the combined processing load, somewhat reduced by the aerospace business crunch. Three 370/135s, a 360/22 and several 360/20s act as local processors and remote job entry (RJE) terminals.

What triggered the action resulting in these changes and what are their effects?

During the 1960s the business fortunes of the five NR aerospace industry divisions had driven their computing installations through the so-familiar cycles of growth and reduction, and it was rarely true that any of them had the "right" computing capacity for more than a short interval of time. The advancing state of computer technology contributed to this perpetual imbalance as NR moved through the 7094, 7010, and 360 eras with IBM and experienced the accompanying overcapacities, learning curves and settling times. This was a situation that badly needed stabilizing, but with the large, geographically dispersed workloads involved, the limited potency of computing hardware, and the lack of data communication facilities, no reasonable improvements were at hand.

For years the traditionally open-shop engineering computer man at NR had been grumbling about not having enough central processing unit power to do what he needed. He also bemoaned the slow job turnarounds of the old batch processes of the late 1950s and 1960s.

Corporate systems planners had watched helplessly through these years as the independent divisional system development staffs made redundant investments in financial and accounting systems, engineering, manufacturing and material systems, project control programs and administrative aids—all these happiness providers for the divisions but very little for the corporate managers. And what of standardized systems?

Into the breach steps the supercomputer of the 1970s, complete with multi-multi operating and control systems, communications features that work and greater computing power. Now it is possible to add the five out-of-phase work cycles and achieve stability, because it is practical, in NR's case, to create one manageable-sized installation which will do all the work of the five divisions. The speed of the cpu and large memory size will give the engineer his sought-after power, and the operating system software and reliable communications capabilities will greatly improve his job turnaround.

Coincidentally, the data transmission art improved during the late 60s so that it is right on schedule with a range of capacities and techniques to make workload movements feasible.

CENTRALIZATION PLAN—Fiscal Year 1972

Corporate Computing Center Major Tasks

Task No.	Task Identification	Schedule Start	Schedule Stop
11	Assess performance, capacity, and reliability before Rocketdyne transfer	3/1/72	5/19/72
12	Prepare for Rocketdyne workload transfer	3/1/72	5/8/72
13	Implement hardware changes	3/1/72	7/1/72
14	Freeze for Apollo 16 launch	4/1/72	4/25/72
15	Implement software changes	4/1/72	7/1/72
16	Transfer Rocketdyne workload to computing center	5/8/72	6/15/72
17	Assess performance, capacity, and reliability after Rocketdyne transfer	6/16/72	8/11/72
18	Prepare for Los Angeles Div. workload transfer	5/15/72	8/15/72
19	Transfer Los Angeles Div. workload to computing center	7/13/72	8/31/72
20	Assess performance, capacity, and reliability after Los Angeles Div. transfer	9/1/72	10/15/72
21	Develop and implement TSO	5/5/72	7/3/72
22	Implement APL	5/5/72	7/3/72
23	Implement configuration control system	3/3/72	7/7/72
24	Implement change request system	5/3/72	7/7/72

A sample of the top-level milestone plan used in controlling NR's centralization project. The centralization was completed, as scheduled, in August, 1972, but performance evaluation continued past that date.

American Rockwell

by J. C. Van Paddenburg

The cost-to-performance ratios of the large systems (370/165, 370/195, CDC 7600, etc.) are so advantageous that they must be considered, and yet they are too large in capacity to be used economically for any single division's need.

It was against this background of history and these current events that the decision to centralize its hardware operations was approved by North American Rockwell's corporate management committee.

Achievements

Less than two years since the decision to centralize, the primary goals have been met.

1. During the first year of operations (beginning 10/1/71) of the corporate computing center, a transitional year which saw new equipment come in and old equipment go out with costly overlaps and redundant expense, NR will realize a savings in total data processing costs, rather than the substantial temporary cost rise one might reasonably expect. In subsequent years, computer operations cost savings of about 10% are anticipated.

2. Currently, the combined divisional workloads total about 2,500 jobs per day. The average job turnaround time, defined as the interval between reading the first card through the card reader and printing the last line on the RJE printer, is an average of 1½ hours for all 2,500 jobs. This is much better service than ever before at NR, where at times one-day turnaround was normal.

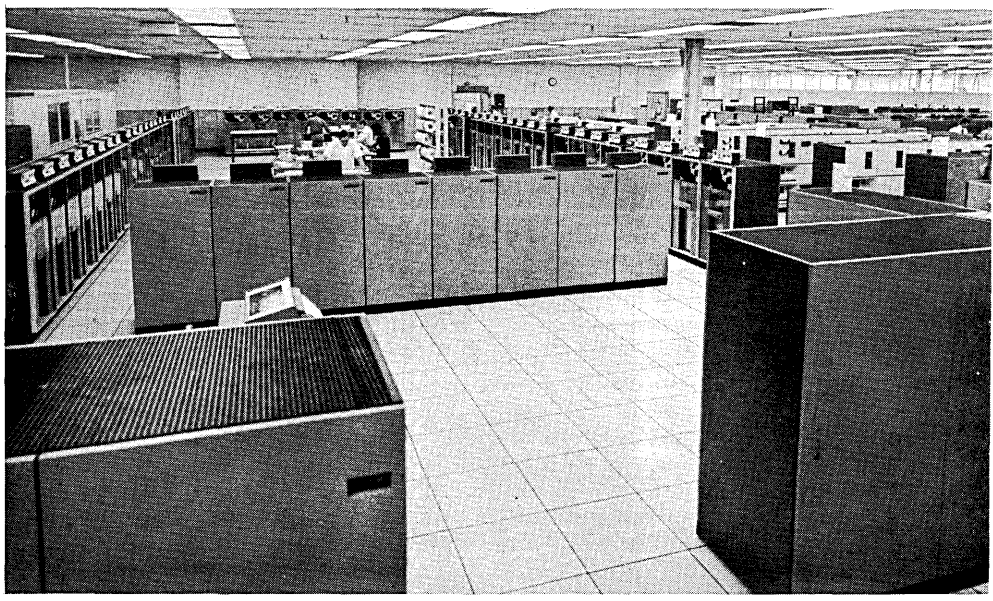
3. The spectrum of services offered today includes over-the-counter batch, RJE batch, IMS,[1] TSO, ATS, APL, CRBE, and a variety of application services such as GPSS, CSMP, Mark IV and AutoFlow. This is a greater number and variety than previously offered to the users of any NR divisional center.

In other aspects, however, advantages of equal importance are attainable as a result of centralization. It is now possible to achieve commonality and standardization of systems and avoid the waste inherent in development, operation and maintenance of similar systems at different locations. A case in point is the recently completed on-line payroll-personnel system which is now used at all Southern California plants and several other company locations. It will gradually be installed throughout the company wherever it is appropriate. Following on, one can visualize a standard accounting system and others in materiel, manufacturing and engineering areas. The important step in opening the door of feasibility has been taken.

Corporate-wide systems yielding new levels of visibility and control are now practical. For example, soon after he was assigned responsibility for the computing center, W. W. Booth, NR corporate vice president of finance, ordered development of the financial data system, the first phase of which is now in operation and produces a monthly consolidated balance sheet and P&L statement of NR's 140 plants within two days after month-ending closing. Other corporate systems are in development, and if there is any desire for a corporate management information system, one has to think that dp centralization is a positive step toward its attainment.

The natural leveling which resulted from combining total workloads of several divisions will sustain a stable environment and allow more effective short and long range planning of dp services and resources. The individual workloads rise and fall with independently varying frequencies, but historically at NR the total of all has been relatively slow changing.

Gradual standardization of the operational characteristics of the several heterogeneous workloads will yield increased efficiency and corresponding capacity increases or cost reductions. This operational standardization will put NR in a better position to realize the advantages of the next generation and beyond, assuming that further capacity and performance increases are to come. Had we remained fragmented and dissimilar, each fragment would have reached its limit of ability to exploit technology at a level somewhere between the 370/158 and 370/168. Odds are that this cutoff point would be too low to reap all the harvest that



In 1970 North American Rockwell had one 360 model 85, six model 65s, and six model 50s located in four installations. Now two 370 model 165s and one model 155, all in the room shown above, handle the combined processing load.

[1] The alphabet soup is IBM-ese for certain standard systems:
IMS = Information Management System
TSO = Time Sharing Option of Operating System 360
ATS = Administrative Terminal System
APL = A Programming Language
CRBE = Conversational Remote Batch Entry
GPSS = General Purpose System Simulator
GSMP = Continuous System Modeling Programs
Mark IV is a data management system from Informatics Inc.
AutoFlow is a flowcharting program from Applied Data Research.

lies ahead, given an abiding faith in the continuing development of bigger and better for less (see DATAMATION, May, 1972, p. 71).

Months of planning, evaluation of alternatives, collecting and cataloging of requirements, forecasting futures, second-guessing suppliers and cajoling the doubters were put forth by a corporate staff group and several divisional teams. That effort produced a centralization plan, an equipment configuration (which is now installed two years later and which does the job) and a specification of the centralized service function.

In June, 1971, one year after decision day, a new management team headed by F. J. Knepper took over the 360/85 installed at one of the divisions and already performing some work from a second division.

Operations staffs were acquired by interdivisional transfer in October, 1971. Delivery of the two 370/165s was accepted, and the real centralization began, to be completed 11 months later. Much activity of very detailed planning, parallel job running, procedures development, documentation, training, coordination, job cleanup, JCL changing, modification of the library of cataloged JCL procedures, performance measurement, capacity calibration, new service startup, tape library system development, production scheduling, and on, and on, was crammed into those 11 months. A number of difficulties and unexpected events were encountered, and hardware startup troubles were very much in evidence. All these things should be expected by the initiated, but they are nonetheless difficult to get over.

The important thing to say is that there were no insurmountable technological problems—just a lot of hard, state-of-the-art work.

There are few secrets that can be revealed or helpful hints to be passed on to others who would centralize. Like any other large project this one depended upon capable people, careful and thorough planning, and industriousness. Careful evaluation of conditions at the start, statement of the end objectives desired, and a good project plan complete the requirements.

North American Rockwell had some important advantages at the outset of its centralization activities. Most important is the company's sizable staff of talented dp professionals who already had the knowledge and ability to carry out successfully the tasks of centralization. In other aspects, the open-shop mode of engineering computing had been well disciplined and standards were set down and communicated through a computing handbook. Business dp systems, although less controlled, were for the most part well developed in OS/360, except for a bothersome amount of IBM 7010 emulation. The ASP control program and OS/MVT were in use throughout, but with local modifications which had to be incorporated in total or standardized. RJE and teleprocessing applications were in widespread use.

By capitalizing on these advantages the planning staff was able to devise a centralization concept which did not introduce any really major changes in the conduct of the dp services to which the users were accustomed. Had this not been possible, that is, if there had been entirely new major services necessary to create and install, massive training programs to be conducted, selling campaigns to be carried on and great documentation efforts to be completed, then much more time would have been needed, more difficulty encountered, and more expense incurred.

Present mode

Thus far, NR has centralized the following functions and resources:

- Major computing equipment and operations
- Operating systems development and maintenance
- System documentation
- Requirements and planning activities
- Corporate application system development

New functions of user coordination, communication network planning and time sharing and communication software development have been created.

The elements which have not been centralized are:

- Certain local satellite processing functions
- Input data preparation (keypunching, etc.)
- Output data preparation (printing, distribution, etc.)
- Divisional application system development
- RJE terminal operations

Business dp job setup and control functions are handled in different ways. For some divisions, the computing center is performing this work; other divisions run business production jobs entirely in an RJE mode with all control handled locally; and in another case, a mixture of the two methods is being used.

The three major computers, two 165s and one 155, are operated as a triple-MAIN LASP[2] system. LASP, running in one 165, controls a single job stream from 17 RJE terminals and the central card readers. Jobs are routed to the three main processors which run in OS/MVT mode. In addition, each computer performs certain of the dedicated on-line systems.

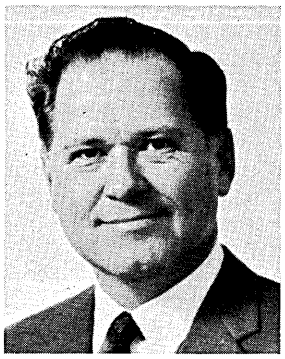
About 90% of the jobs are transmitted to the center from RJE terminals. Those jobs with relatively modest amounts of output are printed at the RJE terminals. Printing for jobs with large output volumes is done at the divisions on their 135 or 22 from mag tapes couriered back from the center.

Half of the magnetic tapes are stored at the center and the remainder at the divisions, with much circulation between. Tape library control, as a result, has been one of the difficult areas and still causes delay in a few jobs each day. Random access data sets are stored and updated centrally.

An extensive set of plots and reports of performance data has been created so that both the users and the management of the center can observe the quality of service. A priority system controls job scheduling and a scheme for change control and configuration management safeguards integrity of the service.

Summary

By centralizing its data processing operations, North American Rockwell Corp. has put itself in a position to realize corporate-wide the full potential of very large computer systems. In this case, having some significant front end advantages, centralization was not unachievable, but was arduous and challenging at best. Having completed the task, NR believes it worthwhile and would do it again. Notably, there were no insuperable technical problems. □



Mr. Van Paddenburg is assistant general manager of North American Rockwell Computing Services. He has worked in the computing field for 23 years subsequent to his BA in mathematics from UCLA. Among other positions he has held are vice president of Commercial Division for Computer Sciences Corp., head of systems & operations for Aerospace Corp., and director of computing services for Aerojet-General.

[2] LASP = Local Attached Support Processor, a version of ASP. Triple-MAIN LASP is an operational mode in which the LASP control program runs in one computer and controls the batch processing in that processor and two other processors.

Even though the equipment is centralized, there are advantages for both systems people and the users in decentralizing systems development

Decentralized Development

by L. A. Tomaszewski

A movement toward user-oriented systems has stimulated the need for a new approach in the organization of information systems development professionals. User-oriented systems can be defined as those in which the user and information systems professional together clearly delineate the thought process of the user, as opposed to the architectural approach by the technically trained systems professional.

How can a systems professional tell when a system is not user-oriented? One indicator of that situation might be the actual maintenance costs of the system exceeding the original development costs. Excessive maintenance costs are generally due to (1) a lack of close communications between the user and the developer, (2) excessive and/or continuous new system requirements imposed on the information systems development (ISD) organization by the user, or (3) poor initial systems design.

Is the system "responsive" to the user's real needs? Many systems developed today are capable of producing more data than the user can possibly digest. How often have you seen systems where the line organization would receive several hundred pages of output only to find that one line of the information was incorrect, thus requiring another run? The user ends up spending most of his time making corrections and little time for information analysis, which is why he asked for computer assistance in the first place. This industry problem can generally be traced to poor systems design.

Another item to be conscious of is the amount of time the user spends in updating the data base. By becoming "involved" in the day-to-day operations of the user, the systems professional may suggest minor alterations in manually prepared reports to allow for direct keypunching.

Does the system being developed include the "practical business experience" of the user? The user has been doing his job manually for many years, and his judgment should be acknowledged. How often have you heard the phrase: "That user just doesn't know what he wants"?

It could be that the systems professional, being limited in his knowledge of the business world, cannot make a true evaluation of the user's problem or proposed solution.

An "interface gap"

In many large companies, the development of computer-based information systems has evolved from a central development organization dedicated to the support of users who are unfamiliar with the working concepts employed by the system professional. This has resulted in an "interface gap." This interface gap between user and developer can best be attributed to a sequence of events which have occurred over the years.

The First-Generation Gap. During the early 1960s, one of the major objectives of automation was the reduction of clerical costs. The user's fear of job insecurity, brought on by automation during this period, created an adverse attitude towards data processing. Furthermore, because of the user attitude, the true value of data processing was not recognized immediately and acceptance of this technological advancement throughout industry was not achieved as anticipated.

The Second-Generation Gap. Second-generation computers brought about other obstacles. The information systems professional was caught up in re-educating himself in the latest computer techniques while management became dissatisfied with the promise of cost savings which seldom materialized. During this period, the user's knowledge of the job and the information systems professional's knowledge of computers brought about a language barrier. This situation created an unwillingness for both the user and the developer to work and cooperate with each other.

The Third-Generation Gap. Third-generation computers brought about new problems. With the introduction of total system concepts, the user was forced to interface with other organizations. While this broadens the user's knowledge of the company business, his sense of loyalty to his own organization makes it difficult for such a concept to become a reality.

The data processing center has become a closed shop. No longer is the user admitted to the data center where he can see the sophisticated machinery which has aided his daily requirements.

Technically trained systems people were being drawn from the predominately non-business-oriented fields, such as engineering and math. While some degree of change has occurred by employing those individuals with com-

puter science degrees, the practical business orientation is still neglected.

As information systems development enters into fourth-generation computers, the role of the user becomes an increasing factor in the success of information systems, and management must take a greater role in support of these systems. This can best be accomplished by organizing the development activities in a manner more conducive to the needs of the user.

Centralization vs. decentralization

With the cost of computer systems personnel escalating during the early 1960s, many large companies attempted to obtain greater efficiency by centralizing the development activities, much as typing pools have been centralized. This type of organization has wide acceptance, and there are advantages in favor of such an organizational structure. Some of the advantages of centralization are:[1]

It enhances the effectiveness of building an information systems organization of well qualified and highly motivated systems professionals.

It improves the coordination of the systems development function.

It provides flexibility in the utilization of manpower resources to the systems development organization as a whole.

It reduces the amount of data and systems redundancy found in most companies where decentralized development organizations exist.

It provides standardization of system documentation procedures.

The advantages for centralized development seem to suggest that such a structure for systems professionals is adequate. However, there are several questions which should be of vital concern to the management of ISD organizations.[2]

Is the ISD organization becoming intimately involved in the major opportunities within the line organizations?

Does the management of major line organizations have access to a responsive systems group?

Has the ISD organization become an unresponsive bureaucracy?

Does the ISD organization have weak support from the line organizations?

Unfavorable response to the preceding points indicates that a systems professional cannot effectively design a computer system unless he becomes "involved" in the daily routines of the line organization, especially if he spends most of his time in a central area far from the main stream of the business.

The "gypsy" staff

My solution to "bridging the gap" between the user and the developer is to assign systems professionals to a mobile staff department, which I refer to in this paper as the "gypsy staff." Talent would be drawn from this group depending upon the system to be developed. This type of organizational structure (Fig. 1) would find the systems professional reporting administratively to a systems development and technical guidance department and functionally to a line organization. The information systems staff members would be physically located for a period of time within the line organization.

Essential to the success of such an organizational structure is the practical business experience each systems professional has acquired during his career. Such an individual is rare in the information systems development field; when found, management usually places him in a line organization.

I stress the term practical business training for two important reasons. First of all, it is difficult for a systems professional to understand the everyday problems of the line organization without having firsthand knowledge. Secondly, it becomes extremely difficult for a user to interpret the language of the systems professional of today. The systems professional who has practical experience can and will bridge the language barrier gap. Additionally, the professional and managerial development of junior information systems people would be enhanced in the proposed environment.

Systems development and technical guidance. An important position in the gypsy staff organization is the systems development and technical guidance department. The individual in charge of this department has the following responsibilities:

The establishment of job priorities and the distribution of manpower resources based on each systems professional's experience.

The standardization of information systems documentation and programming techniques.

The technical guidance for each member of the staff.

The reduction of redundant data and systems.

Obviously, this individual cannot accomplish his tasks without a group of talented project leaders. These individuals serve as the focal point for technical guidance of the staff and the coordination of systems development effort. In addition, the head of this department must also have a management project control system for measuring the effectiveness of development effort.

Maintenance. Continued development effort on systems after implementation would be performed by a centralized maintenance department. While management may decide to use this department as a training area for information systems associates and newly acquired systems designers, the core of this department would be made up of the organization's best programmers. Responsiveness is the key to the successful maintenance department. Technical writers, with exposure to information systems development, could be employed to maintain the system documentation. This department works closely with the production systems management (PSM) department after implementation of the system occurs.

Production systems management. The PSM department is a relatively new concept in ISD organization; but because of its impact on operational systems, this department is perhaps the most vital asset of the organization. The PSM department supplies the following support:[3]

Provides an interface between the line organization and the data center after a system becomes operational.

Performs as a catalyst in expediting jobs through the data center.

Performs as the company's data base administrator.

Performs production problem solving.

A significant aspect of this department is that it serves as a public relations department to the rest of the ISD organization. Keeping the user happy after implementation is a problem which all ISD organizations must face, and the PSM concept appears to be at least a partial solution.

Advantages of the gypsy staff

There are several advantages in implementing the gypsy staff organization. First of all, the responsiveness by the ISD organization to the line organization needs depends largely on the degree of involvement in the gypsy staff role. The systems professional is physically located within the line organization, thus giving him full exposure to the daily requirements of the user and the creation of systems which are more user-oriented. In fact, he needs to become a working member of the line organization for a period of time, even to the point of helping to

[1]Mayford L. Roark, *Centralization Versus Decentralization of MIS Effort*, (Proceedings—Second Annual Conference of the Society for Management Information Systems, September 14-15, 1971).
[2]Ibid.

[3]Dwight E. Thomas, Jr., *Management Information Systems—What Happens After Implementation?*, (American Federation of Information Processing Societies, 1971), Volume 38, pp. 277-281).

run the operation.

Secondly, the systems development staff is not saddled with the job of maintaining the programs and the systems after implementation. This effort is performed by the centralized maintenance department which has been properly trained for maintenance activity. This allows the gypsy staff systems team to expand their knowledge into other areas of the company when new systems become available. As a suggestion here, the time between staff assignments could be used for the technical training of the gypsy staff.

Third, the systems developer becomes a true professional by gaining greater exposure to the practical business world. Such exposure, coupled with this technical education and experience, builds line management confidence in the abilities of the ISD organization to meet their requirements.

Another feature is that the user and the developer agree that a job has to be done within a specific time period and budget constraint. This approach is similar to one contracting to have a house built; the concerned owner will make certain that the house is constructed according to specifications and that the price tag has not substantially increased.

A disadvantage of the gypsy staff

One disadvantage of the gypsy staff development organization is the amount of coordination that has to be done. If the individual in charge of the staff has a closely coupled department, this problem can be resolved. However, it is recommended that each company analyze its particular organizational structure, policies, and manpower resources before implementing such an organization as the gypsy staff.

The role of management

As stated previously, management must take a greater role in support of information systems. One of management's most important roles in the gypsy staff organization is to create a climate of support throughout the line organizations for the staff members. Without this support, both staff members and line organization personnel are likely to become discouraged.

Gaylord A. Freeman, Jr., chairman of the board of the First National Bank of Chicago, states that "the climate of support of top management is really a total commitment of top management now and a continuing dedication to maintain that commitment in the future."[4]

A second important role management must play in the success of the gypsy staff organization is that of "involvement." To accomplish this role, the following guidelines are offered:

Establish periodic meetings with the systems development team. Such meetings should be a must, especially during the initial stages of development.

Obtain a schedule of milestones outlining the various stages of development. Performance against such milestones should be measured as often as is necessary.

Establish a budget for the staff function in conjunction with the project leader(s). A separate account number should be set up to collect actual expenditures. A good management project control system within the existing ISD organization will include such information and it may prove adaptable.

Remember, the interaction between management and information systems staff members must be the interchange of job experience and technical know-how; but also, the job must get done in a reasonable amount of time and within the budgeted dollars.

Conclusion

Communication between the user and the developer has become a serious problem within recent years. One way to remedy this situation is to structure the systems development effort on a temporary "floating basis" within the line organization. This decentralization of systems development effort affords line management with the best talents the ISD organization has to offer. The job experience which the

[4]Gaylord A. Freeman, Jr., *The Role Top Management Must Play in MIS Planning and Implementation*, (Proceedings—Founders Conference of the Society for Management Systems, September 8-9, 1969).

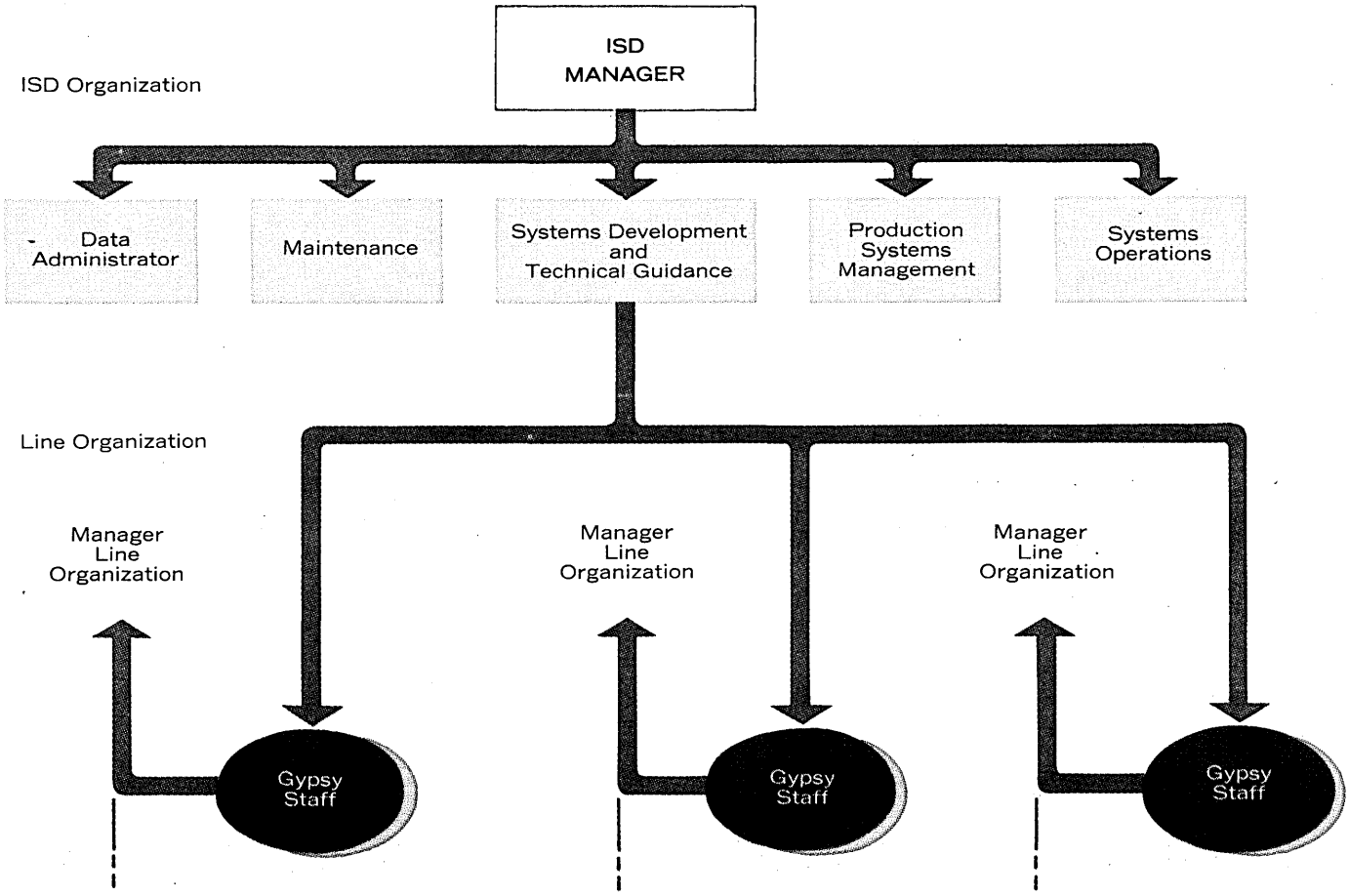


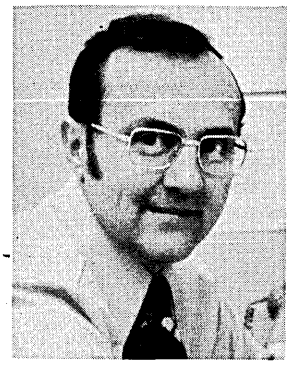
Fig. 1. Gypsy staff organization.

systems staff member absorbs during his stay in the line organization will undoubtedly make him of greater importance to both the ISD organization and the company. In turn, the user becomes more knowledgeable in the uses of the computer and finds much pride in being part of the systems development team.

The following comment from one executive concerning centralization of the ISD organization was documented in an American Management Association Research Study based on in-depth interviews with 91 executives representing 16 companies and 9 industries.

"Centralizing the hardware and its operation makes some sense, but there is nothing to be gained by centralizing or controlling software and systems planning. An operating manager has to know what form he wants information in before the computer can give it to him in usable form. With centralized systems development, he may get more information than he needs or can use. Under this centralized approach the edp organization no longer is a staff group providing information. Instead, it becomes the master architect of what it wants done in the company."[5]

The ISD organization must be a dynamic organization, one which is constantly looking for new ways to improve its function, that being to fulfill the needs of the user in a changing environment. □



Mr. Tomaszewski is an information systems staff member at Western Electric Co., Inc., in Greensboro, N. C. Since joining Western Electric in 1967, his assignments have included development of project measurement systems and the use of Dept. of Defense performance measurement criteria. His present assignment is systems evaluation and efficiency studies. He has a BS from Florida State Univ. and an MBA from Rollins College.

[5]Robert R. Reichenbach and Charles A. Tasso, *Organizing for Data Processing*, (American Management Association, Inc., Research Study, 1968, p. 53).

Theoreticians may debate the topic fruitlessly, but a management information system has become an absolute necessity for successful operation of a large and complex business enterprise

An Executive View of MIS

by Terrance Hanold

Whether there can be a management information system was once a matter of great debate. And there were signs for a time that exhaustion had settled the issue. The debate had been prolonged but hardly profound, so we were grateful for the respite. But recently the charge that MIS is a mirage has once more been raised in the *Harvard Business Review*.

Truth, it seems, is always on the scaffold and Error on the throne.

Scholars, too, I suppose are human. At least the claims of charity require this assumption. But where the rest of us rely simply on blunt assertion to support our biases, they with greater guile clothe their prejudices in the guise of reason.

The classical and perhaps the deadliest weapon they employ for the subversion of truth is the scholastic debate. Even lower in bad eminence is the scholastic spurious debate, where he picks an absent opponent, often unnamed and always unaware of the contest, sets all the terms of the argument, imposes all of the assumptions employed and, if he is worthy of his PhD, demolishes his adversary with considerable ease. This, of course, is the favorite strategy of those who write business review articles.

It is a despicable, villainous device.

Let me advise you in confidence that this is exactly what I now propose to do myself.

As the description of the system he proposes to disprove, my anonymous antagonist (John Dearden, Herman Krannert Professor of Business Administration at Harvard University,

> . . . how an MIS comes into being, where its direction and control are properly lodged, and why it is essential . . .

"MIS Is a Mirage," *Harvard Business Review*, January-February, 1972, p. 90) quotes the following:

> "A management information system is an organized method of providing past, present and projection information related to internal operations and external intelligence. It supports the planning, control and operational function of an organization by furnishing uniform information in the proper time-frame to assist the decision making process." (Walter J. Kennevan, "MIS Universe," *Data Management*, September, 1970)

Whether or not acute analysis might modify it in part, this is a competent and sufficiently extensive description of a management information system.

How does a scholar go about its destruction? His first effort at discreditation is to describe it as "grandiose." Aside from the charge itself, he offers nothing but ridicule to support the description. Then to give it a character it does not claim, he attributes to the definition the universal dimension of a *total* management information system. Quite clearly, the author of the statement makes no such claim of universal content, and it is certainly not fairly subject to attack on that score. It includes only information capable of systematic collection and of organized processing and presentation in a business environment.

The next means of establishing the proposition that MIS is a phantasmagorical mirage is the attempted demonstration by logic rather than by evidence that the creation of a *total* management information system is beyond the capability of man.

He declares the fact that certain rival business schools now offer MS and PhD degrees in management information systems. Such persons, he says, "must clearly be technicians and would have little impact on most of the information supplied to management, particularly at upper levels." Since the author is engaged in the manufacture of Masters of Science and DBAs, his authority on this point far exceeds mine, and I must accept his estimate of their fundamental incompetence to create a useful product. So this category of potential inventors of an MIS is by concession disqualified.

In order to disqualify the rest of the world, he imposes on us his assumptions that the creator of a management information system must be a special-

This article is based on an address to the Midwest Conference of the Financial Executives Institute. A portion of the text appeared in the *CPA Journal*, published by the New York State Society of Certified Public Accountants.

ist, that he must attack the information system as a whole, and that the systems approach must be used in making that attack. This, of course, indulges in the contradictory assumptions (1) that management is incapable of participating effectively in the designation of the content and methodology of an information system and (2) that anyone outside of management would be incompetent to define what management needs. By this system of logic, he attempts to disqualify that part of the world other than doctors of philosophy from competence in this field.

But the only person unequivocally excluded by this misshapen logic is my anonymous antagonist himself. The willful logic of small minds is hardly the proper test of the fact or possibility of an MIS. The best evidence, I think, follows from experience. With this beginning I should like to describe how an MIS comes into being, where its direction and control are properly lodged, and why it is essential to a modern business organization of scale.

Information is at the core of my subject. Hence a few minutes' reflection on the nature of information is an unavoidable inconvenience.

Information has to do with the communication of knowledge inspired by observation—with the interchange of thoughts and ideas proceeding from experience. A more expansive definition embraces knowledge derived from study or instruction as well. So the contributions of the schools are under no ban of exclusion from information if we take a generous view.

Information is different in kind from data. Information has the attribute of communication which data does not have. In the context of business, data is merely the digital shadow of haphazard events indifferently recorded. It enters our data bank in the accidental series of occurrence in time. And even that degree of order is indifferently observed. Each bit is a meaningless fragment in itself, and the mass communicates nothing.

Yet information begins with data. Data is transformed into information through the infusion of purposeful intelligence. Thus information is data refined by intelligence so that it communicates meaning or knowledge, and in the course of communication will inform one or more parties to the interchange with ideas or conclusions.

Further, the quality of the information resulting from this alchemy can be of several degrees, depending upon the sophistication of the intellectual tools applied to the data and to the nature of the actions which the information process must support.

In the ordinary affairs of life, data is transformed into information on an extemporized basis. We make no pretense at a systematic collection of relevant data, nor do we pretend to apply consistent principles, values or methods to its treatment. Thus when eggs are on the breakfast menu, my wife may advise their rejection today because the cholesterol level revealed in my annual physical report is at the top of her consciousness; tomorrow, under the same circumstances, she may insist that I have them because eggs and grapefruit have a tempering effect on my weight.

But in a business context, information must be developed in systematic fashion if it is to merit a confidence level warranting immediate credence and use. Our initial statement of meaning emphasized that information is the *communication* of knowledge. Credibility is at the heart of communication, and the speed with which information is communicated determines its worth.

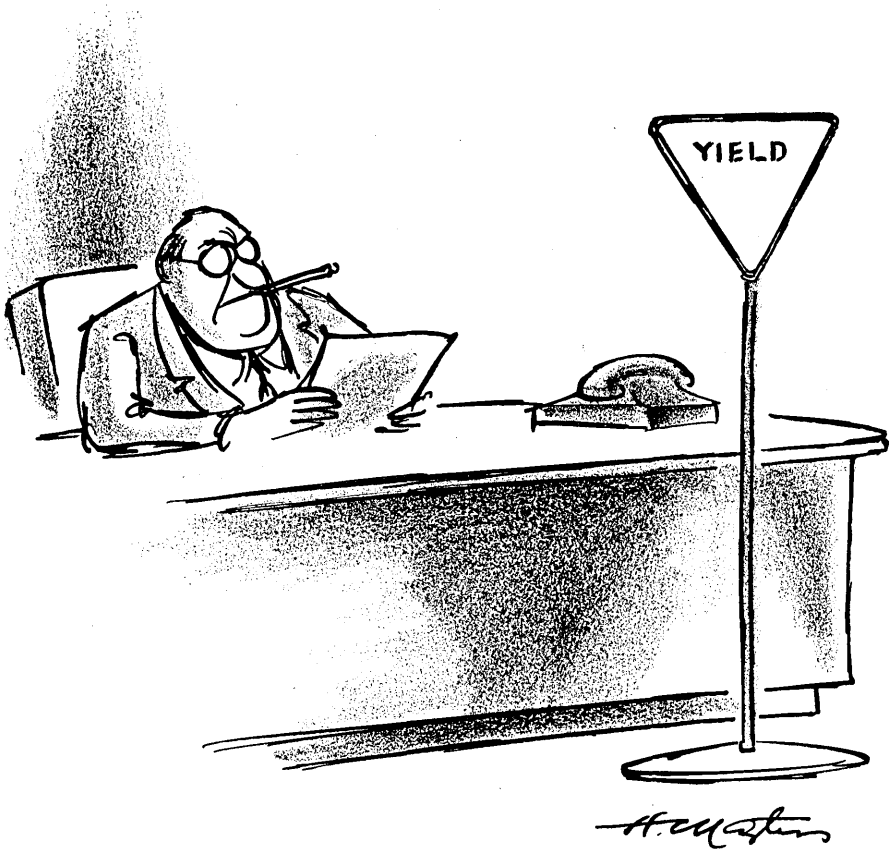
Information begins with data, but it is data infused with an organizing and purposeful intelligence.

I neither deny the value nor decry the use of intuitive rather than systematic information in the critical case. It is occasionally an essential exercise of business expertise. Mutations in corporate practice are as necessary as in the realms of nature when environmental adaptation requires it. But it has an infrequent place in the continuing conduct of a business. And it is legitimate for use in the exceptional case only after the systematic information has been examined and found not quite adequate.

Business information, then, requires the systematic collection of data and its systematic processing according to a series of intellectually valid methods. The output of the system will communicate knowledge which will dictate or assist the selection of action decisions in fields to which the data and the methods are relevant.

Managerial Information. Now, let us consider the nature of *managerial* information. Is managerial information a subclass of business information? We may at least assume that to be the case for the purpose of inquiry. And it is certainly true that, as there is a hierarchical difference between data and information, so there are hierarchical differences between the several levels of business information and between the information systems which serve them.

Information Systems. The definition of a management information *system* raises the fiercest disputations vented



since the Diet of Worms. As an honorary founder of the Society for Management Information Systems, I follow its proceedings with the closest attention. Since the scope of its function obviously depends upon a definition of such systems, it is an area of principal controversy among certain of our members.

After much informal debate and a few unilateral pronouncements by our more authoritative fellows, a formal colloquium on the subject was arranged. For eight hours the subject was collectively threshed. Each participant assailed every definition proposed, including his own, from id to ibidem. None received acceptance by vote, consensus or extrasensory perception.

So the field is free to each to adopt his own as long as he agrees to impose it on no one else. Perhaps the humanistic approach suggested by Bishop Walton in opening one of our annual sessions is the most appropriate for group therapy. He said, by way of paraphrase, "It is almost impossible to define an information system, but it is easy to recognize one." So I shall describe a managerial information system as I see it.

An information *system* defines the data needed to generate the information required to serve a specific business function. It employs a data collection system; a data transmission system; a data storage system; a data retrieval system; an appropriate array of intelligence infusion systems, which are usually described as software or application programs and which employ the principles and methods of the function or discipline served; and an information/communication system.

MIS Described. As distinguished from an *information* system, I conceive a *management* information system to consist of a *cluster* of business information systems. MIS is a symbol rather than a descriptive name, which designates an integrated complex of information systems of such variety and sophistication and interrelationship as experience qualified by rational assessment determines to be essential or useful to the general or executive management of the business enterprise.

These are ordinarily conceived to be strung on an electronic network with a myriad of mind-boggling devices. For any particular information system, it may be demonstrated that there is no need for a computer or random access files or remote terminals or any of the other electronic gear that decorate our offices and inflate our equipment accounts. The span and effectiveness of the information system justify its name, not the apparatus which serves it.

But the conduct in concert of a complex of information systems is in practical terms impossible without a computer.

The Accounting Information System. Accounting supplied the first business information system, I suppose. Accounting defined the data needed to generate the information required for its purpose as that data relating to the assets and liabilities of the firm and to transactions affecting those assets and liabilities. It collected the data needed by the accounting system through the day book, gave it order by processing it through the journal, and meaning and relationship by transferring these entries to the ledger according to the shifting principles and prejudices of the profession. Accounting communicated the resulting information through the balance sheet, profit and loss statement and supplementary schedules.

From the accountant's viewpoint, only the compulsions of time have made a transfer from manual to mechanical to electronic methods tolerable. As far as he is concerned, no change in the accounting information system has occurred in consequence of this shift in tools. Taken by itself, an accounting system is an accountant's information system and not a managerial information system. Only as it becomes entwined in a complex of several information systems does it become a part of a whole deserving that cachet.

Accounting and MIS. An MIS dealing with numbers of information systems as an integrated complex can hardly be established or operated or utilized by management unless they are all threaded together on a computer-directed network. And if it is to succeed, the threading must somehow be directed by the management, not by accountants or systems types or other functionaries. Let me try to illustrate this point by a scatter of examples from one of our businesses—our flour milling enterprise.

> . . . this change from skill-centered craftsmen who knew their job to knowledge-centered professionals who knew their world . . .

Each car of wheat received at one of our flour mills results in an entry which discloses the cost per unit, an official classification, an official grade, a total weight, a protein analysis, a bin location in our elevator where it is stored, a freight transit credit in most cases and several other bits of data. All of these pieces of data are collected in our central data bank.

In the course of processing this data, we derive an inventory of our wheat. Since each shipment loses its identity in the bin in which it is placed, the inventory of each bin is an average of the type, grade, protein, cost and so forth of its contents. We derive accounts payable in favor of the seller. A transit credit account and other fascinating offal of the milling accounting process also result. So by processing this data into like or related classes, we begin its transformation into information.

Concurrently, it is hoped, sales of flour are being made. As orders are received, they are scheduled for production. The central production department allocates orders among the mills by means of a program which employs inventory data, data respecting the location of each mill, the character of wheat supply tributary to each mill, the delivery point of the order, the availability of transit billing suitable for application to its further shipment, the specifications of the flour ordered, the capacity and load balance of our mills and so on. This determination rests on data which have reciprocal as well as consecutive relationships and hence are handled best through computer-administered programs. These programs employ raw data from the data bank, as well as information derived from the accounting system. So information at one level of use is merely data at the next.

On receipt of its production schedule, the wheat committee at the mill uses another computer program to determine the optimum cost and quality of wheat mixes to be used to produce these orders. It is based on data respecting its wheat inventories and the array of orders directed to be placed on the mill. It also uses subjective data in our data bank respecting many functional characteristics of various types of wheat, their several milling qualities, yield and so forth. This program, of course, serves also to indicate the specified order in which these shipments will be manufactured.

The wheat procurement department is advised of the planned depletion of stocks by kind, grade and amount. So having a view both of the kinds and qualities of wheats consumed, of the future orders received or anticipated for milling at that location and the destination points, it makes plans for purchasing wheats in the market of the predicted type, grade, protein, origins, destinations, etc. Again, in making this decision, accounting information is used in combination with a great deal of historical crop and sales data.

Through these processes, an immense amount of market data accumulates respecting the total and seasonal uses of present and potential customers by product and by delivery point. Employing models of several kinds, the marketing department can determine the most profitable mix of products to

sell, to whom and at what destinations and by sales periods. In consequence, it is able to assign specific targets by time period, by customer and by product.

Finally, the general management in flour milling is able to make medium term forecasts, taking into account estimates of wheat supplies by origin, type, cost, estimates of the effect of these elements on prices, margins, volumes and product mix by market area. By varying the data and assumptions, they derive alternative strategies to fit changes in wheat supplies, transportation costs, competitive action and other contingencies. Necessary capital investments, distribution networks, sales force assignments and personnel requirements are also indicated.

What we see here briefly and simplistically is the transformation of data to information for use in immediate departmental actions through the injection of the functional intelligence of that department. As each informational component is successively woven into other data processed through further functional methods and intellectual disciplines, we ultimately reach a system complex and a volume and variety of informational flows which begin to match the needs of the general or executive management. Only at that point do we begin to justify the label of a managerial information system.

The structure begins with the primitive selection and abbreviated classification of data according to the accounting dictate. Accounting is first concerned with an orderly record of every item and movement and transformation of firm assets and of every contract and obligation of the firm which may enhance or diminish those assets.

This is first-level knowledge of critical importance which is not diminished by its position in the managerial scale, but it hardly rationalizes or utilizes all of the data in the bank, nor does it apply all of the talents, such as procurement, production, finance and marketing, that the development of managerial information requires.

Information begins with data, but it is data infused with an organizing and purposeful intelligence. The initial intelligence applied to data is that of accounting, but a whole array of disciplines is introduced into the process as it proceeds to managerial use. The base of the data during these successive processes is perpetually expanding in both detail and extent.

"Why, yes—the conference **was** held in Anaheim. How did you guess?"

Thus, information is data infused or refined by intelligence so that it communicates meanings not immediately reflected by the data alone. When information is communicated, it informs either or both of the parties involved. But the nature of the information conveyed will differ according to the function of the person informed and according to the point in the informational hierarchy from which he derives his information.

We have arrived at the conclusion that accounting produces an information system almost adequate for accountants. We have found that an accounting system is not an MIS because it is not designed to develop the data or to communicate the information required by the multiplying disciplines which must today feed business management. That system is designed to collect only such data as accountants deem relevant to their function and to put that data in such order, to marinate the data in such values and principles, and to subject the data to such procedures as are embraced in their particular functional philosophy.

The burden of management is to influence the future favorably, and even predictably.

These are not conclusions comfortable to accountants. In my defense may I be permitted to say that in my view Karl Marx somewhat overstated the case when he described accountants as "jackals of capitalism."

Disappointment is the product of expectation. As I remember it, 20 years ago the accounting profession felt it had the key to dominance in business decisions. It appeared to sprout from the revelation by our outside auditors of the breakeven chart. From the ranges of results it displayed we could readily select the proper sales and cost levels we ought to obtain, garlanded with an attractive return on investment. And these results could be neatly battened down and guaranteed by a set of controls derived from the DuPont chart room and administered by the accounting department.

Controls could forestall all mishaps and assure a golden future. And obviously the controller would be suitably adorned with dignities and powers and a seat at the right hand of the chairman almighty.

But something unfunny happened on the way to the board room. A number of analyses have since been made, and there are several nominees for the blame. And, of course, there is blame enough so that it may be distributed lavishly among them. Charity forbids that they be singled out. Collectively we may designate them as the inciters

of the knowledge revolution.

Technology made huge additions to the stock of data which could be made into business information. Computers performed its transformation at speeds and costs which made it economically useful. Computers also gave entry into the office of the "science of abstraction —mathematics" in a multitude of applications. This led to the professionalization of the established branches of business and to the invasion of the counting room by a host of new sciences and professions. Both the effect and the cause of this change from skill-centered craftsmen who knew their job to knowledge-centered professionals who knew their world was the transition of the business information base from a transaction record to a data file enormously wider in scope.

So business has advanced to the statistical analysis of the present and the mathematical computation of the future, while the controller was left to this arithmetical accounting of the past. Sic Transit Gloria.

What Now? Fifteen years ago the controller had the only rational and continuing information system in the firm. Today every department in the firm is developing a business information system suited to its function. And the general and executive managements are securing, by accretion if not by design, a management information system which is the composite sum of the lot, plus the contribution made by executive management themselves as required by their own functions.

Can the controller recapture the information monopoly he once embraced? Can he again become the croupier of the only game in town? I think not.

Each information system requires of its governor expertise in the function or discipline it serves. And an information system forms an organic union with those it serves. As Professor Whisler puts it, "Older technologies are extensions of man's hands and muscles and were his tools and servants, while modern information technology is an extension of man's brain and is his partner—or even his master." No manager can afford to tolerate an interloper here. He must establish his own direct, continuing, reciprocal, interacting involvement in the system, subject to no man's leave of hindrance and certainly subject to no man's control.

For these reasons, Pillsbury's corporate policy obliges each of its operating firms "to obtain full utilization and value from Pillsbury's Business Information System." To ensure this result, the policy provides that "the General Manager must assume responsibility for the definition of the information and processing requirements of his" operation. "A senior professional from the corporate department will be attached to the (firm) to serve as the General Manager sees fit in helping him to define his subsystem's requirements."

This same concept is carried to the corporate level. Our policy states that "Certain affairs of The Pillsbury Company are inseparable from its Executive Office. Among them is the Pillsbury Business Information System. Without immediate control of the design and operations of this system in its entirety, the Executive Office cannot effectively function. It is for this reason that PBIS reports directly to the Executive Office."

What Next? What becomes of "managerial accounting for decision making" in such an environment? How am I to deal with a letter from a young and ambitious member of the controller's group who expresses his point of view by this textbook quotation: ". . . it is felt that an accountant's role should not be confined to merely dealing with historic systems, data and controls. Along with looking at the past and present, he must also look to the future of the company which he serves. Nor should he be narrowly viewed as a corporate policeman, but more as an objective viewer of the corporate reality (performing an evaluative-mirroring function). While he may not be the supplier of answers, he can at least help to raise relevant questions and identify problem areas."

These phrases have a singing quality which appeals without persuading. It is the accountant's instinct to coach the manager respecting the decisions he makes, and at the end of the year, it is his function to sit in judgment on the results of those decisions. You and I understand the game, but the lads who are answerable to the world for the published results do not.

The MIS is the responsibility of the general and executive management.

They think it indecorous for a man to urge a decision while uncommitted to its consequences. And they think it indecent, to put the matter in its politest terms, for him later to publish, underline and critique these consequences when they prove unfavorable, while hiding under the flag of neutrality that his accounting title gives him.

The burden of management is to influence the future favorably, and even predictably. A leading partner of one of the principal public auditing firms remarks that in the torment of change which tosses all enterprises today, "Success in committing resources to profitable opportunities is being measured less and less adequately by focusing on profits achieved . . . The concepts proposed in this discussion are based on the firm conviction that generally accepted accounting principles, as they are now constituted, and the management accounting practices that result from them, are inadequate —that they cannot respond to the forces of society which are, today, calling for meaningful information."

As a remedy he proposes a scheme of "entrepreneurial accounting"—a scheme for reflecting the future profitability of a firm—which would alter accounting concepts long in fashion, but would do little to enlarge the basis of judgment or the area of certainty for a manager required to deal with "problems (which) have been exponentially expanded."

We are dealing, of course, with the ancient urge toward aggrandizement of function which is neither foreign nor peculiar to accountants. And the supporting rationale is seductive. Accounting has honorably assisted the decisional processes of management in the past—why not enlarge its dominion so that it embraces the whole information structure on which managers depend?

A computer environment does add a favorable time dimension to accounting information which suits it to use in the arena as well as in the postmortem parlor. This new dimension offers accountants the temptation to float widely over the whole informational range. But they enlarge their span of activity at the peril of loss of stature and effectiveness which depends on their respectful obedience to the limits of their professional domain.

Accountants have the capacity to convert accounting data into accounting information because their professional training qualified them to infuse that data with accounting intelligence. Outside their field they become mere data gatherers, for their training gives them no special competence to convert data into the marketing, production, procurement or other information systems which ultimately fuse into an MIS. If they attempt an indiscriminate power of dictation in areas outside their own field, they lose their professional identity and become simply computer systems technicians.

Worse, they become a well-meaning but formidable obstruction to the creation of the end they say they desire—a true MIS—for they deter the entry of the variety of talents, disciplines and intelligences necessary to that end. The fact is that no single function or discipline can furnish a sufficient information base for management. That is why we have kept our information systems free of the grasp of any one function. Thus, we have enabled our managers to draw the informational output of

every function freely into its channel. Each functional information system is the responsibility of the functional manager in matters of design, structure and purpose. The MIS is the responsibility of the general and executive management.

Also at the heart of the matter is the distinctive character of the accounting function. Here we come to the point of division. MIS is essentially an operative system completely enmeshed in the management function. Accounting, control and audit are essentially an evaluative system—a system for evaluating management's performance *and hence necessarily outside of the management function.*

Accounting's prime concern was once with the form of the entry. Today its first test must be with the clarity of the disclosure. Its function was once private and procedural. It is now professional, charged with a public trust. Recognition of this obligation will be a business landmark in the 1970s. The primacy of their fiduciary duty will preclude conflicting postures, such as are implied by "managerial accounting," or entangling alliances with management which their dominance over MIS would create.

The accounting fraternity is under a fiduciary obligation to the board of directors, to the owners, and to the public to furnish such performance evaluations of the firm and its management. The success of an accounting information system is measured by the support it furnishes to the discharge of this mission. Happily, the better the accounting information system serves this end, the more useful are its inputs to the MIS, because they more faithfully reflect professional accounting intelligence.

Not only must these evaluative judgments be made free of bias, they must be free of the suspicion of bias which comes from a compromising involvement in the operative management function. The fiduciary obligation must rest on the internal staff as well as on the outside auditors. For I cannot conceive, looking to the future, how an outside auditor can certify financial statements prepared by a staff whose interests are conflicting and whose loyalties are divided.

It has been argued that thus limited the accountant's role is simply demeaning. In my opinion, the inputs we get from men who maintain a position of professional integrity are of the ultimate value in the heat of time-pressed indecision. In my opinion the counsel of those who rightly maintain the posture of counselor will be of highest worth to those who have the burden of management in this decade. Those who counsel on the basis of professional principles profoundly understood and respected have a value beyond measure. And their value is the greater because they counsel rather than control, because they reason rather than rule.

A great profession is one whose practitioners think greatly of their calling. Perhaps the privilege of a prideful self regard, justly entertained, is the greatest reward that any future employment can offer.

The Financial Officer. One of my associates has pointed out an uncomfortable omission in my argument which requires a further point to be made. In an accountant's working day role, accounting may be "merely a subset of the substance of his function." It does not recognize "the double identity of a controller, as chief accountant and as finance officer." And my friend puts into place the proper recognition of the critical leadership and contributions which our divisional controllers have made to the development of our MIS, not only in the areas dealing with the hard facts of the past, but in the systems designed to "record, process and evaluate the *uncertain future* of an *uncertain world.*"

He also establishes the interesting proposition that certain of our accountants took the initiative in developing tools for *decision* making in the managerial world of *uncertainty,* and that their example finally led to the "emancipation" of these "managerial functions from the traditional controller's control." So we attain again unto the revealed truth that decisions pertaining to the uncertain present and the unseen future are the prerogatives of management, not the controller.

As in all cases where an absolute line of division is wished for, there is a band of overlap.

But there are some decisional areas often managed by accountants which are beyond the areas of transaction records, control mechanisms, and evaluative measurements and judgments of management. These are the functions of the finance officer.

To adopt my associate's conclusions, "A clear distinction is needed between the controller as an accountant and the controller as a finance officer. The function of finance is distinctly a managerial function dealing with uncertainty, as much as the other functions (marketing, production, etc.). The finance officer has to deal with the timing of finance decisions, the choice of sources of financing, the control of liquidity, the estimation of future shortages or surpluses, and predicting future interest rates. His information system is distinguishable and separate from the accounting system. However, there is a tendency for finance officers and chief accountants to be identical and drawn from the accounting profession."

As in all cases where an absolute line of division is wished for, there is a band of overlap. At the operational levels in the firm these may be both necessary and extensive. But at the senior policy levels it is undesirable and in my judgment will not long be tolerable.

Theoretically, as my friend supposes, the fiduciary character of the controller has always existed. But the focus of responsibility continually shifts with the scale and mission of our institutions and with the ideals and objectives of our society. So the fiduciary nature of the controller's function has advanced from an occasional aspect to the dominant character of his function. (Walter F. Frese and Robert K. Mautz, "Financial Reporting By Whom?" *Harvard Business Review,* March-April, 1972.)

Hence, while the financial office is derived from the accounting function, it has attained a status and character distinct from that of the controller. Prediction is the dominant contribution of the financial officer, who is preoccupied with the acquisition and allocation of resources by the firm; while designation and measurement is the prime concern of the controller who accounts for the inventory and evaluates the benefits of the corporate resources.

Finance by its nature adheres to management. The controller by his function must be allied to ownership and its representatives, the board of directors.

The Imperative Necessity for MIS. I must now return for a closing session with my anonymous adversary. He contends that a series of business information systems, each oriented to a particular function or operation, must result in an MIS which is "uncoordinated, and therefore inefficient and unsatisfactory." Because of the vast differences which necessarily exist between these several systems created for accounting and control, for production and distribution, for marketing, etc., he contends that expertise in one area is of little value in another. It follows he thinks that since one man cannot master the design of every system, there can be no single homogeneous MIS embracing them all.

If we followed the same logic we must also conclude that there cannot be a firm of size or complexity because no one man has the talent to master every function and operation necessary to the accomplishment of its mission.

Consequently, according to his test, no one is qualified to manage it in total. Perhaps we have inadvertently stumbled upon the flaw in the system! But the fact is that we do have the executive office, and it is required to oversee the total effort of the firm. And it must have an MIS to get the job done.

The key to MIS is an integrated data base, not a universal genius expert and omniscient in everything. As we have noted, each of the functional systems utilizes data and output from other systems as well as data inputs from sources peculiar to its function. From these materials it generates information suited to the performance of its particular function. And this information also feeds back into the data base where it is available as data for all of the other business systems.

. . . executive management considers a different opportunity horizon and a different time span than does operating management.

It follows that if our functional information systems cover the operations of the firm with reasonable sufficiency, there is information in the data base adequate to support an executive management information system. Some further data will be needed, of course, because executive management considers a different opportunity horizon and a different time span than does operating management. But with this modest qualification the material is at hand to do the job.

And the job is no more complex—indeed, it is less so—than the problem of creating the several operating systems. The critical problem to the construction of an MIS is the integrated data base itself. This requires first a unified communication system through which the system data must flow, it requires rapidly expanding data file facilities, and it demands a data coding and addressing scheme which makes all the data in the bank reasonably available (hopefully randomly and instantly available) to every system in the firm.

The real obstacle to MIS in most firms is the structure of the data files themselves, and the means in hand for accessing them. Without adequate methods and structures here the problem of system interfaces—which means people interfaces—becomes the condition precedent to performance. And a guarantee of unsatisfactory performance. My anonymous antagonist says that this is a matter to be solved by education, but as you will recall he disqualified B school products as a solution much earlier in the game. So he is bucking the problem to some other branch of learning when he takes this exit. And indeed he closes his article in a state of hopelessness.

"Management must always operate with insufficient information . . . In many areas the truth of these statements is becoming more salient because while the role of management is becoming more complex, the new information technology is not helping significantly . . . The problems of control in decentralized companies are much more difficult than they were ten years ago—increases in size, complexity, and geographical dispersion have made control much more difficult. Yet the new information technology has been of little help in this area, simply because the problems of controlling decentralized decisions do not lend themselves to computerized or mathematical solutions . . . part of our information crisis results from the nature of the present business environment. We shall simply have to live with it."

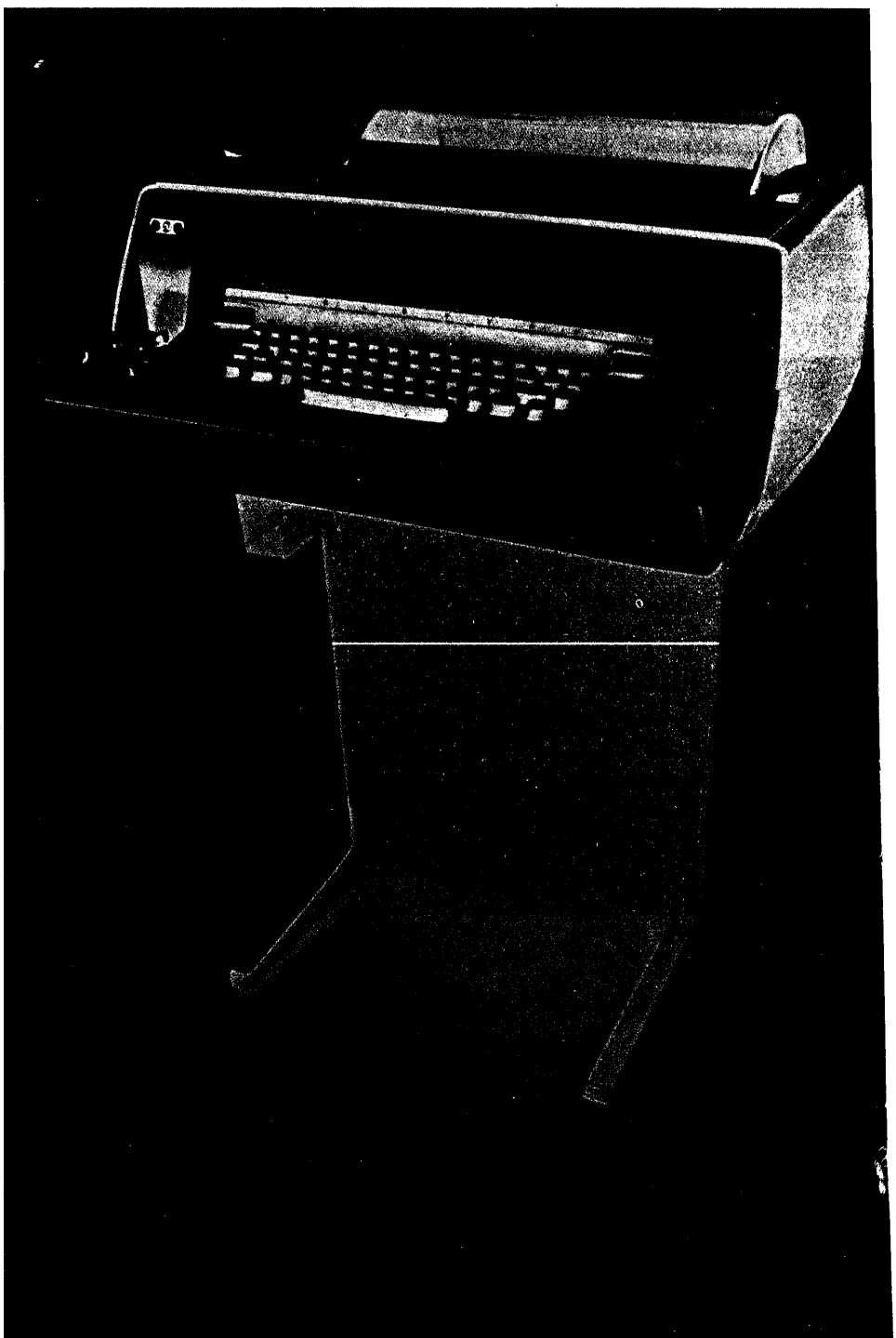
This is a perfect demonstration of the absolute necessity of MIS, and a complete admission of the impossibility of reaching it through his approach. He has discredited people interfaces as a means of establishing data flows between related information systems. He has failed to see either the necessity or feasibility of avoiding this impediment by an integrated data base.

For we shall not reach the MIS we need for the management of the enterprises we have created through the scholastic logic bequeathed us by a medieval heritage. We shall reach it by the perceptive application of the information technology which daily experience teaches us, if we are disposed to learn. □

Mr. Hanold has been president of The Pillsbury Company since 1967 and a member of its board of directors since 1961. He joined the company in 1946 as an attorney, held a succession of financial posts, and before becoming president was executive vice president of finance and international operations. Among other activities, he is a director of the First National Bank of Minneapolis and a trustee of the Committee for Economic Development. He has BA and BLL degrees from the Univ. of Minnesota.

This looks like just another ordinary data terminal.

Until it goes to work.



Our new model 38 eight-level data terminal is anything but ordinary.

Because it's loaded with big machine features.

Like a 132 character printing format on a 15-inch wide platen. It's designed to handle computer print-out paper so you can eliminate time-wasting reformating procedures. And for added versatility, there's a simple modification kit that permits you to use standard friction-feed rolls, too.

More big machine features? The model 38 prints both upper and lower case, in two colors, for maximum visibility and clarity in data presentation. And the four-row keyboard generates all 128 ASCII characters.

Speed? The model 38 moves data at 100 words per minute. For on-line speeds up to 2400 words per minute, it interfaces with the Teletype® solid-state 4210 magnetic tape data terminal.

The model 38 is flexible enough to fit into practically any switched or private-line system. That's why there are three interface options available. You can select from a built-in, factory-tested modem; a current interface; or an EIA interface.

You also get a choice in receive-only, keyboard send-receive, and automatic send-receive configurations.

Finally, the model 38 was designed to offer plug-to-plug compatibility with just about anything—including the model 33.

You'd think that all these big machine features would carry a big machine price tag, right?

Wrong.

We priced the model 38 so low it can be used economically in most applications—even in low usage locations where terminals couldn't be justified before. To offer real-time system up-date, data entry and retrieval, and inquiry response throughout your operation.

It takes more than manufacturing facilities to build the machines Teletype Corporation offers. It also takes commitment. From people who think service is as important as sales. In terminals for computers and point-to-point communications.

That's why we invented a new name for who we are and what we make. The computercations people.

TELETYPE

For more information about any Teletype product, write or call TERMINAL CENTRAL:
Teletype Corporation, Dept. 81A, 5555 Touhy Avenue, Skokie, Illinois 60076. Phone 312/982-2500

In October, we described the procedures for initial planning of your data communications system. Here, in a second installment, are the next steps—evaluating system components to fit the application characteristics

Planning a Data Communications System

by N. Richard Pyes

The first article in this series was designed to help you define your data communications requirement. We also tried to show how certain basic elements of that requirement, such as the amount of data you have to move between two locations per unit of time, help determine what kind of system you need. Then we looked, briefly, at communications channels, interfaces and terminals—the basic components of every data communications system. In each case, we indicated some of the key characteristics affecting the component's efficiency.

All of this explanation was designed to set the stage for the present article, which will describe how to evaluate specific components for specific kinds of applications. The key point to remember about this evaluation process is that the characteristics of the application control the choice. We've already talked about some application characteristics, but there are some others that should be considered.

If the remote users of your projected system don't have fixed locations, and if individual messages are relatively short, you will probably want to use dial-up lines. A good example is a system which links a company's central office with traveling salesmen who use touchtone telephones to input their daily orders, or, alternatively, portable devices acoustically coupled to the phone. Frequently, a company will use dial-up lines to service its customers. The latter have fixed locations, of course, but the system must be capable of reaching new customers as well as present ones, so area coverage is needed.

Private lines are used, generally, when the remote user's location is fixed, and the average duration of each call is relatively long. But not always. A private line must be leased on a full-time basis, so if total message traffic isn't enough to soak up most of this capacity, dial-up service may be more economical. You can see this clearly in Fig. 1. Note that it costs $51/hour to lease a 2500-mile private line and load it 25% of the time, but sending the same message traffic along a dial-up line between the same points during the day costs only $27 per hour and, at night, only $14 per hour.

Laying out a dial-up network is usually easier than planning a private line system because there are fewer options —only one type of communication channel is available, offering a nominal 3 KHz bandwidth, and no conditioning comes with it. There are some options regarding data terminal equipment, however; these are discussed later on in this article. Also, in some areas, newly emerging communications carriers such as Datran and MCI are beginning to compete with Ma Bell and the other long-established channel suppliers. This topic is covered in the next article of our series. The other major option available to the dial-up user involves Wide Area Telephone Service (WATS), a pricing arrangement that can reduce your costs/call significantly.

Using the WATS option

WATS allows you to make unlimited calls within a designated area over a single dial-up telephone line for a flat monthly charge. There can be many telephones attached to the line but only one call can occur at a time. If one line is insufficient, multiple lines can be rented on the same basis.

You can sign up for either "outward" or "inward" WATS, on a full-period or measured time (10 hours per

month minimum) basis. The cost of the service depends partly on amount of time you contract for and partly on the calling distance. The telephone company has divided the U.S. into six WATS zones, each containing approximately the same number of telephones. A user pays a higher rate as the number of zones between him and the remote terminals increases.

WATS is not cheap; a Full Period Zone Six service costs on the order of $1,900 per month (see Fig. 1 for costs/hour with various utilization levels). Also, since WATS uses regular dial-up telephone lines, the service is usually limited to data applications transmitting no more than 2400 bps (although faster speeds may be possible; modems reportedly able to handle up to 4800 bps are now offered for dial-up service). Another factor that may limit the suitability of WATS is the relatively high error rate inherent in dial-up service (which is also affected by such characteristics as bit rate and distance). If your application demands fewer errors than approximately 1 bit in 100,000, you may want to use conditioned private lines even though they cost more. Still another factor to consider is the need for a permanent link between two locations so that data can be transmitted at any time.

Data communications users who find WATS uneconomical, but still need area coverage at the remote end of the system, often use foreign exchange (FX) service. This configuration consists basically of a leased private line running from a customer's location—a central computer site, for example—to a telephone company switching office serving the area encompassing the remote locations. Remote users, by dialing a specified number in the usual way, access the FX channel automatically through the telephone company office. The caller pays for the first portion of the message path (as part of his monthly bill for local service), while the lessee of the FX channel pays for the remainder. Here again, the key question is whether you can develop enough traffic to justify the cost of a full-period FX line. Often, by placing a multiplexor and/or concentrator at the remote end of the FX line, you can handle multiple calls simultaneously, which may make the FX line more cost effective. This option is discussed in detail below.

FX service represents one way of connecting a number of remote locations to a central point; there are many other ways, all involving the use of private lines exclusively. Even if your system seems to require dial-up facilities, you should consider these latter network options. Frequently, dial-up service is chosen because the traffic between two locations isn't great enough to support a full-period private line. However, networking provides a way of *combining* data streams from separate points into a total which may make leased service cost effective.

Interconnection

There are three basic ways to interconnect a number of terminals with a central location. You can run separate message paths from the former to the latter. Or, you can thread a single "party line" through all the remote locations and terminate it at the central point. The third option is a compromise between the first two: separate lines run from each remote terminal to an intermediate point which is linked to the central location by a single line (FX service is an example of this layout).

If the remote terminals have to communicate with each other, as well as with a central site, there are four basic options—the three described above plus a system in which each terminal is connected directly to every other via a separate communications path. The latter arrangement eliminates the need for switching, but the added channel mileage will usually offset this advantage.

Another way of avoiding the expense of switching is to use a party line arrangement and assign each terminal a unique identification code. With this scheme, each message passes all locations but only the intended terminal accepts it. Of course, you can manually schedule the time so that each location uses the line during a different period, but this plan probably will reduce the usefulness of your system substantially.

Of all these options, the party line hookup usually requires the least number of channel miles. Also, it reduces the expenditure required for modems, since only one line instead of several terminates at the central location. But a party line isn't necessarily the most cost-effective arrangement—it depends primarily on the number of terminals that may want to use the common communications channel at the same time.

To keep these terminals from getting in each other's way, a variety of polling systems can be used. But the cost of the software overhead which polling places on the central computer, not to mention the extra terminal investment required, may be more than enough to offset whatever you save in channel and modem expenditures by using a party line network configuration. Polled systems are generally used in applications where the transmission speed does not exceed 600 bps.

Comparing multiplexors

Multiplexors and/or concentrators can reduce the terminal contention problem somewhat, since they permit a number of messages to be transmitted over a communications path simultaneously (although if too many terminals are tied to a subchannel, the problem remains). As mentioned in the October article, there are two basic types of multiplexing equipment—those units employing time division to separate messages, and those using frequency division. Time division multiplexors (TDMs) can be further subdivided into those that transmit a character at a time over each subchannel, and those that transmit a bit at a time. The bit-oriented machines are faster, but use the bandwidth less efficiently. Bit-oriented TDMs present fewer code conversion problems, however.

Frequency division multiplexors (FDMs) operate only with asynchronous terminals, while TDMs can support both synchronous and asynchronous bit streams in the same system—though not with equal efficiency. FDMs are less costly for a relatively small number of terminals—up to about eight—partly because they have much less overhead circuitry than TDMs. Also, TDMs utilize the channel more efficiently, particularly at lower speeds. With an FDM, you can subdivide a nominal 3 KHz voice-grade line into 12 channels each transmitting at 100 bps; with TDM equipment, up to 48 100 bps subchannels can be carved out of the same bandwidth.

FDMs tend to be more affected by transmission noise than TDMs. Basically, this is because some subchannels of an FDM system occupy the outer portion of the bandwidth; noise usually makes these subchannels unusable. In a TDM system, each subchannel occupies the entire bandwidth, so there's

Distance (Miles)	Full Period WATS Utilization: 25%	75%	Measured WATS (10 hrs/month minimum) Utilization: 25%	75%	Private Line (Type 3002, unconditioned) Utilization: 25%	75%	Dial-Up Utilization: Day	Night
100	$12	$ 4	$11	$10	$ 6	$ 2	$12	$ 7
500	17	9	18	17	19	6	18	10
1000	26	11	20	19	26	9	21	13
2500	43	14	24	25	51	17	27	14

Fig. 1. Cost comparison of communications services ($/hour)

generally less signal degradation and transmission can continue without interruption (although a reduction in transmission speed is usually necessary).

FDM equipment is generally preferred where terminals are widely separated—it's easier to terminate subchannels at the intermediate points. And FDMs are also favored in systems where high and low transmission speeds are intermixed, although newer TDM designs are reducing this advantage. Adding subchannels to a TDM is generally easier than doing likewise to an FDM. In the former case, you change the modem; with FDMs, which don't require modems (modulation-demodulation is performed internally), you have to add circuitry and adjust the individual output signals of all subchannels.

As explained in the October article, the major difference between a concentrator and a multiplexor is that the former unit provides buffering; this allows a party line communications channel to serve a greater number of terminals than is possible with a multiplexor. However, since some messages will have to be buffered until the common channel is free, overall transmission time in a system using a concentrator will be longer than a similar system using a multiplexor. The concentrator also costs more than the multiplexor because of the buffering capability.

There is a growing tendancy to use communications-oriented computers as remote concentrators. This arrangement costs more, but allows the concentrator to take over some of the programmable jobs—such as code conversion, code editing, error checking, and data compression—normally assigned to the central computer system.

To evaluate alternate network configurations, and to determine whether you need multiplexors or concentrators, you should begin with the system layout map prepared earlier (see the October issue). Overlaying various network options on this map will give you an idea of which option offers the best possibility of reducing the number of channel miles needed. Then, determine the data traffic load on those links which would serve more than one pair of terminals. Analysis of the load will indicate whether use of multiplexors or concentrators can reduce your communication channel costs. The input for this part of the analysis is obtainable from the data collected earlier (by the methods described in the October issue) on the volume and characteristics of the data communications application at each sending/receiving location in your projected network.

But the data volume statistics you have collected so far are only rough approximations. Before deciding, finally, that you need a particular network topology, before even deciding whether dial-up or private lines service will be most cost effective, it will be necessary to define your projected data traffic load more precisely, to reflect some factors we haven't mentioned yet.

The figures you have collected show, essentially, how fast data builds up at each sending location per unit of time; they don't reflect the *urgency* of delivering particular kinds of messages to the other end of the circuit. This urgency factor has a crucial bearing on the size of the communications channel needed, and thus on your costs.

In some cases, data generated at a remote site during one day doesn't have to be received until the following day. This may permit a significant percentage of the load to be transmitted at night, and allow the use of a low-speed (under 300 bps) channel instead of a medium-speed (300-9600 bps) or high-speed channel. The first two are significantly cheaper than the third. (There are offsetting costs, however, which can largely or completely erase this benefit. You may have to pay an operator overtime to work at night, for example. Even if the terminals at either end can operate unattended, this feature may increase their acquisition cost.)

In many companies, records generated by a certain time each day must reach the computer center before the close of business that same day. By determining the size of the backlog—in words, characters, or bits—that builds up at the sending end and when the cutoff hour arrives, you can estimate the channel bandwidth needed to deliver this load to the computer by closing time.

Another common case involves the system which has to move data as quickly as possible from sender to receiver; often, the data volume fluctuates significantly as well, and follows no pattern. Here, the best plan as to size the communication channel somewhere between the average and peak data volume figures (previous analysis presumably has established these points). How close you go to the peak depends largely on how much you can spend for communications channels and how much insurance you want against overload.

Once you have determined the urgency of transmitting data between each pair of locations in your network, and have adjusted peak-hour volume accordingly, the next major step is to find channels capable of providing the required capacity.

A key point to remember is that the rated capacity of the channel, in words/minute, characters or bits/second, will have to be significantly greater than the peak-hour data volume you've projected between the terminals using that channel. Basically, extra channel capacity is needed to take care of factors that reduce the amount of useable data flowing through the channel. There may be turnaround delays at either end of the circuit, for example, which produce a loss of transmission time whenever a sending terminal switches to receiving mode, or vice versa. If the channel generates transmission errors, and this is inevitable, some data probably will have to be retransmitted, further reducing the effective or "information" data rate. The need to add extra bits to each character and message block—to control various communications functions and help detect errors—is still another factor.

Two solutions

There are two basic ways of minimizing these losses. One is to pay extra for the communications channel: a full-duplex facility will eliminate the turnaround problem, and conditioning will reduce errors significantly (see Fig. 2).

The other basic way of maximizing a communication channel's information data rate is by choosing modems and/or terminals that offer minimum turnaround delay, provide error control, and equalize (condition) the signal before it goes out on the line. This approach is particularly suitable if you're planning to use dial-up channels, since they can't be conditioned and the phone company doesn't offer full-duplex dial-up service. Thus, the only effective way to increase the amount of information data trans-

Type of Conditioning	Effective Bandwidth	Data Rate (binary level modem)	Extra cost/month
none	1200 KHz	2400 bps	——
C1	1400	2800	$5
C2	2300	4600	$19
C4	2500	5000	$30

Fig. 2. Effect of adding conditioning to a (nominal) 3 KHz Communication Channel

mitted along a dial-up channel is by providing the requisite capability in the hardware connected at either end.

As explained in the October article, a modem converts digital signals generated by data terminals into analog signals acceptable to the communications network, and vice versa. At the sending end, this is done basically by using the digital input signal as a kind of switch which turns an analog signal generator inside the modem on and off. Each time the generator goes on, it sends out a burst of energy corresponding to the pulse that triggered it. Thus, the binary ones and zeroes represented by the pulses and nulls in a digital signal are copied in the analog signal produced by an amplitude-modulated modem. (Some modems use frequency or phase modulation. In the former case, binary ones and zeroes are represented by different frequencies, while in the latter, the phase of the analog signal is varied.)

In recent years, modem makers have developed improved modulation techniques that replace these "binary-level" systems with "multilevel" techniques. The result has been to increase the amount of data that can be transmitted per unit of time. There are multilevel techniques for modems using amplitude, frequency, and phase modulation. In each case, the technique is best suited to systems where data has to be transmitted at more than 1800 bps. A typical example of what you can gain is shown by comparing Bell's model 202 modem, which uses binary level modulation, with the Model 201, a multilevel device. The 202 operates at 1800 bps on a C2 conditioned private line, while the 201, on the same line, will operate at 2400 bps.

Multilevel modems are often used to increase the information data rate on dial-up channels. Speeds as high as 4800 bps are now offered. By comparison, 1800 bps is about the most you can get out of a dial-up line using binary level modulation.

The best way to evaluate all these options is to use a form similar to the one shown in Fig. 3. Find out from potential suppliers what effect each feature will have on your data transmission rate, and what each feature will cost, then compare the options.

Modem features

Modems have a number of other features, besides transmission rate, which should be evaluated. The kind of interface provided is one such feature. Most business machines made in the U.S. conform with the EIA (Electronic Industries Association) RS-232-C standard, but Teletype machines use an international standard. Originate-only or answer-only modems are significantly less expensive than units capable of sending and receiving. Where non-Bell modems are interfaced with the dial-up network, you need a data access arrangement (DAA), as explained in the October article. Different models are available, depending on whether calls are originated manually or automatically from the associated terminal. Error performance is another modem variable, and error detection/correction is still another.

Typically, the terminal manages error detection/correction, but the modem must be able to cooperate. One popular scheme, for example, automatically retransmits incoming data back to the originating terminal so it can be validated. This system requires the use of modems with reverse channels.

Equalization is another modem variable. As indicated earlier, this is a means of removing signal distortions that occur during transmission so that more data can be carried per unit of time. "Fixed" equalization is generally used in modems operating at speeds up to about 2000 bps. Manual or automatic techniques are used at higher speeds. The former consumes operator time, but is significantly less expensive.

Modems can also be adapted—by moving a switch or transferring leads—to operate in alternate ways. Among the more common options are: dial-up as well as private-line operating capability (particularly useful when a pri-

Sending Location:
Receiving Location:
(Use separate form for each pair of locations communicating with each other)

Data Transmission Volume	Average			Peak		
	char/min	char/hour	char/day	char/min	char/hour	char/day
Sending						
Receiving						
Total						

Option Analysis	Option A	Option B	Option C	Etc.
Type of Service (dial-up or leased)				
Bandwidth (KHz)				
Class of conditioning Cost/month				
Transmission mode: (simplex, full or half duplex)				
Type/model of multiplexor and/or concentrator*				
Cost/month				
Extra options available 1. 2. 3.				
Type of extra options chosen Cost/month				
Modem model Modem speed (bps or cps) Cost/month Options included: 1. 2. 3.				
Extra options available 1. 2. 3.				
Type of extra modem options chosen Cost/month				
Type of DAA Cost of DAA				
Estimated data transmission rate of this circuit configuration (bps or cps)				
Estimated channel usage, based on above data transmission rate (hours/month)				
Sending Receiving Total				
Estimated channel costs based on above usage ($/month)				
Add above charges for modem, channel, and, if used, charges for multiplexor/concentrator, DAA, and any extra-cost options, to produce:				
TOTAL COST ($/month)				

*If multiplexor/concentrator serves other locations, pro-rate monthly cost.

Fig. 3. Communication channel analysis

vate line system goes down); variable transmission speeds; use of different communications protocols; simplex, half-duplex, or full-duplex operation; synchronous or asynchronous operation; compatibility with EIA or Teletype interfaces.

Virtually all modems include some fault isolation capability. Typically, the process begins with a "local loopback" which tests the operation of a terminal and modem—separately and then together. Next, the communications channel is added, and finally, the modem and terminal at the other end. But modem test sets are usually needed to supplement this supplier-provided capability, because the loopback technique is seldom specific enough; it won't tell you, for example, whether the send or receive side of a modem is at fault, nor will it show whether trouble on the line is due to "phase jitter," "nonlinear distortion," or some other factor.

The modem's physical size is another factor to evaluate. The dimensions of stand-alone units designed for like service can vary considerably. One way of saving space, and possibly reducing your communications equipment costs, is to use terminals with

Table I. Remote terminal requirements analysis

A CHECK LIST OF REMOTE TERMINAL REQUIREMENTS			
	Requirements	✓	Evaluation Factors
1	List the applications to be processed. How many of these require the use of data communications to send/receive? How many of these will involve batched data (and thus require buffering at the terminal) for sending, receiving? What percentage of traffic will be interactive? On outbound traffic, how will data enter the terminal; on inbound, how will data be delivered from the terminal?		1 Depending on requirement, consider terminals designed specifically for interactive or remote batch applications; receive-only (RO) terminals instead of automatic send-receive (ASR) or keyboard send-receive (KSR) units. Also, stand-alone processing capabilities of candidate terminal; size, type of terminal buffering; speed at which terminal accepts input from punched cards, paper tape, optical scanner, etc.; speed at which terminal drives output printer, card punch, graphic display (assuming these I/O devices are to be part of your installation).
2	What percentage of your outbound and inbound traffic consists of messages requiring no data processing at terminal? Where dp is required, is it primarily computational or file-oriented; what programming language(s) now used, how many instructions per program?		2 Use of programmable terminals. Can candidate accept your existing software? If not, how much reprogramming necessary, what will it cost? How much memory will be needed for program storage?
3	Will this terminal site be linked directly to a computer at the other end of the channel, or to an off-line device?		3 Compatibility of terminal control program with system at other end—in terms of code, file format, communications conventions.
4	What is desired data processing rate of the terminal in sending mode—i.e., how many input entries should be converted into output form, ready to transmit, per hour (or minute)? What is the minimum time available to transmit batched data from this site to the receiving location?		4 Redesign of existing record formats to eliminate unneeded data (and reduce amount transmitted). Consider terminal's data compression capability. Does terminal support HASP or similar multileaving technique? In network, determine if terminal allows priority polling. Also, consider use of mag tape, cassette, disc buffers; they offer higher transmission rate than punched cards or paper tape. For each candidate terminal, establish its effective data transmission rate considering all options.
5	What is an acceptable error rate for outbound and inbound data?		5 For data originating at site, consider terminal input validation techniques, error detection schemes, use of visual displays to prompt operator, also use of mag tape, cassette, disc buffers (they're easier to correct than punched cards or paper tape). For data received at site, consider transmission error correction schemes.
6	How many input stations are needed at each location?		6 Use of multistation terminals tied to central controller and central memory. Also, use of similar configuration to connect input stations placed at separate sites which are near each other. How many input stations can candidate terminal support?
7	What is an acceptable acquisition cost?		7 Purchase vs. lease; independent supplier vs. dp system manufacturer vs. communications carrier as terminal supplier. Possibility of reducing unit cost by buying/leasing terminals for locations where need is not immediate.
8	What is an acceptable maintenance cost?		8 In-house vs. vendor-supplied vs. third-party maintenance. Determine requirement for on-site spare parts inventory, and time needed for technician to answer call for help when vendor, third party provides maintenance.

built-in modems.

Terminals and options

The final element in your data communications system—the terminal—probably offers the greatest number of options. Here again, the place to start the evaluation process is with the application. In Table I, we have attempted to provide a logical way of evaluating remote terminals. The column on the left side asks a number of questions related to the characteristics of the application at each sending/receiving station. Try to answer each of these questions, then ask potential suppliers about the items in the right hand column.

The main terminal in your system—the one where the central computer is located—presents some special problems because it does most of the communications control job, besides moving data back and forth.

The interface between the central computer and the communications system can be either a hard-wired controller or a programmable preprocessor (a second computer, usually a mini, and usually designed specifically to handle communications). One major difference between these two devices is that the controller generally costs less—it also has far less capacity and flexibility.

A control unit may be a very simple

Table I. Remote terminal requirements analysis (continued)

A CHECK LIST OF REMOTE TERMINAL REQUIREMENTS				
	Requirements	✓		Evaluation Factors
9	What is an acceptable training cost?		9	In-house vs. vendor-supplied vs. third-party-supplied training.
10	What is an acceptable cost for site modification, power and other utilities; how much space can be allocated to the terminal at each location; how much can be spent for terminal program maintenance, system redesign, records redesign, conversion of existing records.		10	Use of in-house capability vs. vendor-supplied vs. third-party-supplied service.
11	What special terminal peripheral features are needed? Printers: What form width desired; is there need for split platen, individual or continuous form feed, upper and lower case printing? How many carbons are needed? What is the desirable speed? Graphic devices: Do you need to display alpha, numeric, and/or lines and curves? What is the ambient illumination level at the site? Does the application require any special symbols? Paper tape, punched card equipment: What coding scheme is needed, what punching speeds?		11	Printers, graphic devices, paper tape and card equipment. Impact vs. electrostatic printing; line- or character-incremented operation, ability of candidate equipment to meet specific requirements stated in opposite column. Ability of candidate equipment to present alpha, numeric, graphic data; number of characters/line; size of display area, number of lines displayed at one time; character brightness, character resolution; refresh rate (watch out for flicker caused by nearby fluorescent lighting). Does keyboard layout group keys by function? Is candidate equipment compatible with devices that will use cards, tape produced?
12	What special communications features are needed? For example, do you need: To transmit messages to multiple locations? Unattended operation with or without alerting signal? Automatic terminal identification? Special passwords? Compatibility with dial-up and private line network? Multipoint control capability?		12	Ability of candidate equipment to provide needed capabilities. What does each cost?
13	What other special features are required: Will the terminal have to be mounted on a wall, inside a desk? Does it have to be portable? Is there excessive heat, dust, dirt at the site? Is quiet operation important? Are special locks or other special security features needed? What is an acceptable mean time to failure, and to repair?		13	Ability of candidate equipment to meet these requirements.
14	What expansion capability is required, in terms of: Additional applications during expected terminal life. Anticipated growth in traffic. Additional locations and/or input stations likely to be added.		14	Upgradability of candidate terminal's buffer and (for programmed terminals) compatibility with units having more powerful processor. Determine what a bigger system will offer in terms of data processing speed, data transmission speed, ability to add input stations, new applications, efficient networking, better communications channel utilization, and other items covered in this requirements analysis.

device, such as a plug-in circuit card, handling only one communications channel. It can also be a large, expensive unit accommodating hundreds of channels. The IBM 2701, 2702, and 2703 are probably the best-known control units in use today. The 2701 can handle only a few communications lines, while the 2703 will accept 176 half-duplex lines. Additional modules increase this capacity.

The controller provides the necessary hardware for control and timing of functions performed by the main computer's cpu, such as character assembly/disassembly, error checking, data checking, buffering and intercept. The controller's line buffers are usually sufficient for only one or two characters apiece, which means that all message buffering must be performed by the main computer. Additionally, all network management functions, including the queueing of traffic, must be performed by the main system. This can add quite a load, and interfere with use of the same computer for general data processing.

A preprocessor or "front-end processor" adds a second computer to the system, which is dedicated to communications processing. Table II lists a representative selection of preprocessors, with their key characteristics. (For a more complete selection, see the DATAMATION survey, August, '72.) Among the factors that should be considered in assessing a preprocessor for a particular application, the following are probably most important: number of line terminations; number of different transmission formats; traffic load; host computer configuration; extent of preprocessing; and the extent of standalone processing.

In evaluating candidate machines, be sure the preprocessor can handle the mix of communications lines you require, not only now but in the forseeable future—say five years out. The software support and interfaces to your main cpu should dominate all other considerations in selecting a preprocessor. Ask if the unit is plug-compatible with your existing system so that teleprocessing software available from the mainframe vendor can be used. If the answer is "no," you should carefully consider the preprocessor manufacturer's capability to provide and maintain his own software. Determine whether each candidate preprocessor can be supplied on a turnkey basis, ready to run when delivered, so that your in-house software investment is minimized.

Preprocessor costs range from about $50K to $300K. A Univac 418-III with a full set of peripherals is representative of the high end of the scale, while the front-end communications unit offered by GTE subsidiary Programming Methods, using a 16-bit minicomputer, is among the least expensive preprocessors. The latter system being considered here would include the required core, communications interface, and basic peripherals needed to handle 5 to 10 lines in a low-volume system.

Talking to suppliers of preprocessor equipment, as well as those of other components that may be needed for your data communications system, possibly won't answer all your questions. If that's the case, and you have no other readily available source of information, then it would be a good idea to consider hiring a consultant. Even if your system is a relatively uncomplicated one, and you've been able to answer the myriad questions raised by this article and the previous one, it still would probably be a good idea to consider a consultant—he will almost certainly be able to save you time, by doing some of the system planning and design work. He may also be able to suggest additional ways of improving your system's cost effectiveness. Our main purpose in presenting these two articles has been to provide the information you need to make the best use of a consultant's time. In the final installment, we will discuss, among other topics, how to choose a data communications consultant. □

	Model	Max. No. of Lines	Word Length (bits)	Cycle Time (μsec)	Memory Size	Instantaneous[1] Throughput megabits/sec	Throughput[2] megabits/sec
Collins Radio	C System	256	32	0.85	4K-64K[4]	37.6	1.3
Computer Communications	CC70[5]	120	16	1.0	4K-32K[4]	16	.08
Comtec	CT/90	511	16	1.0	4K-32K[4]	16	0.16
Comten	45	240	32	1.2	32K-512K[3]	26.6	0.92
	65	240	32	0.75	32K-512K[3]	42.6	1.47
	3670	212	32	0.65	8K-64K[3]	49.2	.32
Honeywell	1622	132	16	0.96	4K-16K[4]	16.7	.01
	316-700	49	16	1.6	4K-16K[4]	10.0	.01
Interdata	50	126	16	1.0	8K-64K[3]	16	0.4
	55	250	16	1.0	8K-64K[3]	16	0.5
IBM	3705	352	16	1.2	16K-240K[3]	13.3	—
Marshall (CDC)	M1000[5]	128	24	2.4	36K-192K[3]	10.0	0.48
Tempo (GTE)	270T	192	16	0.9	4K-64K[4]	17.7	0.6
Varian	620L	64	16	1.8	4K-32K[4]	8.9	0.10
	620f	128	16	0.75	4K-32K[4]	21.3	0.16

NOTES:
(1) as measured by instantaneous data transfer rate to core (word length divided by cycle time) or auxiliary peripheral devices; not to be considered a true measure of throughput
(2) as reported by the manufacturer or best available sources
(3) as measured in thousands of 8-bit bytes of memory
(4) as measured in thousands of words of memory
(5) multiple processor units can be slaved together to obtain additional performance.

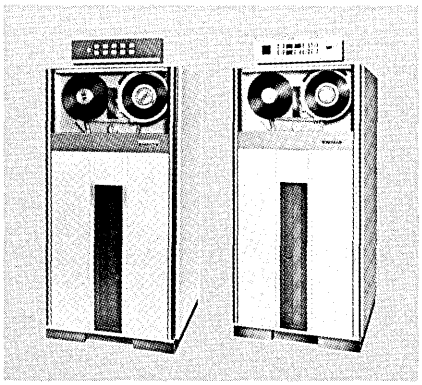
Table II Programmable communications processors—comparison of basic functional characteristics

Mr. Pyes is a vice president of Dittberner Associates, Inc., a telecommunications consulting firm in the Washington, D.C., area. He is responsible for assignments related to planning, design, production and marketing of products for the communications market. Before joining Dittberner, he was associated with Friden-Singer and Collins Radio.

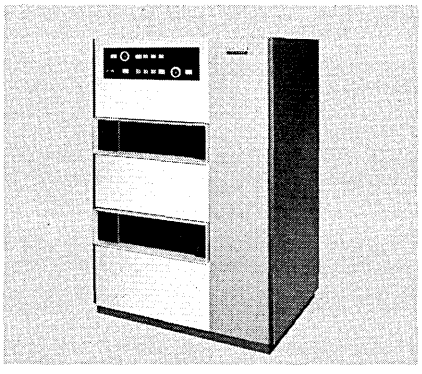
Get Peripheral Performance That Lives Up To Your System Specifications.

When you design a system, performance and reliability of the finished product are of prime importance. Specifying Potter Peripherals—Tape Transports, Disk Storage Drives and Printers—gives you an extra margin of both. That's why there are more Potter Peripherals operating on systems around the world than those of any other independent manufacturer.

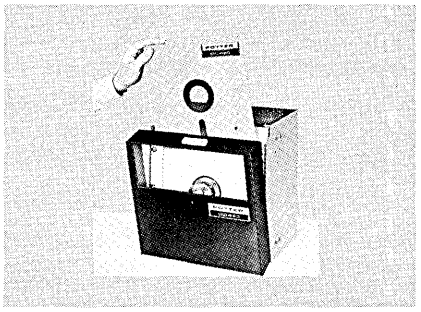
Magnetic Tape Transports, for instance, incorporate the latest technology and design. The single capstan, vacuum column, pioneered by Potter, insures gentle tape handling. All read/write heads feature the exclusive Potter Hard Coat which virtually eliminates head wear. During the automatic load cycle and rewind, the head retracts so that nothing comes into contact with the oxide surface of the tape. These and other features give you top performance and high reliability. Choose your model and tape speed from 12.5 to 200 ips.



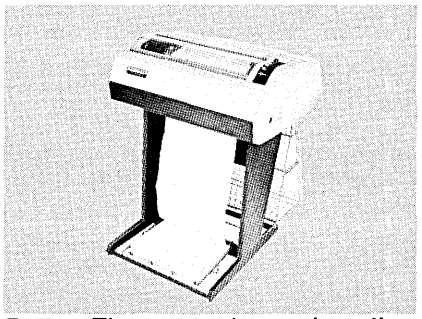
The DD 4330 High Capacity Disk Drive by Potter is a natural choice if you're designing a data processing system with virtual memory. This high performance, 800 million bit capacity drive uses a field proven voice coil head actuator to provide extremely high speed random accessing.



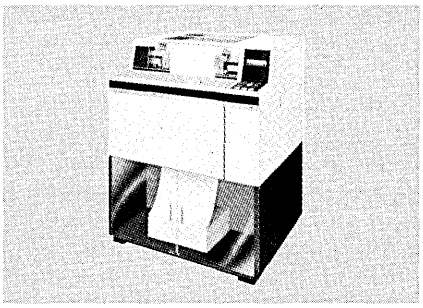
The Potter DD 480 Flexible Disk Drive is ideal if your design calls for a small disk system for microprogramming or data entry and retreival. This new unit uses a single, plastic enclosed, flexible disk as a recording medium. This inexpensive unit will provide random accessing, more convenience and greater versatility than any tape cassette unit available.



Line Printers are also available from Potter. The most advanced medium speed printer on the market today is the LP 3300 Line Printer operating at 300 lines per minute with 64 characters on 132 columns. This printer and its companion, the 135 lpm LP 3000, feature a unique printing method utilizing voice coil actuated hammers impacting a rotating helix. The simplicity of this design provides extremely high reliability. These two printers are ideal for medium scale processing systems as well as minicomputer or data terminal applications.



The LP 3500 High Speed Chain Printer operates at speeds up to 1500 lpm and is ideal for use with systems requiring high speed output. This device features the latest in mechanical and electronic design. High energy, free flight hammers provide the high speed and the encased chain module is operator interchangeable. Overall performance and print quality set a standard for the industry.



When you specify Potter peripherals you insure that your system will provide your customers with all the performance and reliability they require. For detailed specifications on any or all of these outstanding units write to: Potter Instrument Company, Inc., 532 Broad Hollow Rd., Melville, N.Y. 11746. • (516) 694-9000.

POTTER®

A lot more than less expensive.

See Us At Booth 4031-37 FJCC

Since his book on the psychology of programming appeared, the author has extended his studies to include teams as well as individuals

The Psychology of Improved Programming Performance

by Gerald M. Weinberg

Since the appearance of *The Psychology of Computer Programming*[1], the warmth and magnitude of the reception has led me to ask, "Why has this particular book at this particular time struck such a responsive chord throughout the data processing industry?" Though an author would like to flatter himself, I had to admit that there were dozens of people who could have written pretty much the same book. The response is not due to my sterling talents, but is merely a release of our pentup frustration from overemphasis on machines, not people. As Dan McCracken says, ACM should be the "Association for Computing *Machinists*."

The responsibility for this longstanding exaggeration falls on each of us: the universities that strive to be more "scientific" and bring "computer science" closer to the more respectable ranks of the "hard sciences"; the managers who first introduced computers in the hope of eliminating "personnel problems"; the manufacturers whose income depends on sales of hardware and software; and perhaps most of all the programmers themselves, who went into the computer business because they preferred working with machines, not people.

In this article, I would like to demonstrate how we may be rewarded once we renounce our old excesses. Instead of trying to survey all the topics covered in the book, I shall pursue one simple question: "How can programming performance be improved?" In data processing the usual answer is to offer new hardware or software, but our approach is different. "What," we ask, "are the human dimensions of programming performance?"

The study of programming as human behavior is hampered by the lack of clear parallels, for programming is in many ways unlike any other activity. Still, programming is not entirely unique. The computer programmer resembles the professional translator. Like the translator, the programmer's work is not noticed when done well. I sampled the book reviews of technical journals and found that in 78 reviews of translated books, 19 mentioned poor translation, one said something favorable about the translation, and 58 said nothing at all. I believe the same situation prevails in programming. When the programmer manages to "translate" correctly, the act is more or less taken for granted, and most of our attention is focused on failures.

> Can programmers produce different kinds of programs if they are given different objectives?

If we are to study programming, however, we cannot afford such a bias. We have to begin by asking, "What is good programming *and* what is bad programming?" To me, good programming is like successful translation—it captures, in a new medium, what somebody else is trying to say. But a good translation can have many dimensions: Is it faithful to the author's meaning? Does it preserve his literary style? Is it idiomatic in the new language? Has rhyme been translated into rhyme, meter into meter? From a single source, innumerable translations can be produced, each emphasizing a different objective.

Similarly, there are many dimensions on which a program can be "good" or "bad": faithful adherence to specifications, speed of execution, consumption of space, clarity of documentation, ease of change, intelligibility of output, promptness of completion, human engineering of input, and numerous others. Once we become aware of this potential diversity, our human point of view directs us to ask: "Can programmers produce different kinds of programs if they are given different objectives?"

In the book I reported a study done with Lynn Samuels and Brian Roberts

[1] Weinberg, G. M. *The Psychology of Computer Programming*. New York: Van Nostrand Reinhold, 1971.

in which experienced programmers worked on the "same" program—but with group P (for Prompt) working "to get a fully debugged program in as short a time as possible" and group E (for Efficient) working "to get a fully debugged program which is as efficient as possible, in the sense of using the least cpu time."

Although these objectives were but one sentence of a 20-page specifications document, the differences between the groups were alarmingly great, as shown in Fig. 1. In other words, merely by taking the trouble to *tell* the programmers what you want, you may get more satisfaction than from thousands of dollars spent on new software or hardware. Yet how many managers fail to make clear what they want, or else ask for everything at once—both of which force the programmer to guess what is required of him.

Programmers actually do try to outguess their managers. One sidelight to this experiment was that objectives influence not only performance, but *estimating*. Group E was very optimistic in estimating time to complete the project—an average of 22 runs versus

	RESULTS	
OBJECTIVE	Mean Number of Runs	Mean Execution Time
Prompt (P)	29	6
Efficient (E)	69	1

Fig. 1. Effect of objectives in performance

69 actually taken. Group P, on the other hand, though performing much better (29 runs) estimated more conservatively (39 runs). Thus, if the programmer knows he is being evaluated on one dimension, he is likely to estimate that dimension more prudently, which is one reason why managers are reluctant to tell the programmers what they want. Managers reason that if the programmer knows what is required, he will pad his estimates for his own protection.

In other words, accuracy of estimating is another programming objective—one which may interfere with the others. But even so, isn't it better to have an estimate of 39 runs which turns out to be 29 than an estimate of 22 that turns out to be 69? Besides, by making objectives explicit, the manager knows what sort of bias he is producing in the estimate, and can adjust his thinking accordingly. If the objectives are left up in the air, the variance in the estimates becomes entirely unpredictable.

This experiment dealt directly with only two goals—promptness and efficiency—and indirectly with another, accuracy of estimating. What about the other goals? After the book appeared, Ed Schulman conducted a series of experiments to explore other aspects of programming performance. In these experiments, we studied programming *teams*, not individuals, in order to minimize variation based on individual abilities. Yet the variations were just as marked as among individuals, and if we had not carefully set objectives, we would have been forced to conclude that "some teams are very, very good, and some are horrid." For example, out of five teams on the "same" program, one took 1,966 bytes of core and another took 13,438; one took 33 PL/I statements and another took 166; one took 28 man-hours of work and one took 74.

Yet when we look in terms of objectives, we see a clear pattern—one that has nothing to do with "good programmers" and "horrid programmers." As we see in Fig. 2, *each team ranked first on its primary objective.*

Such experiments dispel the myth of "good programmers" and "horrid programmers." While there are no doubt individual differences among programmers, there is a great deal a manager can do to improve the performance of the crew he happens to have. For one thing, he can recognize that individual differences, like individual programs, are not just "good" and "horrid." Since there are many aspects to the programming task, the manager's task is to assign work so that programmers are given a chance to display their strengths, not their weaknesses. This topic is pursued more fully in the book, but one example is appropriate here. "Clarity" is an esthetic concept for which some programmers have a particular flair. Might not the wise manager identify such a programmer and give him the job of "beautifying" the programs and outputs of others, after they are "finished"?

This question returns us to consideration of Fig. 2, which contains much more information than the ranking of primary objectives. Can we indeed "beautify" a program leaving everything else unchanged? Or are some objectives essentially complementary to others? In the figure, we see that there are indeed complementary relationships as, for example, between "output clarity" and "minimum statements," each of which ranks worst on the objective of the other.

When we study these programs—and the understanding of programming is always increased by the simple but rare practice of reading programs—we understand the conflict. "Extra" statements must be added to improve output clarity, and output clarity must be sacrificed if the statements are to be reduced to the bare essentials.

> . . . accuracy of estimating is another programming objective—one which may interfere with the others.

We find a similar conflict between output clarity and minimum core, for much space must be consumed by formatting code and text that will clarify the output. Promptness also conflicts with minimal core, which we can attribute to quick-and-dirty methods. Promptness also conflicts with program clarity, but then promptness seems to interfere with just about everything. No wonder programmers scream for relief from schedules.

But objectives may also be synergistic. Program clarity and output clarity tend to be highly correlated, so that setting one as the objective is likely to enhance the other. Similarly, minimal statements and minimal core are related in an obvious way, while minimal statements tends to be correlated to

	RANKING				
GROUP OBJECTIVE	Core	Output Clarity	Program Clarity	State-ments	Hours
Minimum Core	1	4	4	2	5
Output Clarity	5	1	1-2	5	2-3
Program Clarity	3	2	1-2	3	4
Minimum Statements	2	5	3	1	2-3
Minimum Hours	4	3	5	4	1

Fig. 2. Ranking on five objectives

Reliability like this runs in our family of printers.

See that print hammer? It's our Mark IV. One-piece and friction-free. It swings the straightest, cleanest line in the industry.

Reliable quality like this runs through our whole 2000 Series of printers wherever they're at work—in minicomputers, communications systems and large EDP sites. Want speed? Our new model 2470 prints up to 1800 lpm (2400 lpm in some formats) with OCR and letter-writing quality. Our medium-to-high-speed 2440 and our medium-speed 2420 models offer the same high quality. You get it from our minicomputer workhorses, too: the 2410 and the desk-top 2310.

Whichever one you specify, you *know* your customer will cut his maintenance costs and increase his printing time. He'll be able to reduce his inventory, because the parts that go into Data Products printers are interchangeable. And he can upgrade easily: our 2000 Series family of printers are plug-compatible.

We have a ten-year record of making reliable, cost-saving printers. Last year alone, we delivered 1500 of them. And we're already at work on the ones tomorrow will require. Our family gets around. Call today, and we'll introduce you.

DATA PRODUCTS

Home Office: 6219 De Soto Ave., Woodland Hills, Calif. 91364. (213) 887-8000. **OEM Marketing Offices:** Boston, Massachusetts (617) 237-1950; Bethesda, Maryland (301) 652-8120; Cherry Hill, New Jersey (609) 667-7555; Dallas, Texas (214) 231-2240; Detroit, Michigan (313) 354-5858; Los Altos, California (415) 941-5485; Los Angeles, California (213) 474-1596; Minneapolis, Minnesota (612) 927-8747; Amsterdam, The Netherlands 020-452-457; Tokyo, Japan 493-6451; London, England 01-579-2917; Munich, W. Germany 08-106-5766; Vienna, Austria 34 53 61, 34 44 16

Programming Performance

some extent with *program* clarity—which our raters attributed to a shorter program being simpler to read, all other things being equal.

Through a series of experiments such as these, we are beginning to map out the fine structure of programming objectives. We want to know, for example, whether the "sloppiness" produced by promptness objectives can be remedied by "cosmetic" operations once the program is working to specifications. We can set down new objectives and continue the experiment after the program is "finished." In this way, we have discovered that programs built under promptness objectives can be significantly improved in almost all other objectives, while programs built under minimal core or maximum efficiency objectives tend to be less elastic. For example, in the first study we found that a "specification change" gave far more trouble to the efficiency group than to the promptness group.

All of these findings are suggestive of a programming strategy that has been developed more fully elsewhere.[2,3] First, get the program working quickly in a straightforward manner so that it meets all functional specifications. Then, and only then, decide on the more important secondary objectives and work by incremental changes in those directions. Analysis-coding-debugging is replaced by analysis-coding-debugging-*improving*. Such a strategy requires not only understanding managers to resist the press of getting on to other programs, but also properly disciplined programmers who take enough pride in their work not to be bored by what they regard as mere "clean-up."

It has been said that Americans have lost the pride of craftsmanship. Programming would be a good place to bring back that old-fashioned tradition, so that programmers would be motivated to improve their work. We have begun a series of studies in this direction, too, to discover what features can be added to software to motivate programmers to improve their work. Chester Dellen has completed a pilot study that demonstrates that software design definitely influences the desire of the programmer to continue working after his program meets functional specifications. When the functional test is passed, the computer selects one of three short fixed messages stored in memory—one neutral, one mildly encouraging, and one strongly encouraging. Just a few words of encouragement typed from the terminal raises the percentage of programmers trying to improve their work from 33% to 80%, with corresponding savings in space and time.

> Promptness also conflicts with program clarity, but then promptness seems to interfere with just about everything.

Excursions into the study of programming as human performance often bring us back in this way to hardware or software design. But travel is broadening, and once we have seen the human component in programming we can never again be so naive in our design or use of hardware and software. Though we may construct a terminal system which encourages a programmer to follow the improvement strategy, the manager will still have to tell *what* is to be improved—and *when to stop* improving and get on with the next job.

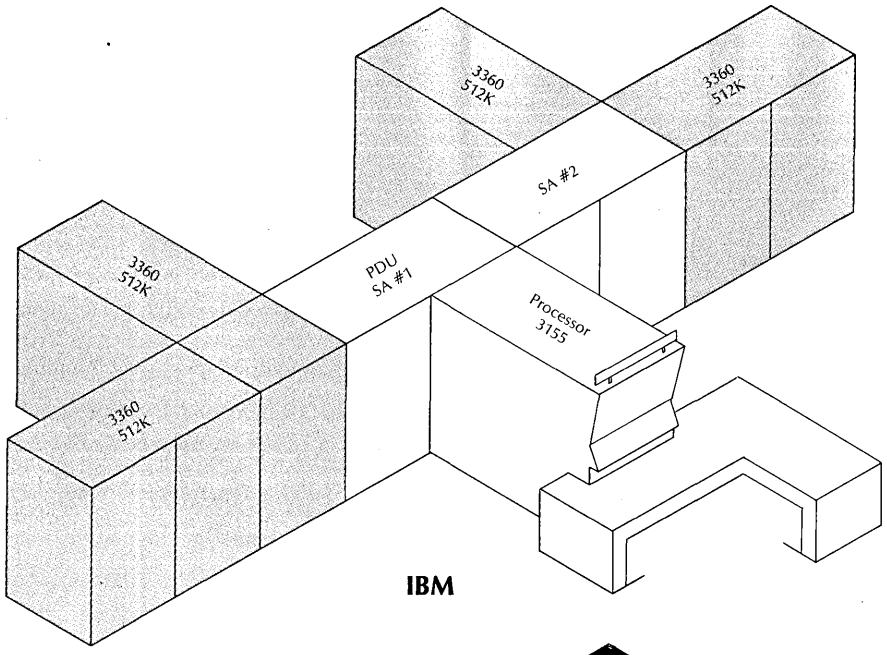
There is, in sum, no way we are ever going to get rid of the human element in programming or in managing programmers. It is time we stopped wishing and got down to the business of understanding that human element—the subject I have called "the psychology of computer programming." □

In response to our request for biographical information, Mr. Weinberg supplied the following on the sensible grounds that it is the kind of thing that he would like to know about authors but doesn't find in the usual formal statements:

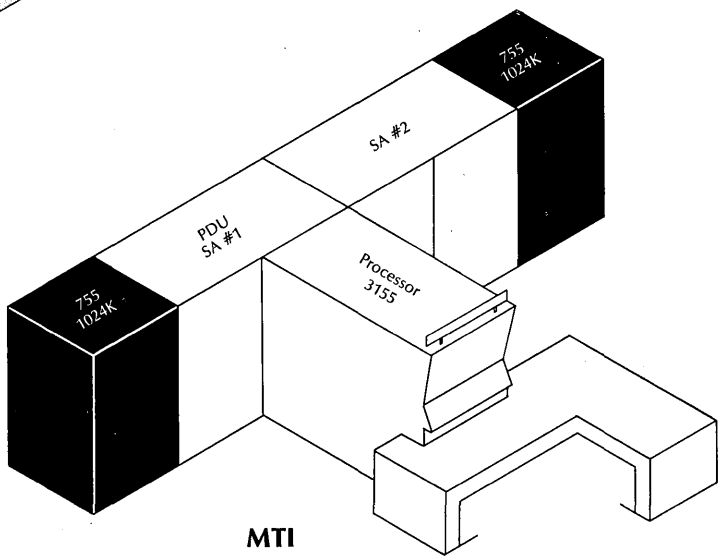
"I have received a lot of interesting formal education over the years, but learned very little about computing from any of it. Almost everything I know is from other people. As a consequence, I am now engaged in trying to reform computing education from the inside as a "professor," and from the outside as a writer and consultant—with very modest hopes for either approach. I have written a lot of programs, read a lot more, and debugged even more. After 16 years, my overall impression from all of our business is that we are struggling with our unaided minds on something far too big for us, and that we're so busy struggling we don't have time to help ourselves or each other. We also take ourselves too seriously, which doesn't help, so I take whatever occasion I can to say something funny about myself and about our business. In my spare time, I write bad novels and look at mountains."

[2] Weinberg, G. M. *PL/I Programming: A Manual of Style*. New York: McGraw-Hill, 1970.

[3] Weinberg, G. M., Yasukawa, N. F., and Marcus, R. *Structured Programming Using* PL/C. To be published by John Wiley & Sons, New York.



IBM



MTI

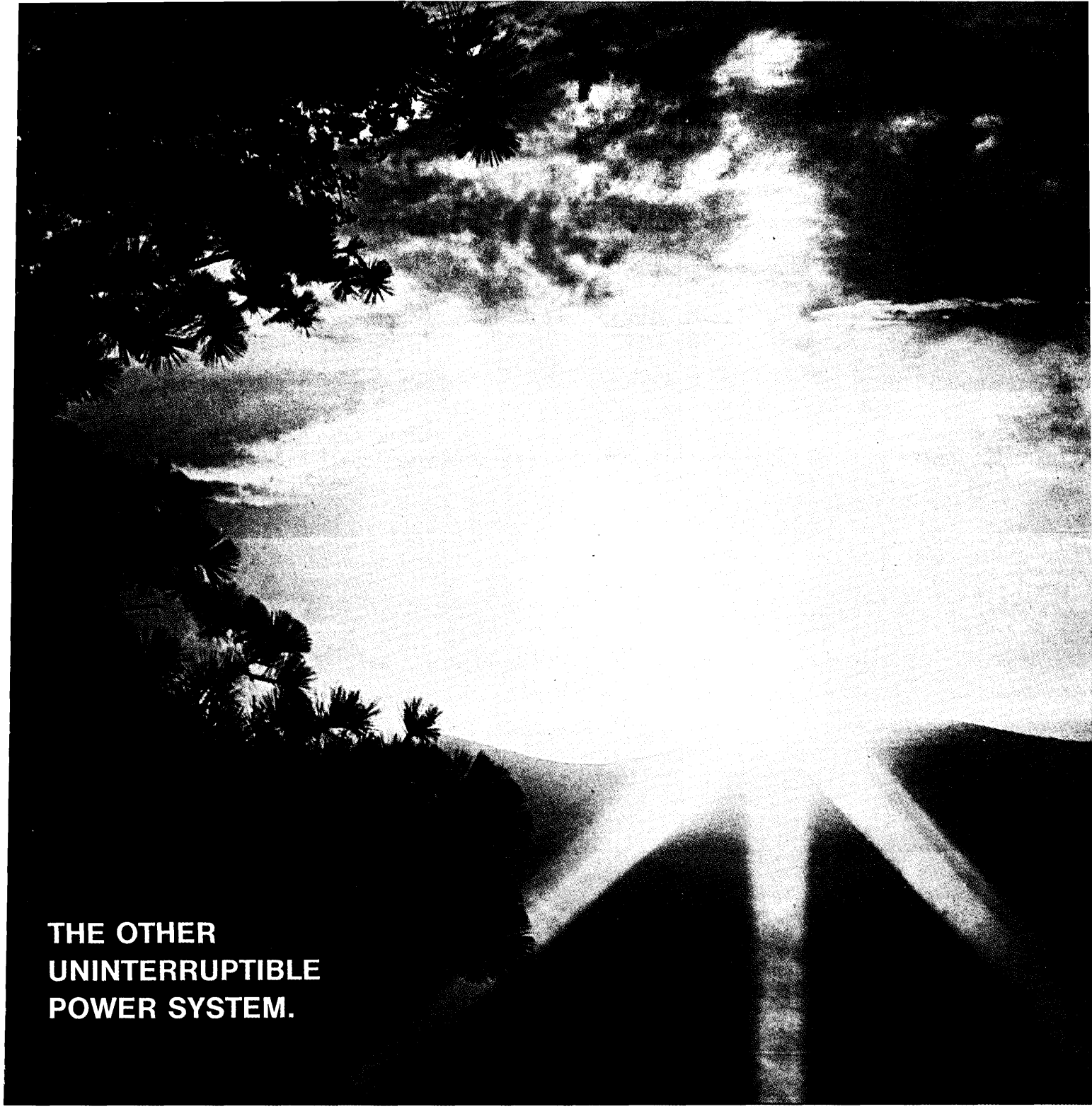
Save space... while saving money...

...on your 370/155 main memory. Now. The MTI 755 achieves up to 77% floor space savings over conventional approaches—at far less cost. (And, because it's MOS semiconductor memory, your system will require substantially less air conditioning —5,800 BTU's versus 21,000 BTU's for a megabyte system.)

You can be sure of the reliability of the MTI 755 because it's designed, manufactured, marketed and maintained by a single source. You get new 370/158 memory technology for your 370/155.

So if you're thinking about replacing or adding on to your present memory, why not find out how we can help you save space... and money. Contact James Crough, Memory Technology Inc., 83 Boston Post Road, Sudbury, Massachusetts 01776. Or, call (617) 443-9911.

MTI Memory Technology Incorporated



It never misses a day's work.

Neither does ours.

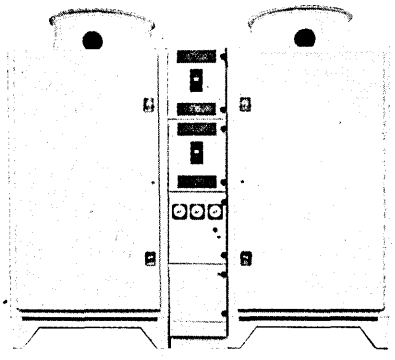
That's precisely why Teledyne Inet is the world's most dependable, on-line solid-state Uninterruptible Power System.

Your computer system can't afford lost real-time data, unscheduled shutdowns, time-consuming recovery procedures . . . even a miniscule glitch on the power line can scramble a computer's brain.

Teledyne Inet's UPS delivers a continuous flow of pure, precise AC power, no matter how many failures or transients there are in the utility power lines.

We have a booklet on this subject we'd like to give you. Write to Teledyne Inet, 711 W. Knox St. Gardena, California 90248, or telephone today (213) 327-0913.

Just ask for the best Uninterruptible Power System under the sun.



TELEDYNE INET

Uninterruptible Power Systems

CIRCLE 28 ON READER CARD

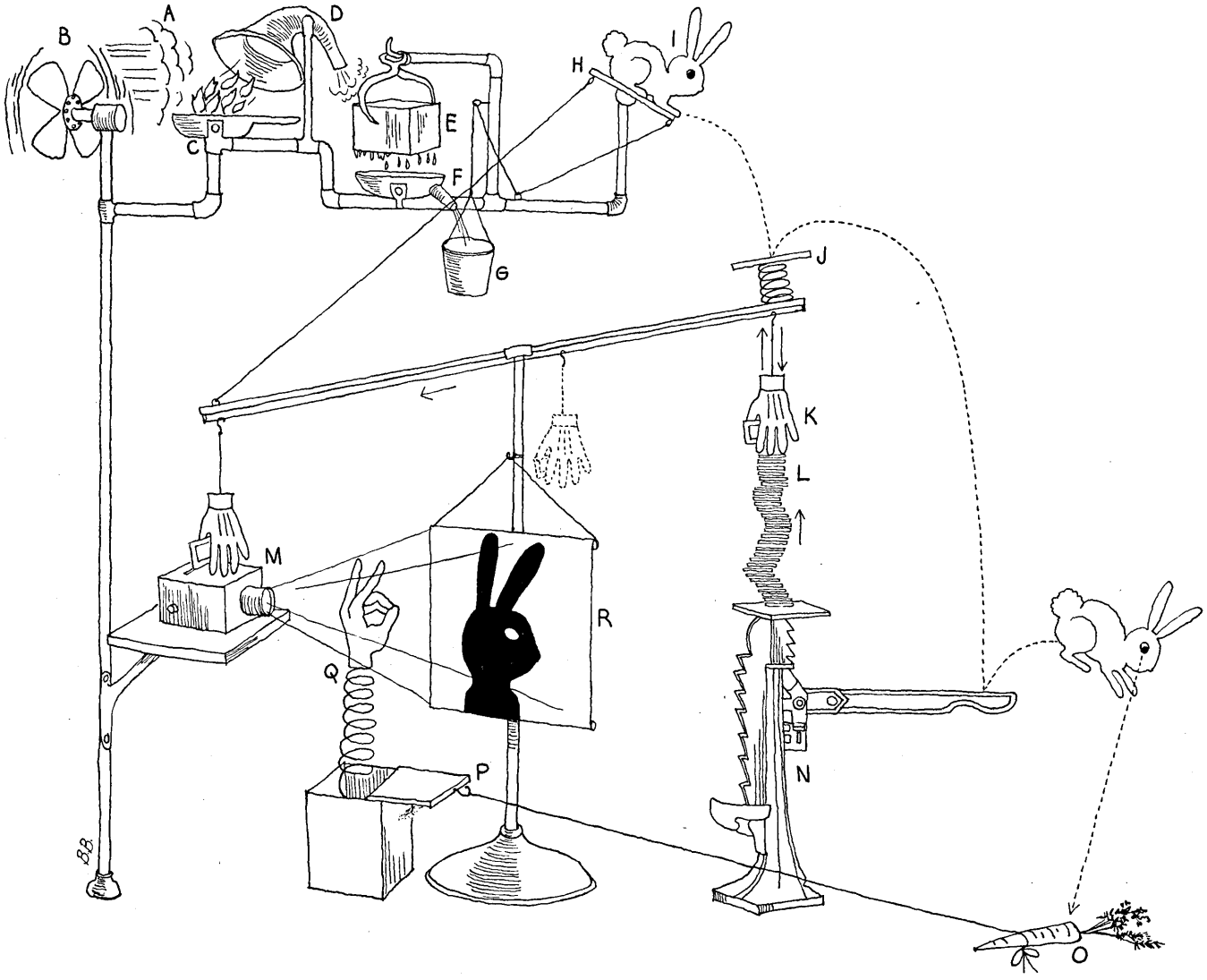
Virtual Slide Projection

by M. L. Coleman

The Klodiac Korp., a subsidiary of the Kludge Komputer Korp., has announced what they call "the most significant breakthrough in image projection since the Edison camera."

This breakthrough is called Virtual Slide Projection (VSP). The principle of Virtual Slide Projection is that a slide projector can be built with a real capacity of 20 slides, but with a virtual capacity of handling over 4,000 slides. A simple principle in theory, it has taken over four years of intensive development to perfect the three operating systems which make Virtual Slide Projection more than just a laboratory curiosity. The Virtual Slide Projection System/1 (VSP/1) will initially handle 35mm. cardboard-mounted black and white slides only, and is available immediately. The Virtual Slide Projection System/2 (VSP/2) will give the capability of handling full-color, holographic, three-dimensional slides and will be available the third quarter of 1973.

The projectionist of the past, when faced with the problem of presenting a slide show on multiple screens simultaneously, has had to set up several slide projectors on a single table. This rather inefficient technique, which is commonly referred to as Table Sharing Operation, or TSO, has been the impetus for the design of the ultimate system. This system, the Virtual Machine Slide Projector (VMSP), will project up to 64 different 16mm., 35mm., and 105mm. slides from a single machine simultaneously. The tech-



Breeze A rotates fan B causing fire C to flare up. Heat rises through trumpet D melting ice E. Resulting water is funneled through pan F into bucket G. Increasing weight of bucket pulls cord tilting platform H, thereby dislodging rabbit I which lands on spring J thus forcing hand K downward to pick up top slide from stack L. On upward movement, hand slides down wire depositing slide in projector M. Rabbit having bounced on to handle of Jack N, causes slide to move up one notch. Rabbit then seizes carrot O pulling back lid of box P, releasing hand Q into stream of light from projector thereby producing image on screen R. Trained rabbit returns to platform in preparation for next slide.

nique which forms the basis of this system consists of rapidly interchanging one slide for another from the virtual storage. The technique is called: Slide In—Slide Out.

All models of their current slide projector will be able to use the Virtual Slide Projection systems. The two smaller models, the 35 and the 45, already have the capability of using the system and just require a small field engineering change to implement it. (The fact that the hardware has been there all along and the user has been paying for something that they haven't been able to use is not relevant.) The model 55 and the model 65 will be upwards convertible to the model 55-A and the model 65-A during the third quarter of 1973. This will extend the benefits of Virtual Slide Projection to current users of these machines. Since the system is effective only for 10-, 20-, and 30-foot screen sizes, those users with 15- or 25-foot screens must decide whether they want to expand upwards to the next size screen or decrease to the next lower.

For users wanting to expand their capability, the Klodiac Korp. has announced the model 58 and the model 68. These are identical in operating characteristics to the models 55-A and the 65-A, but they contain certain enhancements such as integrated power cord and a new fast focus lens which provides automatic focusing in one fourth the time of the old manual focus lens. Of course, the new fast focus lens has its own controller; thus, all the so called compatible lens systems manufactured by other companies will no longer operate on the models 58, 68, 55-A, and 65-A. The models 58 and 68 make use of a monolithic projection bulb. This projection bulb is one half the size of the Carbon Oxide Resistance Element (CORE) bulb and operates with one fourth the power, providing twice the available light.

The Klodiac Korp. has expanded its policy of unbundling by separately pricing all accessories and peripheral equipment. These include their slide sorting package, their Projector Level Indicator (PLI), and their Compatible Bulb Oriented Lens (COBOL). The greatest impact will be on users currently operating with early models of the Compatible Bulb Oriented Lens, these early models not being strictly compatible with the latest one.

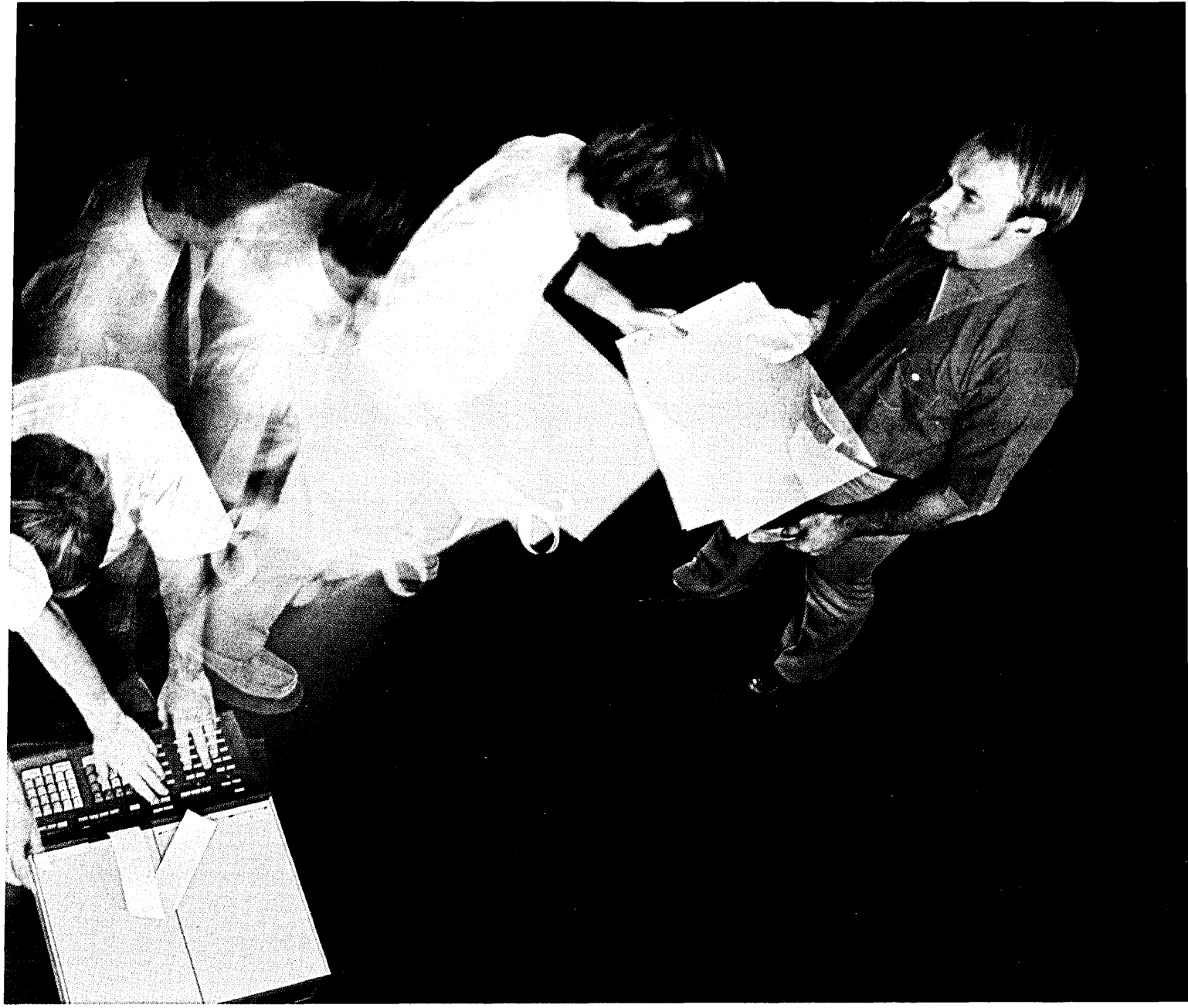
Perhaps the most useful benefit of Virtual Slide Projection is the ability for a small machine to back up a large one and thus protect against a slide show being cancelled due to the main projector failing. Analysis of the failure reports of several large users indicates how highly appreciated this will be. □

Hewlett-Packard Series 9800. The Name And Number That'll Shorten Your Path From Concept To Final Solution.

Get your hands on a Series 9800 Calculator System and you'll experience why it's the shortest, simplest path. From the outset you're certain to notice four outstanding features.

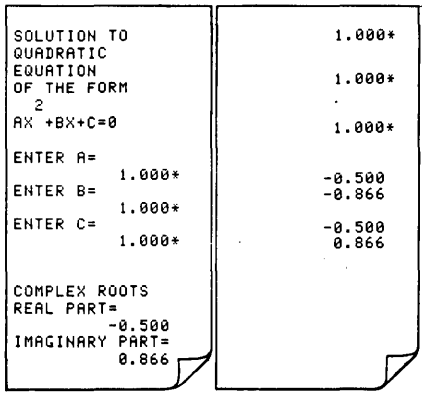
The modular, *plug-in architecture* that lets you design your own keyboard. The choice of *memories* that lets you pick the capacity you need today—with room to grow for tomorrow. The extensive line of Series 9800 *Peripherals* that lets you handle data in the form best for your operation. And the *instrument interface* that lets you plug in test instruments for real-time data acquisition.

But one Series 9800 feature really stands out. *Conversation.* Our calculators "speak" English, German, French, Italian, Spanish – even Japanese. In complete words and sentences, and scientific symbols. To solve a problem you set up a dialogue with your 9800 Calculator. Talk to it through the key-



board. It talks back to you through its exclusive alphanumeric printer (and display on some models).

That's the idea. Here's the payoff. On the left is a typical equation solved with the HP Alpha Printer. On the right, the same equation solved without alpha.



The benefits? Instant verification of your program and input data. Positive identification of each portion of your solution. And the confidence that you can send data to your colleagues and have them understand it.

Moreover, with these easy-to-comprehend user instructions, your assistants can confidently and reliably operate a 9800 Calculator with no computer training whatsoever.

Series 9800 users in science, engineering, medicine, and business have been telling us this silent, built-in "mini-typewriter" is the greatest boon to problem solving since the invention of the electronic calculator. (Note: If you need the formatting versatility of a full-fledged typewriter, we offer one of those. Also with complete Alphanumerics.)

This Printer is but one example of the technology that's enabled us to offer the widest and most exciting line of computing alternatives in the scientific community. Today, our line starts with the dynamic Model 35 Calculator—a shirt-pocket size electronic, super slide rule. Goes to our Series 9800 Programmable Calculators. To our 2100 Minicomputer family. On through to our System 3000, a multi-lingual, multi-programming computer.

The shortest, simplest path? We'll send you maps in the form of definitive literature. Or we'll be happy to guide you with a demonstration of the Series 9800—right at your desk. Just call your nearby HP Sales Office. Or write: Hewlett-Packard, P.O. Box 301, Loveland, Colorado 80537.

092/6

HEWLETT hp PACKARD

HP sales, service, and support in 172 cities in 65 countries.
For more information, circle reader service no. 96.
For a demonstration, circle reader service no. 109.
For information on the HP-35, circle reader service no. 110.

This management technique led to a steady increase in competence and attitude of hardware maintenance people, with a steady decrease in costs

Building a Hardware Maintenance Team

by Russell R. Eyres and James M. Howe

Computer system hardware maintenance has always been a problem and a headache for management. In most instances, the problem is aggravated by high costs, contractor dependence and low reliability of work produced. Some of the basic problems are:

1. Low commitment of the assigned technicians.
2. Hazy job objectives.
3. No performance standards.
4. No measurement of effectiveness.

An evaluation of the maintenance effort at the Naval Electronics Laboratory Center in San Diego, Calif., revealed that the highly contractor-dependent operation was not only doing a poor job, but was causing many other problems. There was no control over personnel selection or performance. Cross-training was not possible. Rival contractors resorted to buck passing, frequently causing scheduling delays and other operational problems.

Low commitment to the task is a traditional problem in a system maintenance area for the following reasons:

1. The work is generally considered to be uninspiring.
2. There is little challenge or incentive to do a good job.
3. No advancement potential.
4. Inadequate reward system.
5. Results seldom identified with an individual.
6. Technicians are given "second-class-citizen" status in the technological community.

Hazy objectives, inadequate performance and measurement standards and a lack of supervision by the installation managers headed the problem list as a set of items generating a generally apathetic work group.

Our first step in attempting to solve these problems was to prepare a specific function statement so that all members of the staff and the contractors would clearly understand our objectives.

1. To establish and perform preventive maintenance programs for computer systems.
2. To identify and resolve computer system malfunctions.
3. To test and evaluate computer system equipment.
4. To establish and control adequate spares inventories.
5. To establish performance requiements (for people).
6. To implement training programs necessary to maintain technical competence.
7. To maintain competent hardware

TASK	TITLE	% OF TIME
1.	Preventive maintenance	25
2.	Emergency maintenance	10
3.	Training	25
4.	Administrative (sick leave, holidays, meetings, etc.)	15
5.	Planned Work (leverage)	25
	Total	100%

Fig. 1. Maintenance technician job analysis

EQUIPMENT	LEVEL OF DIFFICULTY INDEX
CP-642A	1.0 (Standard)
CP-1230	1.3
CP-1218	.8
CP-1240 MTU-2	.9
CP-1232 I/O	.3
CP-642B	1.2

Fig. 2. Performance measuring system

JOB CLASSIFICATION SCALE	UNITS PER DAY	DESCRIPTION
GS-7	3.0	Training at 50%
GS-9	4.0	Must include cpu
GS-11	5.0	Must have system assignment
GS-12	5.0	Acts as Group Leader (Planned Work)

Fig. 3. Personnel performance requirements

oriented software capability.

After obtaining management approval of the objectives, we first directed our attention to the contractor dependency problem in an ineffective effort that consisted of two approaches: (1) convert contractor personnel to Civil Service positions and (2) purchase training courses from contractors for Civil Service employees.

The contract personnel that we managed to convert stayed only for a short time and usually went back to private industry with a 20% pay increase. The contractors who taught the extremely expensive courses made lucrative job offers to our brighter students and failed to teach much of anything to the less qualified students. In essence, our proselyting did not work and we paid them for proselyting our people.

An entirely new approach was needed and we focused on the root of the real problem, which was the overall lack of commitment of maintenance personnel.

Six specific actions were taken:

Skill, level of difficulty and task classification was accomplished. Drawing from work standardization defined and used by such institutions as Corn Products Co. and International Nickel Co., the tasks were analyzed and levels of difficulty and required skills were established. A major premise is that for every X units of physical work performed in troubleshooting, design or problem solution tasks there are Y units which are allotted for gathering of pertinent facts, problem analysis and theoretical review. The amount of Y units allotted relates to the level of difficulty of the task. This general definition is of no benefit for the calculation of a single task, but if standards are carefully prepared, they become accurate when predicting man-months or man-years of labor required provided "experienced judgment" is used in the selection of the level of difficulty classification.

Planned Work was the base used to achieve the first objective. Planned Work consists of:

1. Initiation and development of new systems test programs to expedite fault definition.
2. Feasibility studies of modifications of existing equipment to enhance

	CP-642B	1240 MT	RD-281	1232 I/O	1469	CS-1	individual scope
Tom	4	1	2	3	2	1	13
Dick	3	2	4	2	0	1	12
Harry	0	3	2	1	2	4	12
Pete	2	3	0	3	2	0	10
group strength	9	9	8	9	6	6	

4=expert/instructor
3=expert
2=know basic system
1=trainee
0=no ability

Fig. 4. Visibility chart

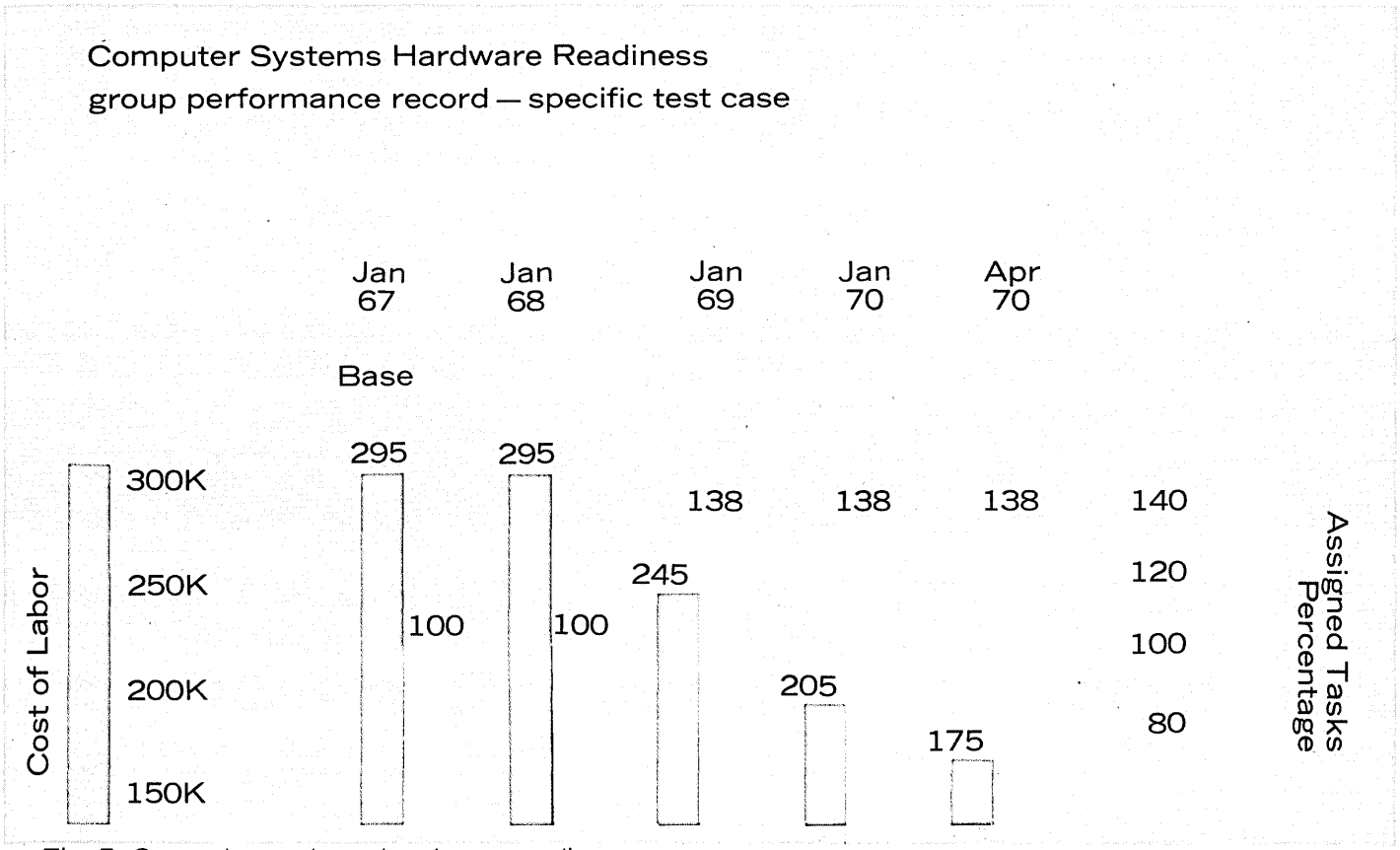


Fig. 5. Computer systems hardware readiness

performance or utilization beyond original design.

3. Systems configuration planning and execution maximizing utilization with minimum degradation of reliability.

The purpose of Planned Work is to gain leverage to minimize future preventive and emergency maintenance by closing the feedback loop between problems encountered and planning phases.

The job analysis established a general workload pictured in Fig. 1, with an average of 25% of each technician's time spent in Planned Work.

A performance measurement system was established. A system of estimating the relative complexity of maintaining each unit of a computer system was determined by an area-wide survey which listed all equipment maintained and posed this question: If Unit A is assigned a complexity level of 1, what would be the complexity level of all other units?

Consulting people with current technical expertise such as design engineers, field engineers, experienced data systems technicians and Civil Service employees resulted in data which was used to establish a Level of Difficulty Index. In combination with task classification date, "units/day" was established. Fig. 2 shows the units established for a group of Univac militarized computers and peripheral equipment.

Basic personnel performance measurement requirements were specified. Performance requirements were established in the same manner as described above for equipment, with the additional factor of job classification/pay scale included in the calculation.

Fig. 3 specifies the personnel performance requirements in units-per-day increments.

A mandatory training program was effected. Each person was encouraged to sign up for available training in areas related to his weaknesses. Lists of courses were made available and all costs were absorbed by the organization. Skilled training advisors were made available to furnish advice and assistance.

Mandatory career and professional development were encouraged to the fullest extent possible within the framework of workload requirements and goals. At the lower pay levels, training and cross-training was an absolute requirement.

The system responsibility concept was established. This concept requires that one man be fully responsible at the lowest level possible for the operational state of an entire system. The person selected for system responsibility is either the most qualified person or one who needs system responsibility for advancement. System responsibility, then, is a personnel development tool.

All other members of the organization support the assigned system responsibility. The use of the system responsibility approach eliminates potential gaps in coverage of problems and disallows buck passing. It helps establish an atmosphere where group relationship and authority/responsibility shifts can be dynamic, shifting from the structure-oriented formal organization to the problem-focused systems responsibility assignment.

This technique aids in solving the problem of how the boss or a senior specialist can assist or support a junior technician in a palatable relationship. In essence, the administrative authority remains constant in the traditional organizational structure, while working authority shifts from man to man depending on the task at hand. This allows each systems specialist to freely and openly request support from his peers and his boss and rely on their response consistent with conditions at the time.

A group interaction "visibility" model was devised and put into effect. The basic intent of this model is to maintain open, candid group communications and to obtain maximum individual commitment to a goal set by the group. The group keeps a large

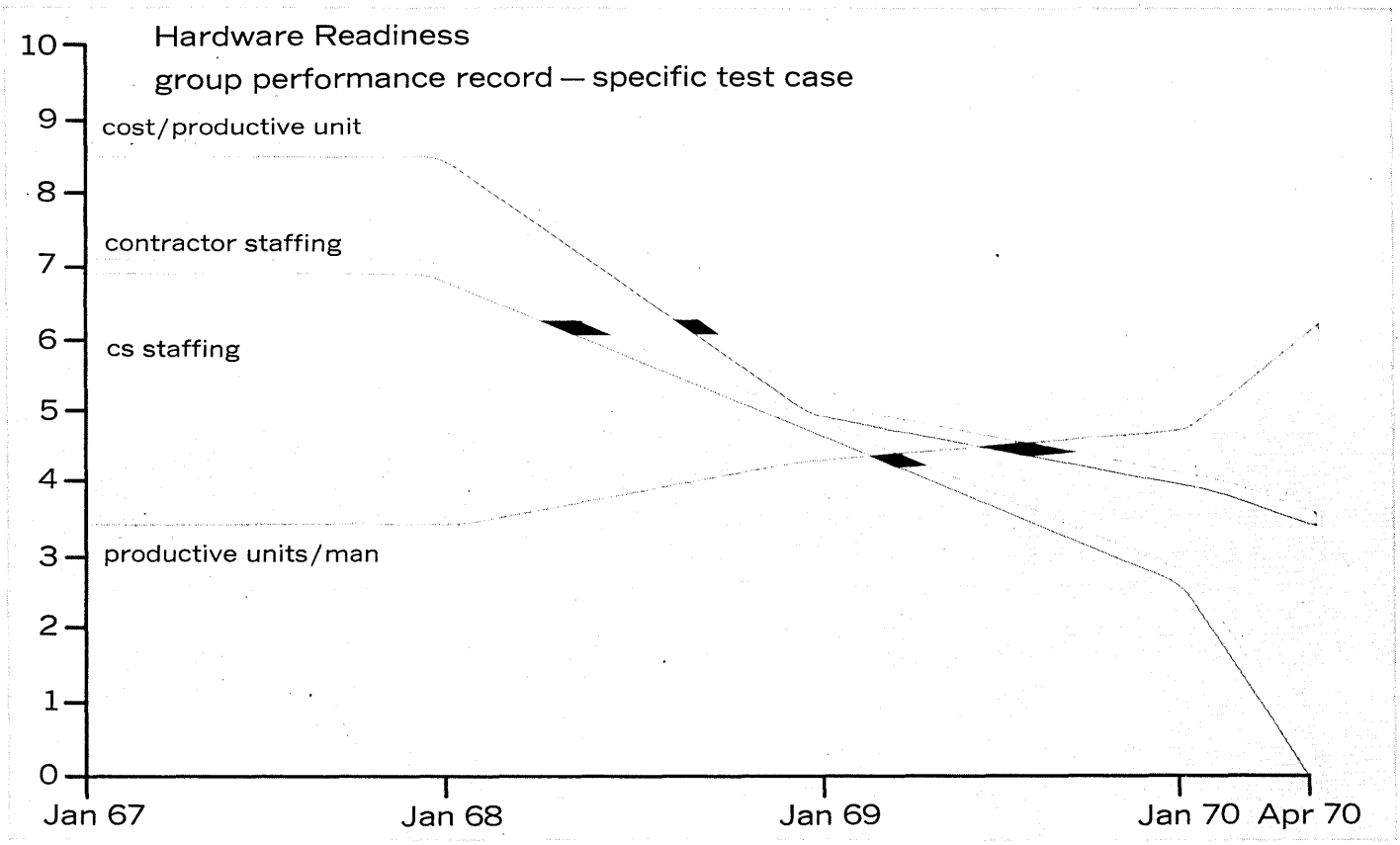


Fig. 6. Hardware readiness

chart with each man's name on one side and 32 different types of systems subtasks across the top. Each man rates his capabilities on each of the subtasks according to the following numerical scale:

1—Capable of running diagnostics and test routines.

2—Capable of locating and repairing minor problems.

3—Fully qualified in the definition and solution of equipment problems.

4—Excels in locating and repairing problems, can teach and give on-the-job training.

Fig. 4 shows a sample Visibility Chart. Because it is public, is filled out by each individual and is changed at will, it tends to be quite accurate.

At a glance, it shows the strength of the group on any particular piece of equipment and it automatically shows the scope of knowledge of each individual in the group.

When such a chart is first established, it causes a certain amount of trauma, but the advantages soon outweigh any feelings of inadequacy on the part of an individual.

Results

The results of these innovations can be expressed in a single phrase—costs came down and reliability went up. A specific test case was developed which is depicted in Figs. 5 and 6.

In order to present the results of the Hardware Systems Readiness Program, a series of comparisons was made on a like family of equipment involved in several different NELC projects. Fig. 5 shows the gross measurement of labor cost versus level of work. January, 1967, was selected as a base for the comparison since it coincided with the first action steps in our improvement program. The equipment and tasks assigned as of January, 1967, were accepted as 100% of our workload. By January, 1968, one year later, there had been no measurable change in either the workload assigned or the cost of the labor force on assignment. However, during that year it was apparent that general ability, attitude, and technical competence of the group was increasing. During the second year, the results became more measurable. By January, 1969, we had received a 38% increase in workload assignments yet cut costs from $295,000 to $245,000. By the end of the third year, the costs had been reduced another $40,000 to $205,000. Three months' experience in 1970 indicated a forecasted ability to further reduce the fourth year costs to $175,000.

Fig. 6, based on the same data, shows the relative changes in cost per productive unit and productive units per man. Over the three-year period, the productive units of work per man increased from 3.4 to 5.5 The cost per unit reduced comparatively although some additional cost leverage was evidenced by the replacement of contractors by lower cost personnel.

The final result of the total effort was an excellent, closely knit team with a high degree of efficiency, capability and team spirit.

Some of the specific accomplishments resulting from these innovations, as fallout to the main effort, were:

1. Increased cost effectiveness by a factor of 2.5 in a three-year period.
2. Designed and installed several general purpose diagnostic software packages.
3. Initiated and implemented numerous design modifications to existing equipment.
4. Established in-house training capability.

The most significant result of this total effort is the fact that so-called uninspiring tasks can become dynamic and uninspired employees can become highly committed and motivated. □

Mr. Eyres is head of the computer sciences systems and operations division at the Naval Electronics Laboratory Center, San Diego, Calif., which uses more than 40 multi-vendor computer systems. He was previously with General Dynamics in the engineering computer support department.

Mr. Howe is manager of adp hardware systems support, computer sciences department, Naval Electronics Laboratory Center, San Diego, Calif. His background includes work on circuit and logic design, electronic equipment maintenance, work standards, and cost accounting.

Before taking the big jump from IBM 1130 class machines to Burroughs B 6700s, these universities conducted a thorough—and revealing—comparison of computers from several manufacturers

Evaluating Computers for the New Zealand Universities

by John Good and B. A. M. Moon

In 1970 the New Zealand Universities were faced jointly with choosing new computing equipment to provide for most of them a quantum jump in computer power and range of facilities. This paper describes the authors' techniques, first to establish present and future power requirements of the universities in a principally FORTRAN-based environment and second to measure the extent to which these requirements were likely to be met by the different manufacturers' proposals.

As can be seen from Map 1, New Zealand has six universities plus an agricultural college of university status. These are scattered over the length of both North and South Islands, spanning a total distance of some 800 miles. They are autonomous and primarily state-supported with some supplementary capital and revenue from endowments and grants made by the private sector, with additional revenue provided by student fees. State finance for the universities is allocated in advance for five-year periods and disbursed through the University Grants Committee. In February, 1970, the New Zealand government made known that it was prepared to fund capital expenditure on computing equipment during the 1970 to 1974 quinquennium. Universities were requested jointly to seek and consider alternative re-equipment proposals and to make recommendations to government through the University Grants Committee. The universities were happy enough to concur with this plan for, though all possessed some sort of computing equipment already (see Map 1), they were all restricted by the very limited range of facilities provided. Universities in the North Island were already experiencing saturation of their facilities while those in the South Island expected to reach saturation by 1972.

Map 1 also shows the final decision announced by the government in August, 1971, to install Burroughs B6700 computers at the five larger institutions and to serve each of the smallest with a data communications link to the adjacent B6700 site.

After detailed consideration of a large number of alternative proposals from six computer companies this was felt to be the best way to meet the needs of all the universities for access to systems providing a wide variety of programming languages, operating primarily in a batch-processing mode with some time-sharing capacity.

As part of the selection process, it was necessary to establish the computer and peripheral powers needed by the universities and to measure these aspects of the vendors' proposals. This paper describes some of the techniques used by the authors in this work. While it was carried out on behalf of the New Zealand Universities Vice Chancellors' Committee, the opinions expressed here are those of the authors.

Given certain basic capabilities (in this case local and remote batch modes with some time-sharing), at any given time a computing facility must provide certain basic levels of computing power, printing capacity, and card reader speed. If these are not provided then some of the work cannot be done. These are quantitative factors and therefore measurable on proposed equipment. As needs they are assessable and, within limits, predictable.

There are also qualitative factors, such as the range of programming languages, the flexibility of the operating system and the quality of printed output which are of greater or lesser importance in assessing the merit of a proposal and which can only be given subjective valuations.

Many factors—for example, core size and backing store capacity and speed—have both qualitative and quantitative aspects.

Our objective was to establish some of the more fundamental quantitative factors.

Estimating quantitative needs

To establish the quantitative needs required us to determine the load in a base year and estimate the growth rate. The latter is necessarily predictive but past experience offered a useful guide.

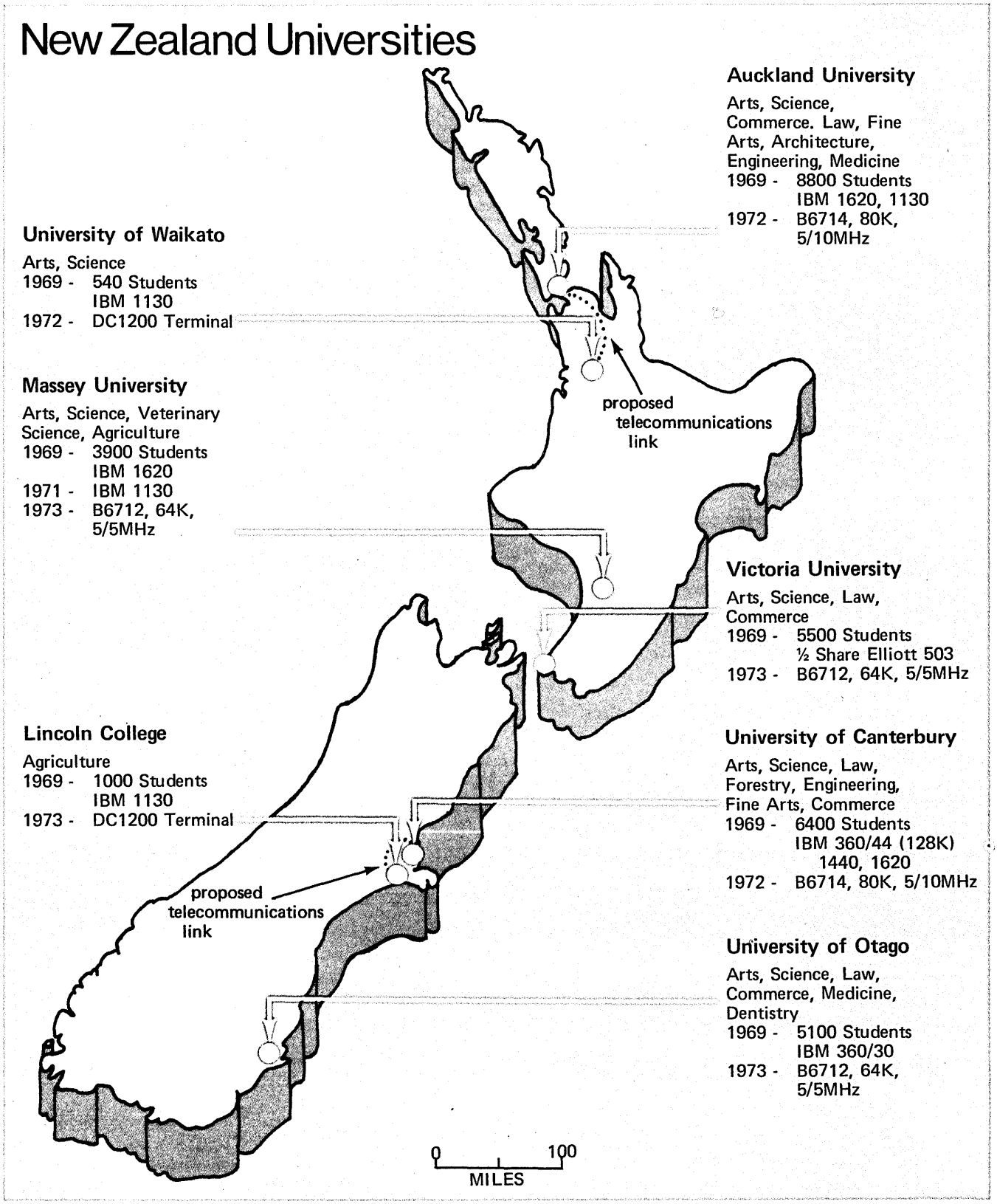
During the eight years of computing experience at Canterbury University, when disruptive factors have been absent, computer use has doubled every two years and, on grounds of continuity, the same type of basic growth rate is expected in the future. However, the acquisition of new equipment is itself a disruptive factor. It may reduce the work load, because the jobs will be done more efficiently; it may increase it because the new facilities will not only satisfy immediately visible needs

but will also have a multiplier effect stimulating new use of the total configuration.

Another disruptive factor experienced at both Canterbury and Otago was the introduction of charging for computer time. A charging system for use of the Canterbury 360/44 was instigated in 1969 and the immediate effect was to cut usage by one third, though growth then continued from this reduced level at the accustomed basic growth rate.

The effects of such disruptive factors could only be estimated for the future. More predictable was the growth in the universities themselves with concurrent changes in the relative sizes of the different faculties and the establishment of entirely new ones.

To determine the base load, we studied the pattern of computer load distribution at Canterbury University and the composition of the various institutions in the country. It was necessary to establish the relative per capita use between graduate and undergraduate



New Zealand Universities

students and the different levels between faculties.

Faculty members themselves contribute appreciably to computer use but this is closely related to student load in most faculties and so treating the load as if it all came from students was sufficient for predictive purposes. The faculties whose distribution of use between staff and students is atypical (e.g., medicine) contribute only a small share of the total.

Available evidence showed that the relative per capita load graduate/undergraduate was likely to be around 40:1 and that the total picture was not sensitive to variations in this ratio.

Equating forty undergraduates to one graduate the number of equivalent graduate students (EGS) per faculty was obtained. Dividing the number of hours of annual computer use by the number of EGS for each faculty gave annual per capita values. These were expressed as average rates of annual usage of a fully utilized 360/44 cpu, which was a convenient unit of power for subsequent benchmarking purposes.

Similar data were available from some other universities and, after making the necessary adjustments to reflect the much lesser power of their computing equipment, it was possible to incorporate their experiences into an overall predicted need for the New Zealand Universities. Actual average hours of 360/44 cpu use per EGS for major contributing faculties and their share of the overall total on a national basis at the 1969 level are given in Table 1.

Application to the loads per faculty of the basic growth rate, planned changes in relative faculty sizes and disruptive factor estimates yielded an estimated power requirement for each faculty at the end of the period to be served by the proposed new equipment. Summing for all the faculties, the results showed a national load in 1975 equaling six times the saturated (600 hours per month) throughput capacity of a fully utilized 360/44 cpu.

The evaluation is little affected overall by the quite real disparity in current computing rates bound by existing facilities. The operations of one faculty do not distort the needs of another since faculty estimates of hours used are independent. Though use by individuals in any single faculty will vary widely and statistical analysis is difficult, faculties do represent much more homogeneous groups over which to average than undifferentiated student populations and the results were appreciably different from those a "head count" would suggest. There was no substantive evidence of departures from homogeneity by faculty across universities and the figures remained

	EGS	HOURS/EGS	SHARE OF TOTAL
Sciences	962	2.71	41%
Engineering	200	10.24	28%
Arts and Social Science	1,251	0.61	9.5%
Agriculture	267	2.46	8.4%
Commerce	145	3.38	7.3%
Medicine	68	5.59	5.3%

Table 1

CPU		CORE WORDS	OPERAT'NG SYSTEM	COMPILER	CPU SECONDS	DISC TO DISC ELAPSED SECONDS	CPU UTILIZATION %
Burroughs	B5500	32K,4usec	MCP	B5500 FORTRAN	1,499	1,637	92
	B6700 (5/5MHz)	80K,1.2usec	MCP	B6700 FORTRAN	511	644	79
CDC	6400	64K	SCOPE	SCOPE FORTRAN	199	240	83
	3300	Not known	MASTER			1,440[1]	
IBM	360/44	128Kbytes	44PS	44PS FORTRAN IV,	1,120	4,459	25
			44MFT	44PS FORTRAN IV, CANTRAN		2,100[3]	53[3]
	360/50	512Kbytes	OS/MVT		998	1,163	86
	360/65	1024Kbytes	OS/MVT	WATFOR, FORTRAN G, FORTRAN H	298	370	81
	360/67	1024Kbytes	MTS		426[2]	453	94
	360/75	1024Kbytes	OS/MVT		207	255	81
	370/135	240Kbytes	OS/MVT		1,050*	1,500*	70*
	370/145	572Kbytes	OS/MVT		525*	656*	80*
	370/155	1024Kbytes	OS/MVT		263*	309*	85*
ICL	1904S	128K	GEORGE3	XFAT,XFEW,FLAIR		780[1]	
	1906A	512K	GEORGE3	XFAT,XFEW,FLAIR		410[1]	
DEC	PDP10A	64K	T/S MONITOR (2 batch)	FORTRAN	874	1,248*	70*
	PDP10I	128K	T/S MONITOR (2 batch)	FORTRAN	390[1]	488*	80*
Univac	1106	128K	EXEC8		412	549*	75*
	1108	128K	EXEC8		201	237*	85*

* Authors' estimate
1 Manufacturer's estimate of best performance
2 Includes system cpu time
3 Improved 360/44 throughput obtained with a slightly modified benchmark under 44MFT, use of CANTRAN in-core compiler and a spooling system.

Table 2. Configurations and performances

MACHINE	IN TERMS OF A 360/44 CPU[3]	TO A SCALE OF 19
Univac 1108	4.72	19
CDC 6400	4.67	19
IBM 360/75	4.39	18
IBM 370/155*	3.62	15
IBM 360/65	3.03	12
ICL 1906A[2][1]	2.73	11
IBM 360/67	2.47	10
DEC PDP-10/I[2]	2.29	9
Univac 1106	2.04	8
Burroughs B6700 5/5MHz	1.74	7
IBM 370/145*	1.71	7
ICL 1904S[2]	1.44	6
(360/44 CPU)	(1.00)	4
IBM 360/50	0.96	4
DEC PDP-10/A[1]	0.90	4
CDC 3300	0.78	3
IBM 370/135*	0.75	3
Burroughs B5500	0.68	3
IBM 360/44 best throughput	0.53	2
Original 360/44 throughput	0.25	1

* Authors' estimate
(1) Based upon an estimated cpu utilization
(2) Based upon a manufacturer's estimate
(3) 1120 disc-to-disc benchmark elapsed seconds, (1120 sec=360/44 cpu time required to execute the benchmark and includes a small amount of cpu time required for system overheads)

Table 3. FORTRAN batch throughput powers in the University of Canterbury environment

relatively stable (within a percent or two) in the face of many criticisms and refinements of a secondary nature.

Benchmark programs

The tool used for measurement of cpu power needs and performances was a batch of some 34 FORTRAN programs. Individually some of the programs investigated particular features of the FORTRAN language and hardware of the configuration under test. Collectively they formed a model of some of the individual characteristics, like core occupancy and distribution of elapsed times, of the University of Canterbury's job stream. Most programs were "live" ones written by ordinary computer users at Canterbury, Auckland and Otago Universities as part of their personal studies. A realistic proportion contained known "bugs."

The batch of programs was known to be compiler-intensive in comparison with the job stream. It was also input-output intensive. This was revealed by running it as a datum on the 360/44 at Canterbury University and timing the activities of various components of the system with an IBM 2989 Basic Counter Unit (BCU). This showed that the batch was 24.6% cpu active while the job stream which it was modeling was probably about 35% cpu active. Given the total number of cards and lines of print involved in the batch it was possible to obtain an indication of the rated speeds of card readers and printers suited to the cpu speeds given in the different proposals for the New Zealand university environment, after making some allowance for the stimuli towards both greater efficiency and also greater use which more advanced systems were likely to have on patterns of input-output. However, the major purpose of the exercise was to provide a base level of performance (the cpu time recorded on the BCU for the batch of programs when run under the 44 Programming System on the 360/44) against which the throughput power of each configuration under test could be measured.

A model of a FORTRAN jobstream was the only benchmark of this type practicable for the New Zealand Universities and certainly this technique could be criticized for narrowness. However, as a measure of overall system performance we believe that it gives a sufficiently accurate measure of quantitative performance for comparative purposes, especially since, no matter what other languages are provided, the present investment in FORTRAN programs and expertise and the relative absence of programs and expertise in other languages at most New Zealand Universities will make FORTRAN likely to be the most used language for some years ahead. Were a deficiency to be discovered in a particular compiler, other than FORTRAN, the New Zealand Universities might contemplate making the necessary software improvements themselves. If a machine is inadequate in FORTRAN for the New Zealand Universities' environment it is fundamentally inadequate for their purposes.

Machine performance

Almost all machines of interest to New Zealand Universities perform their input-output operations with hardware independent from the cpu. There may be competition for memory; only in one or two cases are cpu cycles "stolen." It very quickly became clear that adequate input-output capacity was attainable on all the machines to be tested. Attention was therefore focused upon the ability of the cpu/FORTRAN compiler/operating system/core/backing store combination to execute the benchmark. Two items were of interest.

The first was the disc-to-disc (in some cases, magnetic tape-to-magnetic tape) elapsed time required for execution of the benchmark. The second was the cpu time required to execute the benchmark programs, excluding cpu time spent on system overheads except on the datum 360/44 whose cpu overheads were minimal. It could broadly be said that the cpu time thus recorded was a measure of the raw power of the compiler/cpu/core speed combination while the disc-to-disc elapsed time reflected how much of this power was permitted to be used by the operating system/backing store/core size combination.

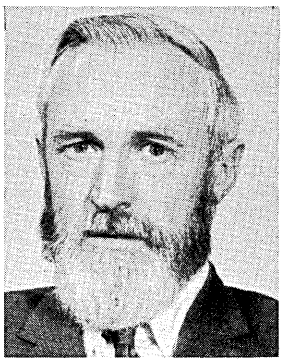
Table 2 shows the cpu and disc-to-disc elapsed times used. It also shows cpu time expressed as a percentage utilization of elapsed time. These figures are given for the different configurations tested, together with estimates for certain machines which were not available for testing in 1970. Almost all the times are to some extent estimated because it was not possible to obtain identical output from the different companies. One lesson learned in our analysis was the importance of giving precise unambiguous instructions to those responsible for running the benchmark. They should be given a copy of the exact program execution output expected. We did not do this and the results suffered accordingly.

Table 3 shows the powers of the various configurations in terms of the throughput powers of the 360/44 cpu and also rounded into a scale of 19. It will be noticed that the Univac 1108 and CDC 6400, which were the most powerful machines tested, have throughput capacity 19 times that of the original 360/44 configuration and that the 18 computers investigated are spread quite evenly across that range.

Readers should be clear that these performance figures refer to execution in a batch environment of a model of the University of Canterbury's 360/44 job stream. The figures serve as a valuable pointer to the likely power of each machine configuration in the general New Zealand university environment. Extension of these figures to cover environments substantially involving other methods of use and different programming languages would need some caution. Far better that readers investigate their past and present use, ascertain their likely growth rates and construct their own benchmark model to reflect their usage.

Every acquisition of new computing equipment involves a leap into the unknown and the leap was a very large one for the New Zealand Universities. This paper describes a method designed to wring the last ounce of useful information out of past and present use so that future use could be more accurately predicted and most economically provided for. □

John Good is chief programmer/analyst at the computer center of the Univ. of Canterbury, New Zealand. He previously worked for a computer manufacturer in Johannesburg, South Africa, and at a commercial installation in Auckland, New Zealand. He has B.Sc. degrees from Leeds Univ., England.



Bruce Moon is director of the computer center at the Univ. of Canterbury. He has worked with computers for the Australian government and for IBM World Trade Corp. He has M.Sc. degrees from the Univ. of New Zealand in mathematics and the Univ. of London in computer science. He is also a Fellow of the Institute of Physics, London.

Rest easy, we're not talking needless extinction, but our company grew out of a simple idea.

Eliminate the pokey old punchcard. Go directly to magnetic media. You'll increase throughput 15% or more, and the bundle you save will be in both people and equipment costs.

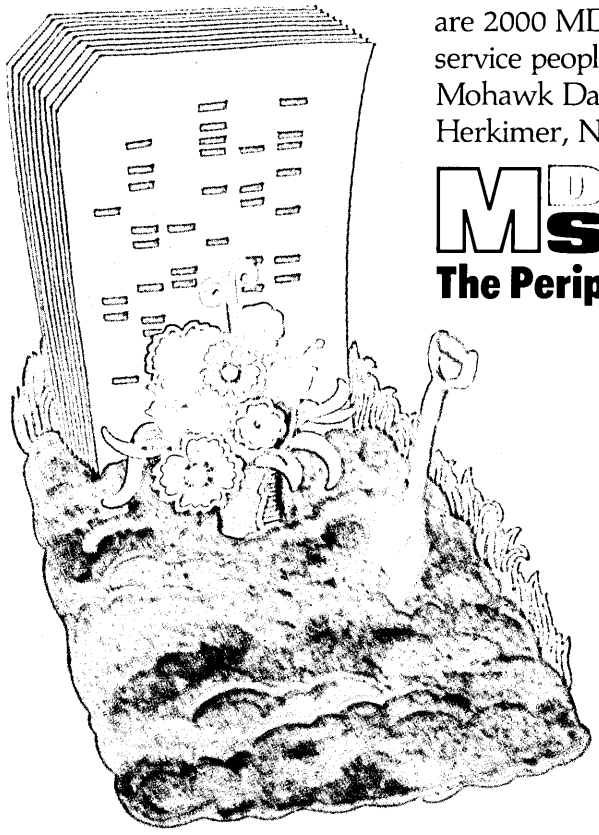
Good ideas have a habit of growing. And the newest in a full spectrum of MDS key-to-tape capabilities is System 2400 key display.

The tutorial CRT not only tells inexperienced operators what to do, it lets them see they re doing their work right. What's in it for you is quicker, cleaner data entry.

But data entry only scratches the surface on System 2400. This one can be a dedicated cluster of up to 20 positions, sure. It can also be a communications terminal. What's more, it can off-load the mainframe for editing and sorting and printing.

And now, with the boost in available core to 65k, System 2400 can be all of the above. You can configure yourself out of a lot of problems and into some real savings all at the same time.

Questions? Good. You call, we'll come. Call our nearest office or call MDS Domestic Marketing Dept. 22 at (315) 867-6610. We'll send the MDS man near you. And that's easy, because there are 2000 MDS sales and service people in the field. Mohawk Data Sciences Corp., Herkimer, N.Y. 13350.



MDS®

The Peripheral Power

You've never had a better reason to eliminate the expensive middleman, the punchcard.

Westinghouse 1550:

Emulates 2780, $650 per month (including maintenance).

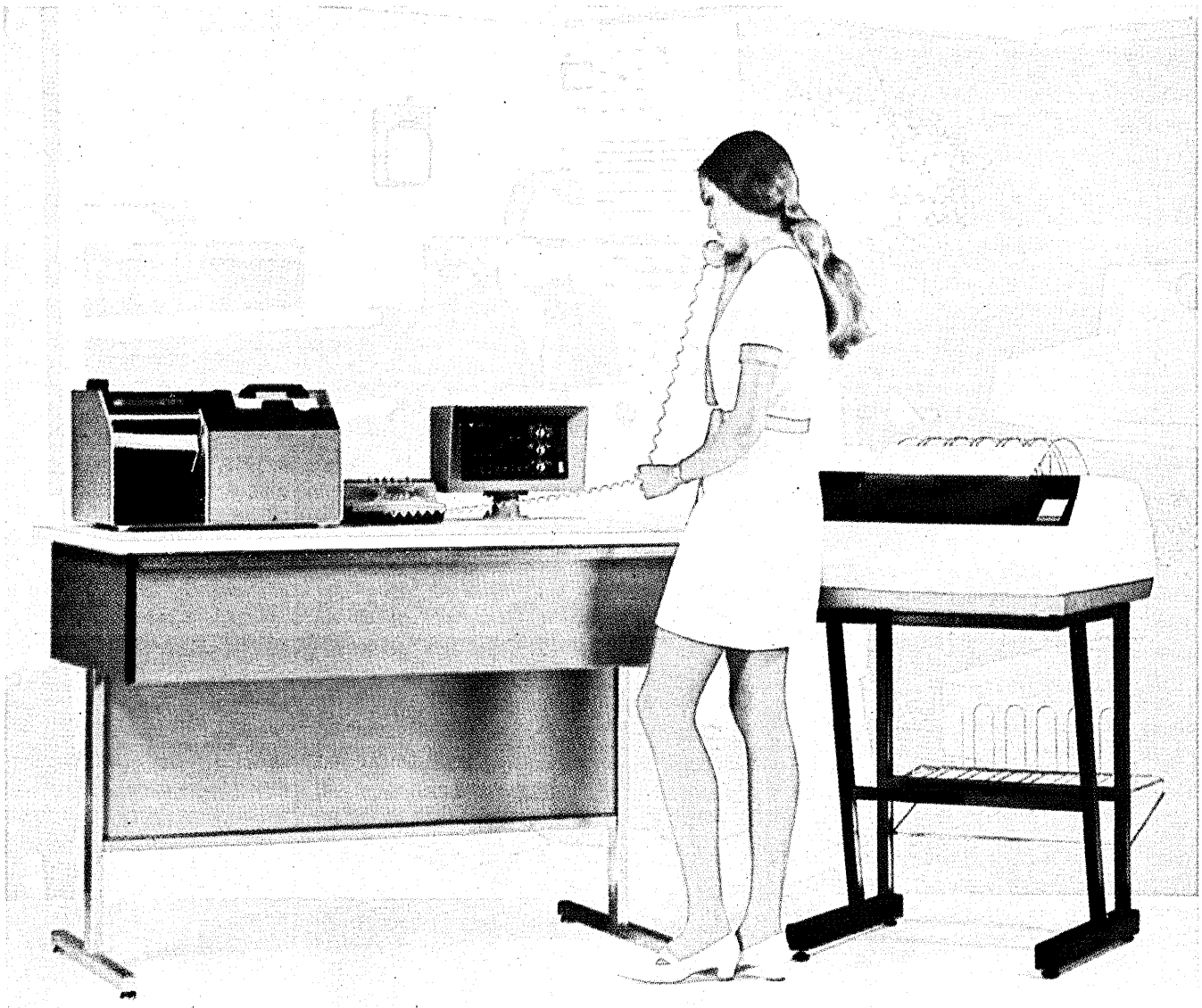
Call the regional office nearest you for the telephone number of your closest representative:

Washington	301 341-5330
Chicago	312 297-7330
San Francisco	415 854-4801
Houston	713 622-3820

Or contact Westinghouse Electric Corporation, 1200 W. Colonial Drive, Orlando, Florida 32804. Telephone 305 843-7030.

SD-5-72

You can be sure... if it's Westinghouse



Lots of sessions, a belated nod to the users, and Mickey Mouse and his pals await visitors to the Fall Joint Computer Conference

FJCC: Last of the Joints

The joint computer conferences got so big that the sponsoring American Federation of Information Processing Societies (AFIPS) began hiding them in such remote places as Atlantic City, Las Vegas and Houston. (In Boston in 1969, 36,000 jammed the city's War Memorial Auditorium.) But soon the mainframers with their multibooth (and some multistory) displays began to pull out. Then came the recession and then went the crowds.

A year ago the Las Vegas Fall Joint Computer Conference drew a sparse (by previous standards) 15,000 people. The SJCC drew 21,000. "We're talking to scientists and other exhibitors," moaned an exhibitor at Las Vegas. "Where are the big user industries we used to see?"

This year AFIPS is making a game try to get these user industries back to the FJCC by moving it out of Las Vegas to Disneyland near Los Angeles and adding special sessions to attract dp people in banking, medicine and manufacturing. But, alas, the exhibitors—who pick up the tab for the joints and for a sizable chunk of AFIPS member society budgets—had the last say: the three-day FJCC at Anaheim's Convention Center Dec. 5-7 is the last of the twice-a-year events. On the advice of an industry advisory panel of major exhibitors, AFIPS is scrapping the semi-annual event for a National Computer Conference once a year, the first to be held June 4-8 in New York's Coliseum.

The pressure from exhibitors seemed legitimate: they have too many other bases to cover to afford two mass-audience shows. Dp users in the medical, manufacturing, banking, railroad and petroleum business have their own exhibitions. There now are such smaller traveling shows as a "Computer Caravan" and a "Grand Tour" of Europe. This fall, 12 manufacturers of minicomputers and peripheral equipment began a tour of eight cities with what is called the Invitational Computer Conference. The Tulsa peripherals maker, Telex, this month loaded its equipment into a van that will log more than 20,000 miles on a tour to prospective customers in 60 cities. And next September a Micrographics Cavalcade to nine U.S. cities is being organized for microfilm companies.

The last of the semi-annual conferences may turn out to be the best. Certainly it's the biggest measured by the number of sessions, 59—so big that to save time the traditional keynote address is being dropped. The luncheon speaker is Anthony Oettinger of Harvard, who is chairman of the Computer Science and Engineering Board of the National Academy of Sciences. His topic is "Information Technologies and Public Policy."

The general chairman, Robert Spinrad, says the program for the first time "reflects our desire to promote an increased dialogue between the computer specialist and the edp user." He says half of the sessions are devoted to applications and user needs, but there still is plenty for the specialist. A rundown of some of the sessions show this mixture:

Technology

An update on the use of magnetic bubble materials in a general purpose computer will be given by researchers at Monsanto Co. in a session Dec. 7 on Advanced Technical Devices. The computer under design has a memory size from 4K to 1 million 16-bit words, with each 4K words requiring between nine and 17 bubble chips. At that session, two scientists from IBM's Components Div. tell of their design of an 8-million-byte charge-coupled device memory for use as a direct access storage device. The authors say that in test models they've achieved a bit packaging density of 3 x 10^6 bits per square inch.

Measurement

The highly topical subject of measuring the performance of computer systems will be given exhaustive treatment with no less than 30 speakers—21 delivering papers and nine serving as panelists—participating in five sessions. In one of these, Case Studies, on Dec. 7, four users will talk about their "trials and tribulations of measuring in the real world," as a summary of their session puts it. One of the panelists in a session on measuring system performance is Bell Labs' Richard Hamming, the man who gave recognition to the science of measurement in September of 1970 by giving it a name, Compumetrics. Another is the Navy's Cmdr. Grace Hopper who takes part in a panel on software validation and reliability.

History

For students of computer science's evolution, Historical Perspectives are being offered in an evening session Dec. 6 chaired by Montgomery Phister, Jr., reviewing the history of computer development and usage. Maurice V. Wilkes of England's Cambridge

FJCC'72 PARTICULARS

Theme: Coming of Age.

Registration: Members—$25; Nonmembers—$45. (After Nov. 17: $35 and $50).

Exhibits only: $5 (one day); $10 (three days).

Proceedings only: $20 (members); $40 (nonmembers).

Dates: Dec. 5, 6, 7. Exhibit hours: 9 a.m.-6 p.m.

Last of the Joints

University traces computer architecture and IBM's James H. Pomerene tells how advancements in components contributed to computer memory development. Albert S. Hoagland's paper on mass storage concludes with a forecast that magnetic recording density during the next 10 years will increase by two orders of magnitude. Walter F. Bauer and Arthur Rosenburg trace the genealogy of software from the subroutines of the early '50s to the complex file management systems of the present with a wistful comment on the "great time gap between concept and practical reality of a new idea," which they describe as a "general indictment of the programming profession."

On privacy, there's an interesting paper describing how a study was made in Canada of the way some 2,000 organizations handle large files of records containing personal information (Privacy and Security of Databank Systems, Dec. 5). On supercomputers, Goodyear Aerospace's J. A. Rudolph talks about his company's associative processor, the STARAN (Supercomputers: Present and Future, Dec. 5). And on memory organization, W. T. Wilner of Burroughs describes the B1700 where programs are 25-75% smaller than on byte-oriented systems (Memory Organization and Management, Dec. 6).

Titles and leaders of four day-long user applications seminars to be held during the conference are: Medicine and Health Care, Kenneth Pierce, Health Data Net; Computers in Manufacturing, Richard Lilly, Manufacturing Management Services; Computers in Banking and the Changing Electronic Payments Mechanism, Richard Mills, First National City Bank; and Computers in Information Data Centers, Joe Ann Clifton.

The exhibits of some 150 companies occupying 410 booths—full capacity of the convention center hall—is much healthier than the spring show of 146 companies in 294 booths; but it's still behind last fall's 535-booth display by 180 firms. The record is 997 booths at the Las Vegas show in 1969 by 368 companies—many of them shouting their last hurrah on the eve of the recession. But the show still is considered a prime marketplace by at least 30 companies who have chosen the event to announce new products, as reported below. □

'72

The rapidly improving economic climate seems to have contributed to best fall product harvest in several years

Product Preview

AMPEX CORP.
Marina del Rey, Calif. **Booth 1056**

Add-on Memories

It recently occurred to some Ampex engineers that they could add a relatively small semiconductor cache memory onto some of their much larger and slower core memories, resulting in a memory that most of the time appears to the system to be running faster than it really is. That is what has been done with the 1.8-usec ECM core memories that were offered as faster alternatives to the IBM LCS auxiliary store.

Mainframe-ECM consists of up to 32K of 250-nsec MOS memory with an access time of 150 nsec. Behind it will be up to a megabyte of 1.8-usec non-interleaved core memory. The combination is out to replace the 2365 memory on the IBM 360 models 65, 67, and 75. That memory was rated at 750 nsec, and so is the Mainframe-ECM —most of the time. "Hit ratios" now must be taken into consideration. It would seem a good guess that during 90% of the cpu fetches, the information desired will be in the cache. If it isn't—and a certain percentage won't be—the cycle time drops to 1.8 usec. The system won't run any faster (the cpu rate is not altered), and it will probably run a small percentage slower. But the really nice thing about Mainframe-ECM is that a megabyte rents for around only $9K/month on a two-year lease. (Prices were being finalized just in time for the show.) This rental undercuts Ampex's rental of their 750-nsec all-core 2365 replacement by several thousand dollars per month. No software changes and only a minor change to the plug interface are said to be required. For information:

CIRCLE 320 ON READER CARD

BRIDGE DATA PRODUCTS, INC.
Philadelphia, Pa. **Booth 3002,04**

Card Reader

It's unreasonable to expect remote site dp users to enter all programs and data through paper tape or a keyboard when 200-cpm card readers like the 8020 are available at oem prices as low as $1600. Built for 80-column cards, the unit is offered in a stripped version without the communications interface for as little as $980 to oem buyers, or in a non-terminal mark-reading/hole-reading style for $1830. The terminal version has an RS232C interface. All have 500-card input and output hoppers. For information:

CIRCLE 321 ON READER CARD

CAELUS MEMORIES, INC.
San Jose, Calif. **Booth 4524-28**

Tape Drives

Important claims made for these 7- and 9-track tape drives are their estimated 4,000 hours between failures and average 15 minutes per year downtime. Model 700 has 7-inch reels, runs at up to 10KC, and is priced at around $2200. Model 800 gets 8½-inch reels, runs at up to 20KC, and costs around $2500. Model 1000 has full-size 10½-inch reels, runs at up to 80KC, and

(Continued on page 111)

costs around $2800. Three recording densities (200, 556, and 800 bpi) are selectable on 7-track units; 800 bpi and 1600 bpi are electronically selectable on the 9-track versions of the three models. For information:
CIRCLE 322 ON READER CARD

CODEX CORP.
Newton, Mass. **Booth 2080**

Modem

Regular voice-grade dial-up lines can be used for full-duplex transmissions at 4800 bps with this modem, thanks to an adaptive equalizing and modulation technique with the mouthful of a name of Quadrature Amplitude Modulation. And because it has a little bandwidth left over even at 4800 bps, the unit is offered with a 300 bps secondary channel for sending housekeeping kinds of messages like acknowledgements. Simplex and half-duplex versions of the 4800 Dial Modem extend the price range from a minimum of $3175 to $5975 for the full-blown version. For information:
CIRCLE 323 ON READER CARD

COURIER TERMINAL SYSTEMS, INC.
Phoenix, Ariz. **Booth 1060**

Communications Controller

Automatic polling and dial-up line connect are two of the features of the Multiline Communications Controller. Meant as an IBM 2701 replacement for Courier terminals, the MCC can handle as many as 192 voice-grade lines running at 2400 bps, and so will find itself in service as a 2702 or 2703 replacement, too, or as a 3705 running in 270X emulation mode. Aggregate transfer rates are limited only by the 360/370 byte multiplexor channel to which the unit connects; individual line speeds are limited to 4800 bps.

An eight-line system with Type III line adapters runs $1540/month on a two-year lease compared to a figure of $2220/month for a 2701, according to this vendor. The purchase price for that MCC configuration would be $31,720. Additional pairs of lines are added at 10% of IBM's monthly charge, Courier claims. For information:
CIRCLE 324 ON READER CARD

FACIT-ODHNER, INC.
Secaucus, N.J. **Booth 01-03**

Paper Tape Punch Head

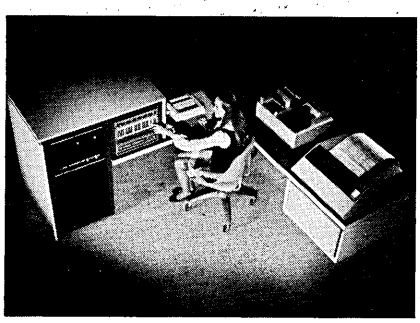
The model 42-8033-03 paper tape punch head mechanism is the first low-speed unit (35 cps asynchronous) offered oem's in this country by the Sweden-based firm. The device can be incorporated into dp equipment as well as into office machine and measurement recording product lines. Both five-through eight-channel paper or mylar tape can be punched, and additional features include a separate magnet for backspacing, inductive clock pulse timing, and, optionally, contacts for echo and parity checking. Orders for 100 units drop the price to $328 each, with availability from stock, depending on size of order. For information:
CIRCLE 326 ON READER CARD

GENERAL AUTOMATION, INC.
Anaheim, Calif. **Booth 4525**

Minicomputer

Crammed into the GA booth will be three active displays, all of which include minicomputers, and one of which will include a minicar (presumably a Honda since nothing larger will fit). The car will be there for the Vehicle Electrical Test System, and it might overshalow the company's new product, Mini DMS (Disc Monitor System).

Mini DMS is for those IBM 1130 installations that have by now determined that they are never going to move up to an IBM 1800 and therefore don't need all the power of GA's 18/30 replacement for the 1800 either. The



mini version is program compatible only with the 1130 (the larger system is compatible with that and the 1800), and is basically a detuned version of the 18/30 DMS. It has a 2-usec processor, 8K of core, a 300-cpm card reader, 125-lpm printer, IBM 2310-compatible disc, a keyboard console, and a disc operating system. It is priced at $39,500. For information:
CIRCLE 327 ON READER CARD

HATHAWAY INDUSTRIES INC.
Tulsa, Okla. **Booth 3564**

Facsimile Scanner

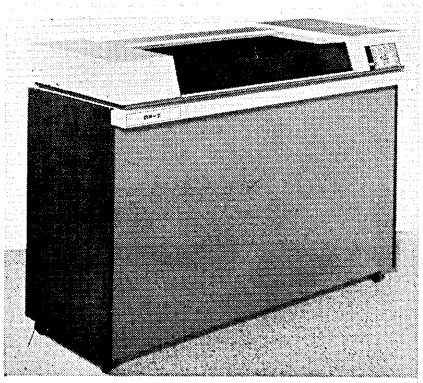
Some kind of high-speed facsimile transmission or tv-to-facsimile demonstration will be in operation at Hathaway's booth, although they may not be able to run their gear at full speed since its microwave links could wreak havoc on neighboring demos. The problem will be that they will be running what is claimed to be the fastest scanner on the market, the 741 Faxscanner, which normally requires 2.5MHz lines.

The unit translates 8½-inch documents into 10 tones of gray at a rate of two inches per second, with a resolution equivalent to 400 scans per inch both horizontally and vertically. This degree of accuracy is needed for sending photographs or fingerprints, or in tv monitoring. The 741 is priced at approximately $2500; its companion facsimile recorder, the 731, goes for about $3500. For information:
CIRCLE 328 ON READER CARD

HOUSTON INSTRUMENT
Bellaire, Texas **Booth 4065**

Off-line Plotting

Two new products comprise this off-line plotting system, the DP-7 incremental plotter and the MTR-4 tape drive. The 1,800 step/second plotter has a triple-pen option, a 1,000-character buffer, and up to 36-inch wide



roll paper. A single character of relative address data can cause it to move up to 63 space increments (about 0.3 inch). The 9-track drive, which uses full-size 10½-inch reels, is offered in 200-, 556-, and 800-bpi versions, all IBM format compatible. It features forward and reverse block addressing for restarting a plot. The plotter is base-priced at $9500; the drive at $15,500. Both units are available separately for use with other HI gear. For information:
CIRCLE 329 ON READER CARD

INFOTON INC.
Burlington, Mass. **Booth 3024,2524**

Crt Terminal

One way to nearly insure a market is to build into a product all the features you can think of. This seems to be what happened to the Vistar Display Terminal, a buffered, variable-speed oem crt. For instance, the terminal operates at switch-selectable transmission rates of 75, 110, 150, 300, 600, 1200, 1800, 2400, 4800, 7200, or 9600 bps. Full-duplex or half-duplex opera-

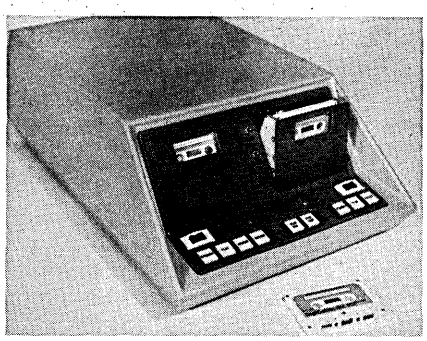
tion is also switch selectable, and the Vistar can run in unbuffered, line-buffered, or page-buffered mode.

The display has space for 24 lines of 80 dot-matrix characters each. Upper case ASCII is used. Features include line-by-line roll up, erase screen, and erase to end of line commands, either 50 or 60 Hz refresh rates, a nondestructive cursor, a printer interface, and a choice of parity checks. Unit pricing starts at $2295. For information:
CIRCLE 330 ON READER CARD

INTERNATIONAL COMPUTER PRODUCTS, INC.
Dallas, Texas **Booth 2041,1540**

Cassette Recorder

This dual-channel cassette recorder, normally used to transfer data from a terminal at rates to 2400 baud, has enough logic built in to do some useful functions like off-line cassette duplication. It can do a cassette-to-cassette



copy at 350 cps if the copied data is also being printed on the terminal, or at up to 2400 bps in nonprinting mode. The incremental drive employs a two-track recording technique that packs ASCII data at 550 bpi (50,000 characters per cassette) and is said to be insensitive to variations in recording speed. Called the Model 3200, it has a conventional RS232B interface and sells for $2800. For information:
CIRCLE 331 ON READER CARD

KENNEDY CO.
Altadena, Calif. **Booth 3559,61**

Cartridge Recorder

For its first foray into mag tape cartridges or cassettes, this firm has chosen the increasingly popular 3M quarter-inch tape cartridge to build around. A step up from units based on the Philips cassette, the 330 Digital Cartridge Recorder offers 1600-bpi recording density, 21-ips tape speed, and a resulting transfer rate of 40,000

bps. Forward and reverse tape positioning can be done at 90 ips.

With a dual gap read/write head for read-after-write operation, the unit is available in single-, dual-, or four-track versions. Up to 23 million bits theoretically could be stored on a single cartridge. Intended for oem use, the 330 comes without an enclosure at prices ranging from $200 to $750 in quantities of several hundred. For information:
CIRCLE 332 ON READER CARD

KYBE CORP.
Waltham, Mass. **Booth 23,24**

Tape Cleaner/Tester

In addition to cleaning reels up to 10½ inches in diameter, the TMS-35 simultaneously tests the tape for condition and documents its findings on a little strip printer on the front of the unit—all in less than five minutes. The TMS-35 is priced something under $7K with deliveries 30-45 days ARO. For information:
CIRCLE 333 ON READER CARD

LITTON ABS
Carlstadt, N.J. **Booth 3070,72**

Teleprinter

The latest product from this oem supplier is the model 120 terminal, which can print 96 upper and lower case ASCII characters in 5x7 dot-matrix form on up to six copies of paper at operator-selected speeds of 10, 15, 30, 60, and 120 cps. Tractor-driven forms can be up to 14⅞-inches wide, allowing a 132-column print line. A variety of options permit manufacturers to obtain the 120 in different stages of completion—from just the basic print mechanism, to a complete KSR terminal with modem and all electronic components. The in-

terface can be serial (RS-232B for optional 202C and 103A2 modems) or parallel, which must be built at the TTL level. In quantities of 500, the model 120 sells for $2098/each. The terminal will be available during the first quarter of next year. For information:
CIRCLE 334 ON READER CARD

NORTRONICS CO., INC.
Minneapolis, Minn. **Booth 1572**

Mag Tape Heads

Suggesting what is to come in mag tape drives, this firm's recording heads are made to operate at speeds to 300 ips, at densities to 3200 bpi, allowing for transfer rates to 960 Kbps. Oddly, the fact that customers want self-threading drives influences the design of the head as well as the high speeds and densities do. In addition to the half-inch heads, a new line of cassette drive heads, for tape speeds to 10 ips, is being introduced. For information:
CIRCLE 335 ON READER CARD

OMI MEMORIES, INC.
Los Angeles, Calif. **Booth 2519**

Disc Memories

Technically, this booth probably contains the most interesting product at the show. The models 6001 and 6002 are unusual in almost every respect and should give users something to think about in choosing their disc storage systems.

Two disc platters comprise both systems. The bottom one is an IBM 3336-type platter fixed to the unit, and the upper one is a 5444-type removable cartridge. A closed-loop track-following system, together with narrow 3330-type heads, achieve a recording density of 666 tracks/inch (more than three times the 3330's 200 tracks/inch), and a transfer rate of 850 KB/second. The two models differ in that the 6001 has a 63-megabyte capacity and an average access time of 40 msec, and the 6002 has a 5-megabyte capacity with a much faster average access time of 15 msec—the fastest one we know of for a movable-head drive.

The controller is unusual, too. It retains the rotational position sensing feature of the 3830 and also has some

unique features, such as error correction for up to 16 bits (the controller can even go to the cpu, fetch the bad word back, correct it, and stick it back in memory on a cycle-stealing basis without the cpu ever knowing what happened), and its microprogramming can be used to create word masks to search for specific data.

The final surprise about the disc systems is that they are for minicomputers, with the first complete interface targeted for the Digital Equipment PDP-11. The controller, a disc operating system, and dual-platter drive for that computer is priced at approximately $17K. There is little price difference between the 6001 and 6002 drives, which oem's can also purchase for approximately $5400 in orders for 100 units. For information:

CIRCLE 336 ON READER CARD

PARADYNE CORP.
Clearwater, Fla. **Booth 4555**

Remote I/O

Teleprocessing looks like standard unit-record I/O when the IBM 270X is discarded and Paradyne's PIX system installed. The substitute system's on-site control unit, the PCU, emulates an IBM 2821 card reader and line printer controller. It can have up to 16 4800-bps lines coming into it from remote sites. At the remote site another unit, the PRC remote channel, emulates the 360/370 multiplexor channel. It interfaces the 2821 controller which in turn connects to the card equipment and printers. The result is a claimed hardware savings of 10-15% plus the ability to address remote peripherals through FORTRAN and COBOL. The system can also be used for cpu-to-cpu communications.

Component prices are around $16,000 or $400/month for the PCU with one line and $10,000 or $250/month for the PRC (both including modem and error control). For information:

CIRCLE 337 ON READER CARD

PIONEER MAGNETICS INC.
Santa Monica, Calif. **Booth 4548**

Power Supplies

Two additions to the 2400 line of oem memory power supplies will be shown. The 2412 is a 140-watt uninterruptible multiple-output convection-cooled unit that can serve up to eight 4K x 16-bit MOS RAM modules. Batteries provide no-break power in case of complete AC failure. The model 2408 is rated at 500 watts from an input voltage ranging from 80-123 volts RMS. Prices are in the $300-400 range depending on models and quantity. For information:

CIRCLE 338 ON READER CARD

RANDOMEX, INC.
Palos Verdes, Calif. **Booth 1077**

Disc Pack Cleaner

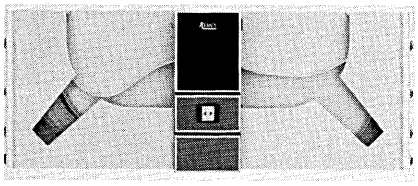
The model 335 disc pack cleaner scrubs IBM 3336-type disc packs with brushes soaked in a specially developed detergent solution during a five-minute cycle. There are no cleaning swabs or sponges; all cleaning is done by the brushes, which are said to last more than 300 pack cleanings. It's claimed that 97% of the contaminants are removed by the model 335, which is priced at $3750. Deliveries are scheduled before the end of the year. For information:

CIRCLE 339 ON READER CARD

REMEX
Santa Ana, Calif. **Booth 2513-17**

Paper Tape Reader

Paper tape reading is not dead, partly because of units like the RR-6300, which can enter data asynchronously at rates to 300 cps, are available at prices that card readers can't touch. A



card reader would have to run at something like 225 cpm to compete, and such readers aren't available for $695 in small quantities, as the 6300 is. Shown with its $100 fan-fold tape handling option, the unit operates bi-directionally and is available immediately. For information:

CIRCLE 340 ON READER CARD

SIGNAL GALAXIES, INC.
Van Nuys, Calif. **Booth 3057**

Memory Add-ons

On display will be 4K and 8K MOS memory boards for the 1.2-usec Data General Nova model. The SG 8200 is offered to oem's and end users willing to pull the back panel from the Nova and insert the memory board into one of the available slots. The prices—$1700 for 4K and $2350 for 8K—might create a whole new group of do-it-yourselfers. For information:

CIRCLE 341 ON READER CARD

Not on display at the show, though announced at it, will be 850-nsec MOS memory add-ons for the Xerox Sigma 5 and 7 computers. Several sizes are available, with 16K 32-bit words selling for $25K. Marking a turn in its marketing policies, SGI is willing to lease this equipment. No maintenance agreements exist for these memories, but since so many of the Sigmas went to engineering facilities, engineers at those sites should find it easy to replace any component that might fail. For information:

CIRCLE 342 ON READER CARD

SYSTEMS FURNITURE CO.
Gardena, Calif. **Booth 1071,73**

Cabinetry

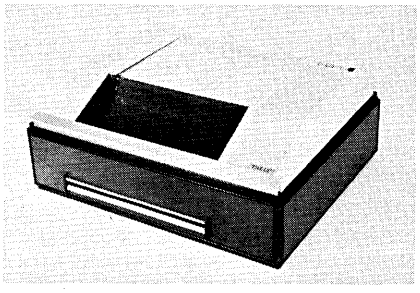
A line of modular packaging furniture called the DATA DESK will be shown to system designers. New to the series is a stand for the popular Centronics, Potter, and Printec serial printers, and the venerable tty. A photo of the stand was not available, but the designer says that "the lines are all in the right places." That's the intent of this company: to relieve system designers of the chore of attractively styling their systems. The support stand is priced at $115. For information:

CIRCLE 343 ON READER CARD

TALLY CORP.
Seattle, Wash. **Booth 1530-36**

Printer

The model 2000 printer generates up to six copies of 132-column printout at rates up to 200 lpm using only two moving parts in its print mecianism. The mechanism is similar to that used in the slower 100-lpm model, and it comes with a one-year warranty. Available with either a parallel interface for use with minicomputers or with a serial modem interface, the 2000 sells for $3150 in quantities of



100. Delivery is 60 days ARO depending on size of order. For information:

CIRCLE 344 ON READER CARD

TECHTRAN INDUSTRIES
Rochester, N.Y. **Booth 3030**

Cassette Terminal

The model 4200 dual-cassette communications terminal complements the single-cassette 4100 introduced last year (May 15, p. 65) that found ready acceptance among both oem's and end users. The 4200's design parallels its sibling, with 70,000 ASCII characters stored on Philips-style cassettes that run at 6 ips and search tape at 40 ips. There are low-speed RS-232B interfaces for such terminals as the tty models 33, 35, and 37; the GE Termi-

Introducing Bruning. The bold new force

The Foundation

For years, Bruning has been coming up with better ideas and products for engineering graphics. That's the Bruning tradition. Now, this pattern of leadership has put us in a front-running position to supply micrographics systems for the general business market.

The evolution was natural enough: our big specialty for many years has been the diazo coating process for efficient, high-quality document reproduction. This led us to significant achievements in dry diazo microfilm for image duplication. Today's Bruning diazo film is easier to use than silver halide film, images have better resolution, costs are lower, and through-put time is sharply reduced.

The Development

Bruning several years ago began development of a series of advanced machines for producing hard copy from microfilm. To accelerate our expansion into micrographics, we have recently acquired the Microfilm Division of Kleer-Vu Industries, an acknowledged leader in the field.

Our Bruning machines now being released, combined with Kleer-Vu's complementary machines and broad line of software, give Bruning a major capability in microfilm systems for information distribution.

Ingredients of Our Systems Capability

First, of course, there's the great Bruning dry diazo microfilm. Next, a remarkable range of enlargers, duplicators, printers, readers, and collators —for use with roll film, fiche, or aperture-card formats. Many of these machines perform several functions in space-saving, time-saving, cost-cutting combination.

Add in our comprehensive software line developed by Kleer-Vu, and you get the picture of Bruning's broad systems capability.

The People

But hardware and software don't develop efficient micrographics systems. People do. And, traditionally, that's where Bruning excels. Bruning Micrographics System Specialists are in place now across the country to serve you —along with the broadest network of sales and service people in the business.

So if you are already in micrographics, or feel you are ready to take advantage of this advanced method of information distribution, call your local Bruning Sales Office today. We have lots to show you. Bruning, 1834 Walden Office Square, Schaumburg, Ill. 60172.

The bold new force in micrographics.

in micrographics.

BRUNING

DIVISION OF ADDRESSOGRAPH MULTIGRAPH CORPORATION

Net 300; Datapoint 3300 crt; and the Texas Instruments 700 series terminals. High-speed interfaces are optional for communicating at up to 2400 baud to the computer. Controls on the 4200 are used for on- or off-line data preparation and editing. Units are available 60 days ARO for $3250. For information:

CIRCLE 345 ON READER CARD

TELE-DYNAMICS
Fort Washington, Pa. Booth 3059,61

Modem

To be available in March, the model 7208A Bell 208A-compatible data set can operate in a simplex or half-duplex mode over two-wire lines or in full-duplex mode over four-wire leased lines. It has an adaptive equalizer and is available as a stand-alone modem or as PC cards for oem's at prices running from $2500 to $3000. For information:

CIRCLE 347 ON READER CARD

TELEPROCESSING INDUSTRIES, INC.
Mahwah, N.J. Booth 6,7

Communications Processor

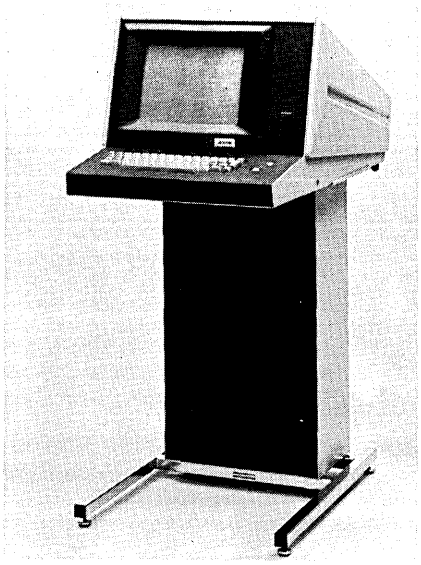
The C2100 communications front end processor for the Univac 418, 494, and 1100 series computers is a redesign of the C2000 unit introduced earlier this year. Among the significant changes made to the 2000 are the ability to start with a smaller number of lines (48, expandable to 256), the ability to communicate with any type of communication line (the 2000 was restricted to certain categories of lines), and easier addition of lines. A minimum configuration is priced at $84K and is available nine months ARO. For information:

CIRCLE 348 ON READER CARD

TEKTRONIX, INC.
Beaverton, Ore. Booth 3500

Business Graphics

APL marks its 10th birthday this year, and its facility for manipulating vectors, matrices, and other arrays with relative ease is finally becoming general knowledge. Whenever there are vectors and matrices, users usually want to plot them, so Tektronix has done some extensive modifications to its 4012 business graphics display system to cater it to APL. The APL system is called the 4013, and among the changes are a full ASCII and APL character set (188 characters), and a reworked, unbundled, software library. The 8 x 6-inch display holds up to 35 lines of 74 characters displayed in 7 x 9 dot-matrix fashion. Vector drawing time is 2.6 msec. A basic 4013 is priced at $5450 with a basic data communications interface. Tty port options are available for a number of popular minis for $300, and operation at a number of speeds up to 9600 baud to any computer supporting APL is also $300. Deliveries are starting about now. For information:



CIRCLE 346 ON READER CARD

TEXAS INSTRUMENTS INC.
Houston, Texas Booth 2500

Data Terminal

Any tty-compatible terminal being introduced to the market this late had better be special, and this addition to TI's Silent 700 series is. The model 733 is available in ASR and KSR versions built around the electrostatic print mechanism used in other series members, printing a tty-equivalent or full ASCII upper/lower case character set across 80 columns on heat-sensitive paper. The ASR model features one or two Philips-type cassette drives for off-line data preparation, editing by block and character, duplication, and on-line transmission at switch-selectable speeds of 10, 15, 30, and, optionally, 120 cps. A long list of options includes high-speed file search, automatic remote control of record/playback functions, answerback buffer, modems, and RS-232C or current-loop interfaces. Baudot CCITT models are also offered.

Reliability is high on every terminal user's priority list, and in addition to the 733's inherent reliability because it is not basically a mechanical device, TI's own integrated circuits are used throughout. It's estimated that about two service calls per year should about do it for maintenance.

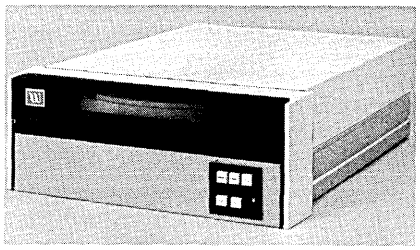
The pricing structure would seem to assure success for the 733. A dual-cassette ASR sells for $2750 and rents for $120/month. The KSR version, which is a 30-cps terminal, sells for $1500 and rents for $75/month. Production shipments begin in January. For information:

CIRCLE 349 ON READER CARD

WANGCO INC.
Santa Monica, Calif. Booth 2020,22

Disc Drives

An 18-model collection of single- and dual-cartridge disc drives will be introduced for oem incorporation into IBM 2310 (1130 and 1800 computers) and 5440 (S/3) disc replacements. All models have one permanently mounted cartridge, and the two-cartridge models have in addition a removable front- or top-loading cartridge. There are choices in capacities (11.3 to 100 megabits); recording and track densities; and rotation speeds (1500 and 2400 rpm) that yield average access times of 35 and 48 msec and transfer rates of 720, 1,562, and 2,500 kilobits.



The actual reliability of the new product line won't be known for some time, but the designers have aimed for less than one nonrecoverable error in 1 x 10^{12} bits, a MTBF of 5,000 hours, a mean time to repair of one-half hour, and preventive maintenance not more than once per 1,000 hours of operation. There are interfaces adaptable to existing controllers for Diablo, Caelus, and Iomec units.

An order of 100 or more 24-megabit dual-disc units with power supply drops the price per unit to $3200. Delivery is 90 days ARO. For information:

CIRCLE 350 ON READER CARD □

Aperture card systems from Bruning.

If aperture cards are the name of the game in your information distribution system, get everything you need from Bruning. Our acquisition of the Microfilm Division of Kleer-Vu Industries now gives us broad systems capability.

For example, make diazo duplicate cards on our OP-35 fully automatic duplicator. Up to 1100 cards an hour; from one to 99 per master card.

Or use the economical OP-60 table-top duplicator for individually fed master cards. Now or later add the OP-61 module for automatic multiple-card duplication.

Bruning also offers verifier units for duplicating prepunched master cards, assuring identical punching on master and copy card before image processing.

Depend on us, too, for a full line of aperture cards and copy cards, including the remarkable Bruning cards with film ultrasonically sealed in the aperture.

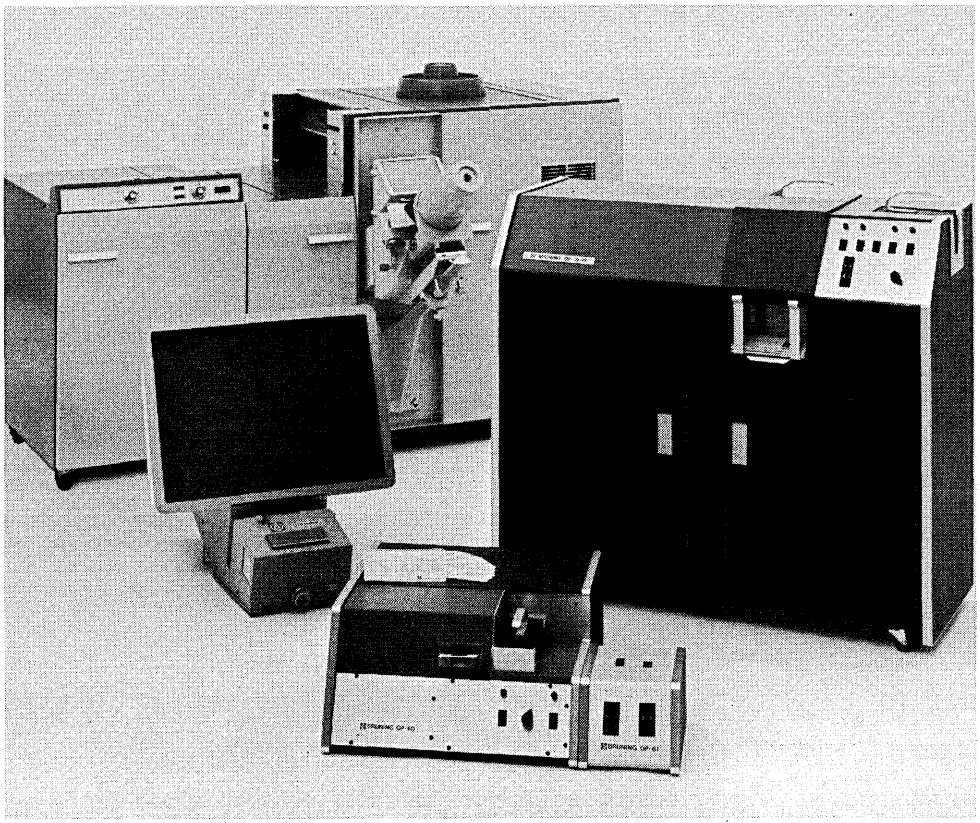
And finally, for hard copies up to 18 x 24 inches in size, call on the Bruning 1200 enlarger printer.

The Bruning Micrographics Systems Specialist in your area is ready to demonstrate our aperture card systems. And tell you about other Bruning hardware and software which make up our total capability in micrographics information distribution.

Call your local Bruning Sales Office today. Or write Bruning, 1834 Walden Office Square, Schaumburg, Ill. 60172.

The bold new force in micrographics.

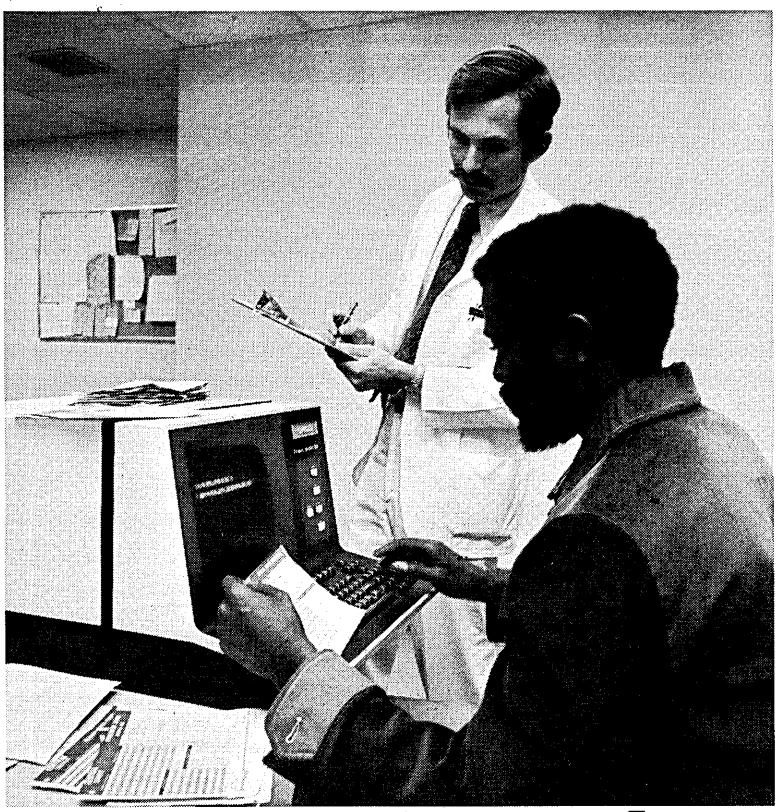
Here's the whole deal for your card game.



BRUNING

DIVISION OF ADDRESSOGRAPH MULTIGRAPH CORPORATION

CIRCLE 71 ON READER CARD



How Denver General Hospital took the emergency out of its replenishing procedures.

Denver General is a 350-bed hospital in Colorado's capital city.

Like most hospitals, it struggled with a 150-day inventory load that still couldn't eliminate expensive rush ordering.

Its accounting system couldn't account for more than 75% of all items moving out of inventory. Which meant that somewhere along the line, 25% of proper patient charges weren't being made.

This year, Denver General installed SYSTEM TEN* computer by Singer.

Now, Denver General bills from its accounting process 100% of all inventory used.

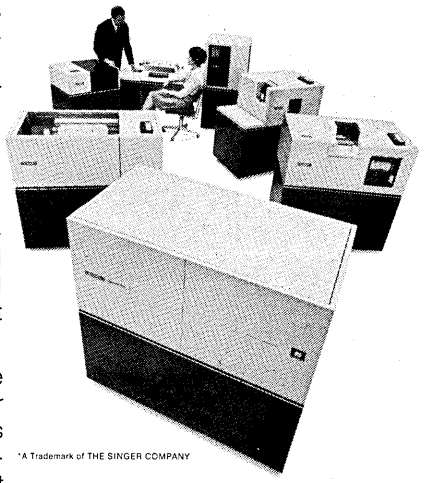
The hospital is now working with a 30-day inventory, with virtually no rush-ordering.

Every ward and every service orders supplies through SYSTEM TEN. Files are constantly updated. The system prints out on a regular basis: balance on hand, current usage, year-to-date usage, year-to-date receipts, and current receipts. A stock status report is printed monthly, but could be done daily if needed.

Once a week, purchase orders are generated from the system, with the ability to override orders in order to increase them, decrease them, or not order at all.

Soon, another SYSTEM TEN will take over the hospital's total accounting system, following patients from admission to discharge, tracking charges, preparing bills — even preparing the General Ledger. Together, the two systems will give Denver General an automated cost accounting system.

We can supply you with all the facts on SYSTEM TEN installations for many industries. Specific case histories that include hardware, software, configuration, sample forms, costs. Just contact your nearest Singer Business Machines representative. Or write: Singer Business Machines, San Leandro, California 94577.



*A Trademark of THE SINGER COMPANY

System Ten by SINGER

SINGER Consumer Products, Industrial Products, Aerospace & Marine Systems, Business Machines, Education & Training Products.
***Business Machines Division**–producers of calculators, mailing equipment, computer systems, data transaction systems, billing/accounting systems, graphic arts equipment.*

Bruning's new OP-40/80 microfiche duplicator

It produces cut-to-size and collated fiche in one operation. That's because our new OP-40/80 from Kleer-Vu is really an automated duplicating *system.*

It's this simple: your operator puts the master fiche in the input station, dials the number of copies required (up to 99 from any master), and pushes the start button. The OP-40/80 begins at once to deliver cut-to-size, collated fiche at up to 1000 copies an hour.

Here's the system you've been looking for to eliminate waste film, cut operating time, and significantly reduce your fiche duplicating costs.

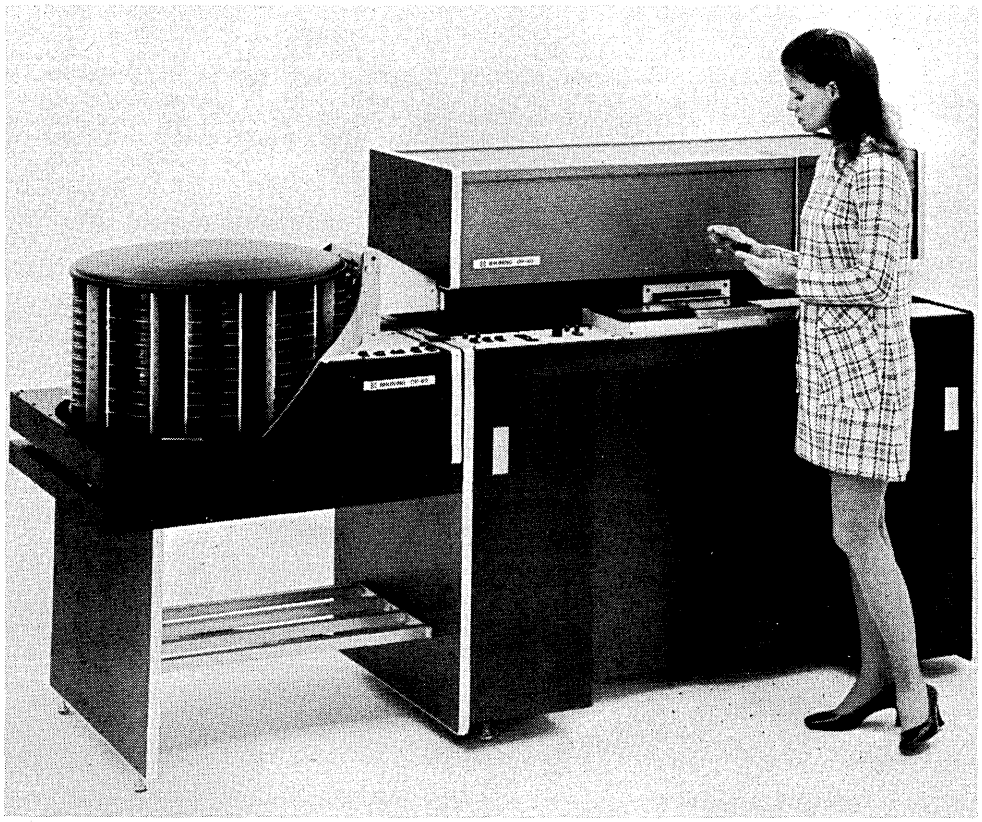
And what convenience: You get automated pushbutton operation. There is no plumbing and no venting needed. You can use positive or negative masters to produce flat, non-static copies.

The Bruning Micrographics Systems Specialist in your area is ready to show you the OP-40/80 in action. And tell you about other Bruning products—such as the OP-49/88 roll-to-fiche duplicator—which make up our total capability in micrographics information distribution.

Call your local Bruning Sales Office today. Or write Bruning, 1834 Walden Office Square, Schaumburg, Ill. 60172.

The bold new force in micrographics.

Duplication automation.



BRUNING

DIVISION OF ADDRESSOGRAPH MULTIGRAPH CORPORATION

GRASP- the first true software alternative to more hardware.

Software Design, Inc.'s advanced DOS package... the complete solution for over 300 satisfied users.

Before you make the move to additional hardware or the transition to OS, you owe it to yourself to know the GRASP story.

In operation throughout the world, GRASP has saved hundreds of DOS users the kind of important dollars in hardware and manpower that no company can afford to overlook.

But more important as DP management, you're taxed with the problem of providing complete service to your company and perhaps many divisions or subsidiaries. What will it be for you? More hardware and people? Or GRASP? *GRASP dramatically increases your production with no additional hardware.*

Very simply, GRASP is an automatic spooling/buffering system with very modest requirements of core and disk.

The system is very easy to install. And, we provide you with the kind of implementation support that you'll not get from any other source.

If you don't spool, GRASP should be considered. It will increase system availability from 15% to 30%, thus reducing overtime of both people and hardware. With GRASP, you can effectively spool with as little as 20 cylinders of 2311 and 4K of core with NO CHANGE to existing programs or procedures. And within 15 minutes of installation.

If you use POWER you are paying too much for the core and disk it consumes, you're not getting the throughput you should, and you're lacking some important capabilities—like another partition, OS-type Load Libraries, and Partition Priority Balancing to name just a few.

If you are looking at OS, look at the costs, both one time and continuing, then look at the capabilities you get, then look at DOS-GRASP/II. For most DOS users, GRASP is the right solution.

For complete information,
call us at any of our locations.

Software Design, Inc.

880 Mitten Road, Burlingame, California 94010 (415) 697-3660

Atlanta (404) 768-1733	**Boston** (617) 661-8550	**Chicago** (312) 887-0880	**Cleveland** (216) 333-5375	**Connecticut** (203) 775-2552
Dallas (214) 634-0207	**Detroit** (313) 559-5556	**Kansas** (913) 888-7652	**Los Angeles** (213) 322-8540	**Miami** (305) 661-2191
New York (212) 757-7498	**Philadelphia** (215) 545-2100	**San Francisco** (415) 441-8934	**Seattle** (206) 622-4324	

In Canada: Comserve, Ltd., 2400 W. Eglinton Avenue West, Toronto 15, Ontario, Canada
In Europe: Software Design, S.A., 24A Chemin Ed.—Sarasin, 1218 Gran Saconnex, Geneva, Switzerland. Phone (022) 48 4022

A great microfilm name is now a great name in micrographics systems.

Great diazo microfilm has been Bruning's little specialty for years. Today's Bruning dry diazo film is a better value than ever; it's easier to use than silver-halide film, images have better resolution, costs are lower, and throughput time is sharply reduced.

Bruning offers a complete line of microfilm in fiche and roll form, in a variety of sizes, for duplicating both camera- and computer-generated film. In black, blue, or sepia images. You'll find it doesn't cost a cent extra to get Bruning's superior quality and service.

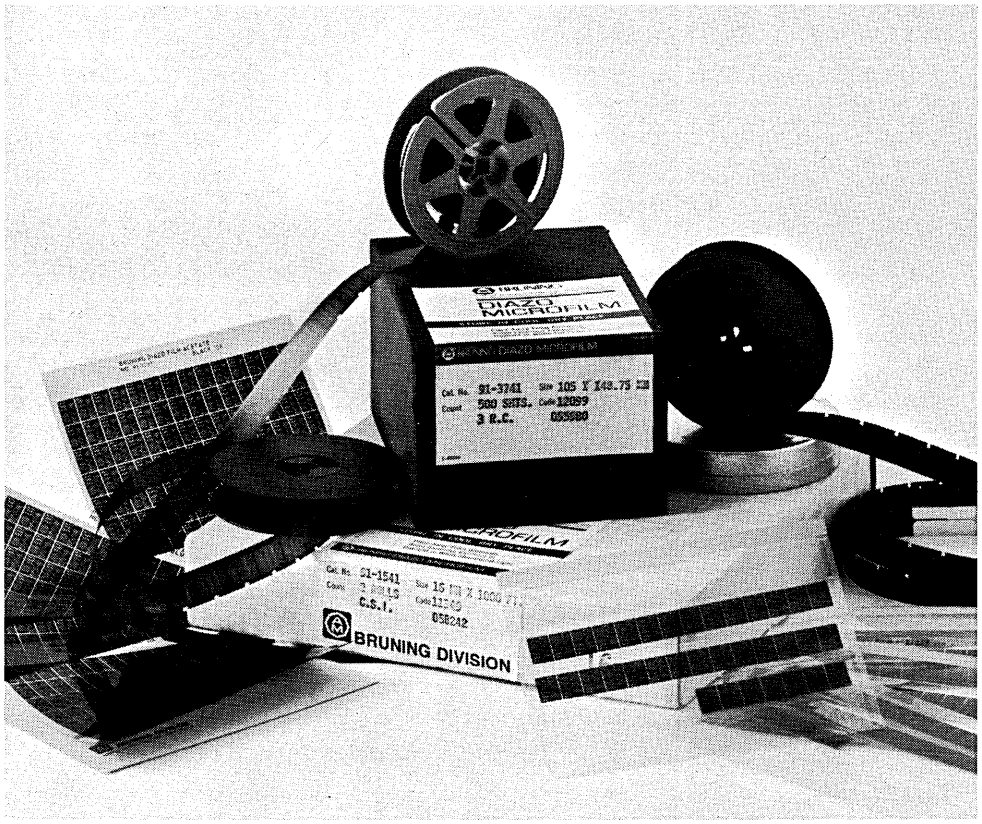
And now Bruning is a single source for assured micrographics duplication quality. In addition to film, we offer a remarkable array of enlargers, duplicators, printers, readers, and collators. Many of these machines perform several functions in space-saving, time-saving, and cost-cutting combinations.

The Bruning Micrographics Systems Specialist in your area is ready now to demonstrate the superiority of Bruning diazo microfilm. And to tell you about other Bruning hardware and software that makes up our systems capability in micrographics.

Call your local Bruning Sales Office today. Or write Bruning, 1834 Walden Office Square, Schaumburg, Ill. 60172.

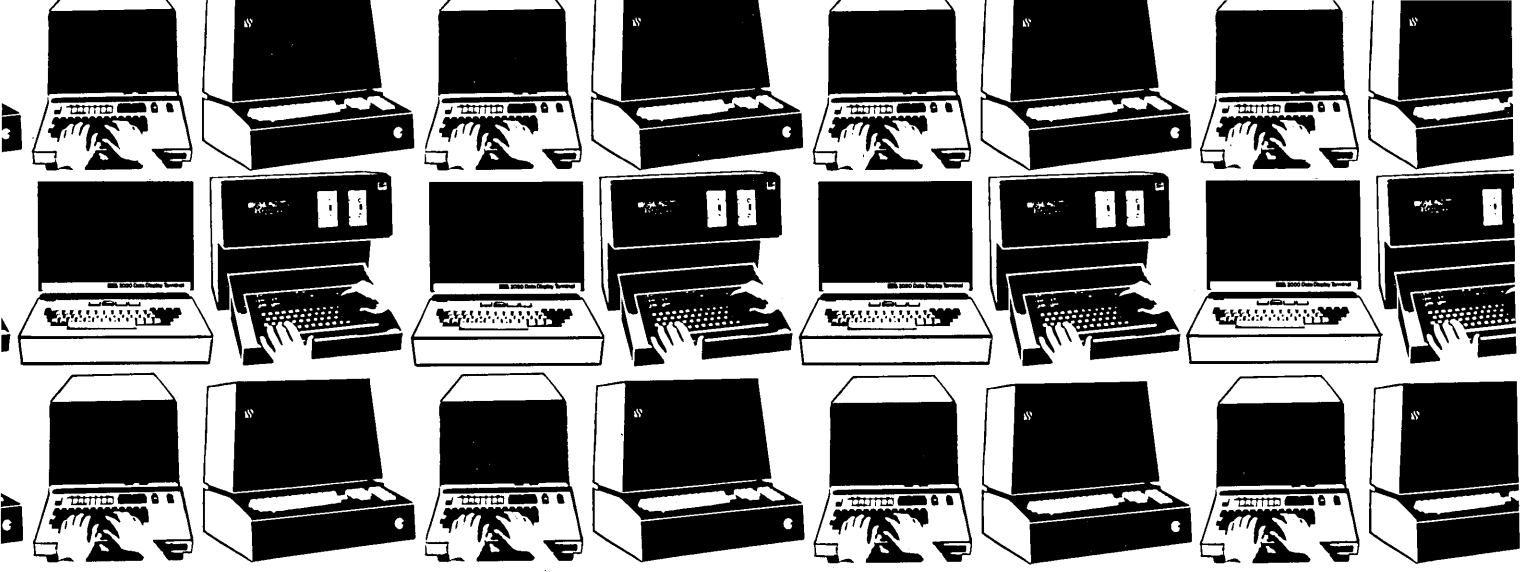
The bold new force in micrographics.

The best microfilm is diazo. The best diazo is Bruning.

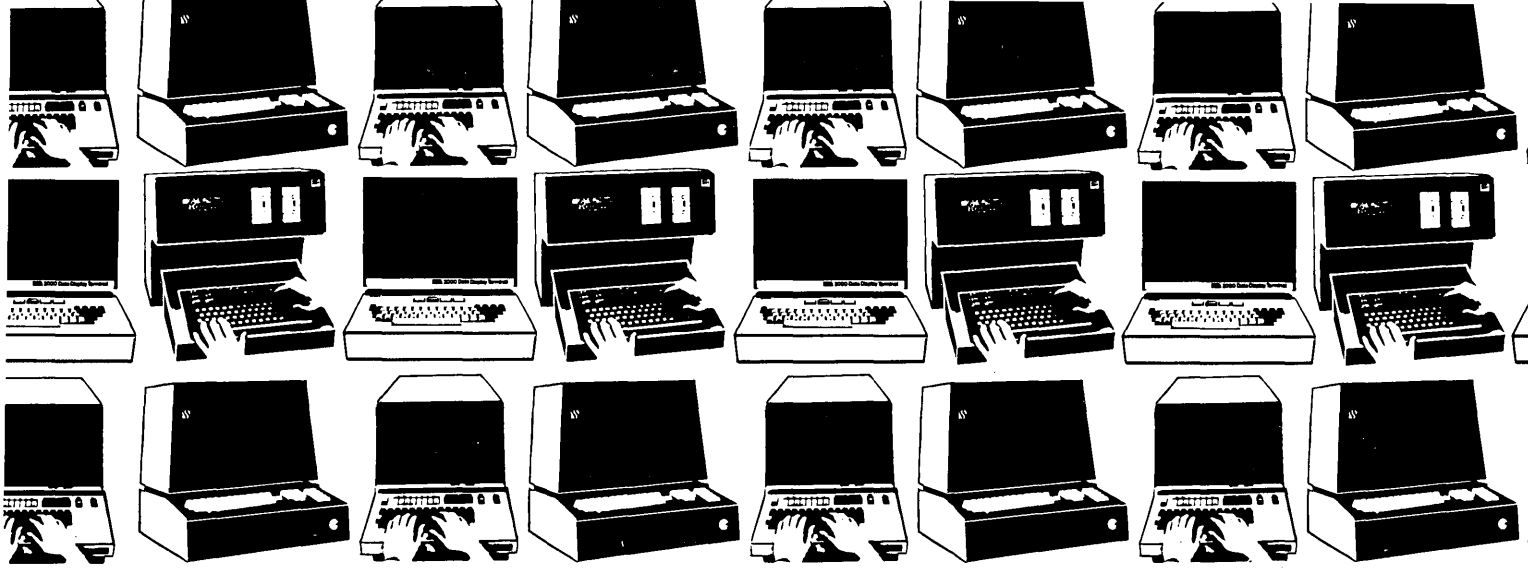


BRUNING

DIVISION OF ADDRESSOGRAPH MULTIGRAPH CORPORATION



Computer manufacturers know all there is to know about data entry. Right?



Wrong.

Computer manufacturers know computers. But nobody knows data entry like data entry specialists. And Inforex is Number One.

Our key-to-disc systems are way ahead of keypunch. And key-to-tape. And other key-to-disc systems. Take our CRT key-station display. It's an Inforex first. Displays the full user-record at every keystation. Plus helpful system-generated messages that guide operators every step of the way. Nothing like it for accuracy.

And Inforex shared-processor systems give you a broad range of functions to meet data entry needs. Like balance totalling. Calculating and comparing check digits. Automatic pooling on 7- or 9-track compatible tape. Plus attractive optional features. Like On and Off Line Communications. Line Printing. 1600 BPI Tape Drives. Reformatting. Blocking.

It's modern data entry at its best. The kind of data entry you get only from Inforex. Which is one reason we have more shared-processor keystations on the job than anybody else.

Let Inforex upgrade your data preparation —and discover why we call it "a different world." Contact your Inforex Representative. We have offices in major cities throughout the United States, Canada, and Europe. Or write, Inforex, Inc., 21 North Avenue, Burlington, Mass. 01803.

See us at FJCC

INFOREX

CIRCLE 44 ON READER CARD

If you're oppressed by congestion or just looking for a change, here's a first-hand report on the job market and living conditions in a friendly English-speaking country

Data Processing Opportunities in Australia

by Edward Yourdon

Despite the cheery statistics and optimistic forecasts of various government agencies for the past several months, the current state of the economy seems to be more accurately reflected by the number of jobs listed in the want ads of such newspapers as the New York Times: better, but nothing to celebrate about. A recent issue of the Sunday Times contained 9 columns of advertisements for programmers, compared to 6-8 columns a year ago, and 15-20 in the golden years of 1967-69. An IBM 360 COBOL programmer with 2-5 years of experience will have no trouble finding an average job at an average salary in New York City; for those who prefer other computers, other programming languages, or other cities, the job market tends to range from mediocre to dismal.

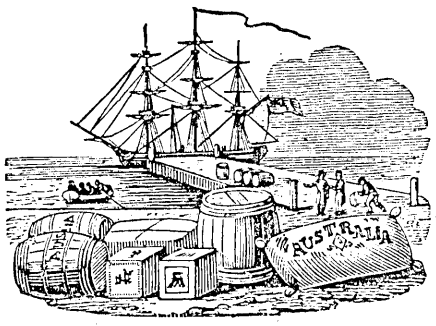
Perhaps this explains part of the recent interest in data processing opportunities in Europe, Canada, Australia and other distant lands. Canada and Europe, as many programmers have read in magazines and confirmed on vacation-job-hunting trips, tend to have even fewer jobs than the U.S.—and the salaries are generally much lower. Australia, on the other hand, is so far away that very few have had a chance to investigate its possibilities; at the same time, it seems to offer a kind of California life style that appeals to quite a few members of the data processing community: good weather, cheap land, and friendly, healthy people. A surprisingly large number of programmers and analysts I have spoken to around the country have voiced a strong desire to "get away" to Australia—but most of them don't know how to get there, or what they would find when they arrived.

The purpose of this short report is to describe the job market in Australia, and to make a few brief comments on the living conditions, and the difficulties one might have emigrating to the land of the kangaroos. The report is based on my observations during a lecture tour to Sydney and Melbourne for CDC's Institute for Advanced Technology in January, 1972.

The job situation there

It is probably best to start with the bad news before going on to a more pleasant discussion about the living conditions in Australia: there really aren't very many data processing jobs in the country, and the salaries are about half of the comparable American salaries.

A few statistics will help illustrate the situation: Australia is a country of



approximately the same geographical area as the U.S., with a total population of 12 million. There are 12,000 people in the data processing field, *including* keypunch personnel, computer operators and a few stray kangaroos; the programmers number about 4,000, and there are about 2,000-3,000 analysts.

A trainee computer programmer (e.g., someone with a college degree in engineering, mathematics or computer science, but with no practical experience) can expect an annual salary of 3,000-4,000 Australian dollars; a junior programmer typically earns $4,000-6,000; a senior programmer makes approximately $7,000-8,000, and an analyst can expect $8,000-12,000. These salaries seem to be about half of the equivalent salary in most of the population centers in the U.S., though it must be pointed out that the Australian dollar (which is used for all financial figures in this report) is worth approximately $1.20 American; also, as we will see below, the cost of living is somewhat lower than our extravagant American way of life. It might also be noted that the median income of the Australian worker is $80 per week.

To make the situation worse, there seems to be very little demand for programmers at the moment. The front pages of the Australian newspapers proclaim that the country is suffering its worst unemployment since the 1930s (though a little further research indicates that this terrible unemployment amounts to 2% of the labor force!); the classified pages of the same papers list no more than five or six computer-related jobs, many of which are in what most Americans would consider the less desirable parts of the country (part of one's education about the nether regions of Australia should include the movie *Outback,* which began showing in the U.S. in early March of 1972).

A few more statistics will help illustrate the extent of Australia's commitment to computers. There are about 1,200 computers in the country, approximately 70% of which are in three cities on the eastern coast: Sydney, Melbourne and Canberra. Most of the major computer manufacturers are represented, though, as usual, IBM has the lion's share of the market. Because of Australia's close ties with England, ICL is more active than one might otherwise expect; Univac, CDC, Burroughs, Honeywell and DEC have also established a significant business in the country.

Very few of the machines are large. There are only a small number in the

CDC 6600 or Univac 1108 class; most are in the 360/30 and 360/40 class, and there are also quite a few minicomputers. Similarly, there seem to be very few large projects or large computer departments in any of the Australian organizations. A group of 3-5 programmers is considered average for most companies; 6-10 is considered large; only in a few isolated cases (e.g., some of the government and military agencies and a few airline reservations systems) can one expect to find a group of more than 20 people. Most of the computer applications are the traditional batch-oriented business and scientific applications that one would find in the U.S.; there seems to be relatively little experience with on-line, time-sharing or real-time systems.

Though most of the computer applications are currently rather modest, there is definitely a trend toward larger, more sophisticated projects. The Australian government is in the planning stages of several large on-line administrative and MIS-oriented systems involving terminals all over the country; universities and research facilities are gaining more and more experience with time-sharing systems; government and military agencies are working on air traffic control systems and air defense systems; several computerized off track betting systems, similar to New York's OTB system (but, from all reports, considerably more popular and more reliable!), are either installed or in the development stage; several of the larger companies are beginning to think about complex process control systems, on-line order entry systems, and teleprocessing systems for various other business functions. Thus, a programmer with experience in these areas may be able to get in on the ground floor of some exciting projects.

The Australian data processing community primarily consists of native Australians, though there are a significant number of European migrants with extensive experience in the field. There are only a few Americans at the moment, and many of them are teaching; those who work in industry often work for the American-based computer manufacturers, such as CDC or IBM. All of the nationalities seem to mix very well on the job, with one exception: the Australians (both native and naturalized) resent Americans who come to the country and draw American salaries; they also resent those highly experienced American programmers and analysts who, by working for an American firm in Australia, prevent the Australians from getting the promotions they feel they deserve.

Aside from these problems (which usually don't exist for those who take an Australian job at an Australian salary), the Australians are quite pleasant to work with. As a general rule, they seem more serious, conscientious and well-informed than their American counterpart; their isolation (much of which is imaginary, since they seem to prefer ignoring the existence of most of the Oriental countries around them) motivates most programmers to keep up with the major American and British computer literature.

Australian programmers and analysts also seem more professional and more interested in their work than do the Americans. While in Australia, I had the opportunity to give three evening lectures on the subject of program modularity, two sponsored by Control Data for open audiences, and one for the Melbourne branch of the Australian Computer Society. All were attended by overflow crowds, and one had the feeling that they attend with enthusiasm all other lectures, work-shops and meetings on subjects of professional interest —in contrast to the average American programmer, who is often not even aware of the existence of local chapters of the prominent computer societies.

As for programming languages, FORTRAN and COBOL are both quite popular. Assembly language is more widely used than in the U.S., perhaps because of the Australians' reluctance to indulge themselves in vast excesses of core memory and cpu capacity. PL/I, "that abominable language," as one Australian called it, is not very popular; judging from the mood of the people I met, everyone will be quite content to wait for PL/II.

Living in Australia

The life style in Australia is somewhat difficult to define; the Australians themselves have written several books in an attempt to analyze themselves,

and have found it difficult to capture the elusive nature of the people. On a fairly gross level, one can think of Australia as being a hybrid mixture of America and England; one could also draw close parallels between Canada and Australia. Of course, a true appreciation of the life style can only be obtained by visiting the country and learning something of its history. In this short report, we will mention only two aspects of life in Australia: the cost of living, and the advantages of one of Australia's most popular cities —Sydney.

The cost of living is cheaper than in the U.S., but not as much so as one would expect. Food is one of the best bargains: meat and groceries are about half price, unless one insists on imported American frozen TV dinners. The most expensive main course in the best restaurants is rarely more than $4, and an excellent steak can be had for $3. Beer and wine are superb and equally cheap (considering the amount of superlative programming done under the influence of these two liquids, it is no wonder that the Australians are so talented and dedicated). A good bottle of vintage Australian wine is considerably better than California wine; a bottle typically costs $1-2 in a liquor store and $3-5 in a good restaurant. Beer, considered by many Australians to be the mainstay of life, is strong, cold and cheap.

Housing, on the other hand, is not guaranteed to be so inexpensive. Those who can tolerate apartments will fare reasonably well: a good 2-3 bedroom *furnished* apartment, with a fabulous view of Sydney harbor, will rent for approximately $40-50 per week. For those who prefer to own their own castle, things get a bit worse: the price of most of the new houses in Sydney is generally in the $30-40,000 range (Australian dollars, remember), and the local banks usually require a 25% down payment for mortgages.

Which leads us to the next unpleasant subject: taxes. One of the advantages of buying a house in the U.S., of course, is the huge tax deduction for interest payments on the mortgage; in Australia, on the other hand (and apparently in most other Commonwealth countries), interest payments are not deductible. Also, the tax rates are substantially higher than in the U.S. (except for those beleagured citizens of New York City): a married man with one child and an income of $20,000 pays 50% in taxes. On the bright side, it is interesting to note that the Australians pay no tax on capital gains.

Another major expense is the ubiquitous automobile; despite two local manufacturing plants, new cars are frightfully expensive. The average price of a new compact car is about $3,000; for larger cars or imported cars of any variety, the price quickly rises beyond the reach of the average man.

As for the general living conditions, it is generally agreed that Australia's east coast offers the best climate and social life. Sydney is the most cosmopolitan of Australian cities, and is often compared to San Francisco. It has a population of 2.5 million, a magnificent harbor bridge, a stunningly beautiful opera house that could only have been designed by a computer programmer (it has been 90% finished for the past nine years!), narrow hilly

streets, *300 miles* of clean coastline within Sydney harbor, and pleasant sunny weather. It sports the tallest building in the Southern hemisphere (some 40 stories), respectable theaters, indescribable dens of iniquity called pubs, cheap comfortable ferries to shuttle passengers back and forth to various parts of the harbor, excellent swimming, surfing, tennis and other outdoor sports.

On the other hand, some of the public services taken for granted by Americans are somewhat Spartan. Highways within the metropolitan area, for example, are quite adequate (aside from the fact that everyone insists on driving on the wrong side of the road!), but outside the city limits one can rarely hope for anything better than a two-lane paved highway—our concept of interstate highways does not exist (for which the Australians should probably be grateful). Similarly, public transport is adequate in the major downtown areas, but almost nonexistent elsewhere; air transportation is comfortable and efficient, but the schedules are not as convenient; public health services are probably better than in the U.S., but not as good as in England. Television is controlled by the government, and is generally considered abominable; while continuing to argue about the kind of color TV they hope to install some four years hence, the three major stations are content to show reruns of such classics as *Rin-Tin-Tin* and *The Cisco Kid* in prime time.

Conclusions

To sum it up, Australia is a beautiful and fascinating country, but one that has a limited number of jobs, significantly lower salaries, and, from a materialistic point of view, a lower standard of living. The Americans most strongly attracted to the country seem to be those seeking to escape the noise, drugs, riots, pollution, and disheartening political situation in America; they seek, and are usually successful in obtaining, a return to the simpler life of the 1940s and 1950s.

If it sounds appealing, the first step is to get more information. The Australian Consulate will be glad to provide information about emigration policies (which many may find offensive—emigration of blacks, Orientals and various other races considered to be nonwhite is severely limited), job opportunities, housing, and other information. Those who possess a trade or skill that is desirable and in short supply (e.g., qualified teachers) and whose financial resources are limited, may be able to obtain assistance from the Australian government for the travel fare; however, the extent of the assistance is a function of one's salary and assets, and most members of the data processing community would not be eligible. The Australian Consulate is located at 636 Fifth Avenue in New York City; there are also offices in San Francisco, Los Angeles, and Washington.

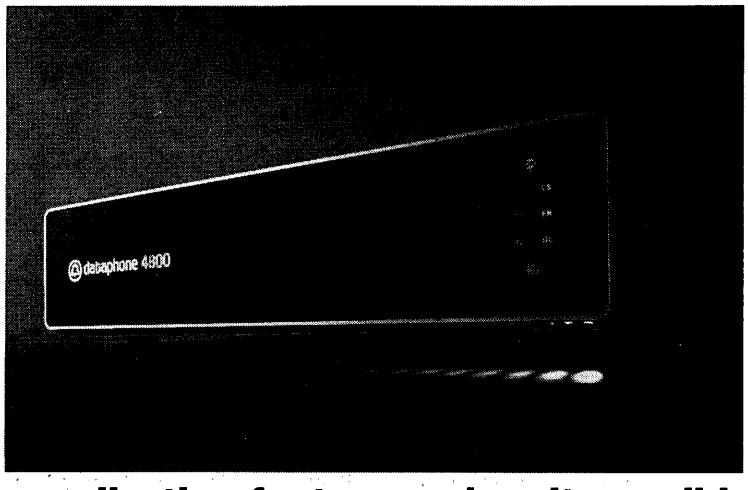
Another good source of information can be found in the back pages of such magazines as *New York* and *Saturday Review;* for a dollar or so, you can get a slightly more detailed (but probably more subjective and possibly obsolete) description of potential problems of emigrating from the U.S. to Australia (often written by people who tried it and *didn't* like it). It also helps to read a few books to learn something of the history and culture of the country; two excellent ones are *The Lucky Country* by Donald Horne (Penguin Books, 1964), and *Australia,* by Hammond Innes (Andre Deutsch Limited, 1971).

If you are really serious about moving to the country, the best approach is probably to go there and spend a few weeks looking around. One American that I met in Sydney spent six weeks traveling through half a dozen widely separated Australian cities; as he pointed out, though the job market is slim, a person with talent and good experience can usually find a job. He received nearly a dozen offers, finally took a job with Control Data, and *then* brought his wife and five children over from the States.

The only remaining problem is that every American who emigrates to Australia wants to be the *last* such American; it would be ironic, and not too surprising, to see emigration restrictions against Americans in a few years time. In the meantime, good luck! □

Mr. Yourdon is an independent consultant, lecturer and author and is currently spending much of his time lecturing for CDC's Institute for Advanced Technology in the U.S., Europe, Canada, and Australia on advanced programming techniques and design of on-line computer systems. He was previously with ELI Computer Time-Sharing, GE, and DEC. He has a BS in mathematics from MIT.

Introducing the 4800, first in a new family of data sets from the Bell System.



The Bell System's new solid state 4800 data set is designed for transmission at 4800 b.p.s.—and it's economical.

This set cuts transmission costs three ways. First, the charge for the set itself is low.

Second, an automatic equalization feature makes it possible to transmit at 4800 b.p.s. over basic, *unconditioned,* private-line facilities.

Third, it features rapid startup and turn around—ideal for polling applications.

This new, compact data set also offers the convenience of local and remote loop-back testing as well as status indicating lamps.

For details on the new data set, including its low price, call your local Bell System Data Communications Consultant, or mail our coupon.

AT&T and your local Bell Company.

DATA SERVICE DEVELOPMENT
American Telephone and Telegraph Company
Room 2038A
195 Broadway, New York, N.Y. 10007

Dear Sirs: I am interested in "dataphone 4800"
☐ Please send me additional information.
☐ Please have a representative contact me.

Name_____ **Title**_____

Company_____ **Tel.**_____

Street_____

City_____ **State**_____ **Zip**_____

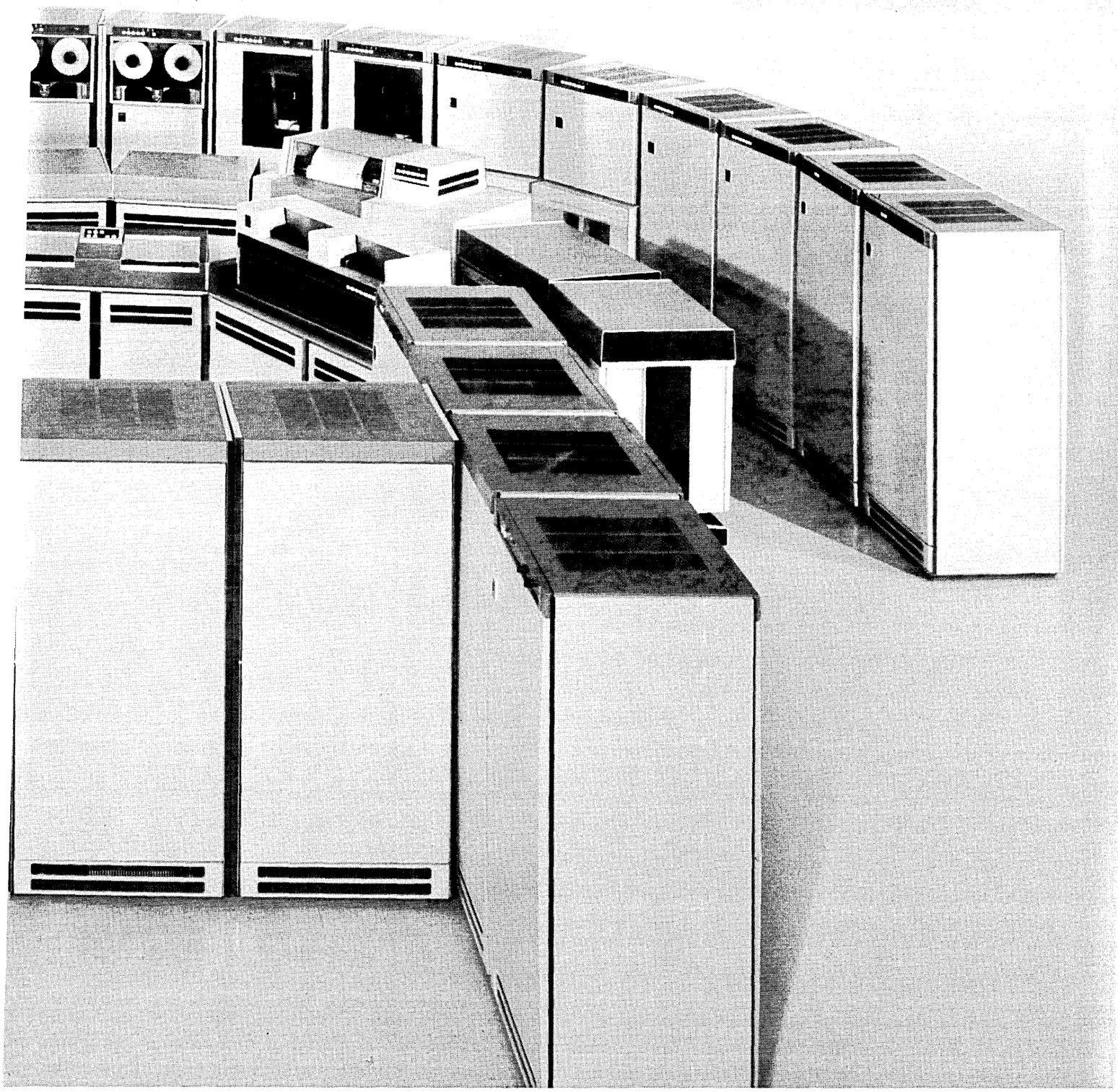
our big brother

The NCR Century 300, our biggest and most advanced computer, means more power to you, for less.

The NCR Century 300, the "Big Brother" in the NCR Century family, is a powerful computer system. It's designed to handle big jobs for companies that need more computer power. There just aren't many information processing jobs around, scientific or commercial, too big for it to handle.

The "300's" combination of sophisticated software and powerful hardware allows big users the kind of real-time / multiprogramming throughput they can appreciate. Here's a system with plenty of power for satellite computers to draw on. And with modular peripherals and memory designed for almost unlimited expansion.

Big as it is, the NCR Century 300 provides a



better return on every dollar invested than any comparably priced system in the industry.

One reason why is reliability. The "300" utilizes the most advanced concepts in hardware and software architecture. Combined with highly efficient and proven peripheral units, the result is that system performance, processing power, and reliability surpass competitive systems. Including many higher priced systems!

Another reason is because the big "300" uses standard industry languages, with compilers, operating systems, utilities and applications software already written and tested. And in operation right now in Financial, Government, Distribution, and various other industries.

Ease of operation and control is still another reason for looking into the big "300." A combination CRT and thermal printer console provide the operator instantaneous, complete instructions. And, it allows rapid response to program requirements to insure maximum control and awareness of all on-going programs and systems.

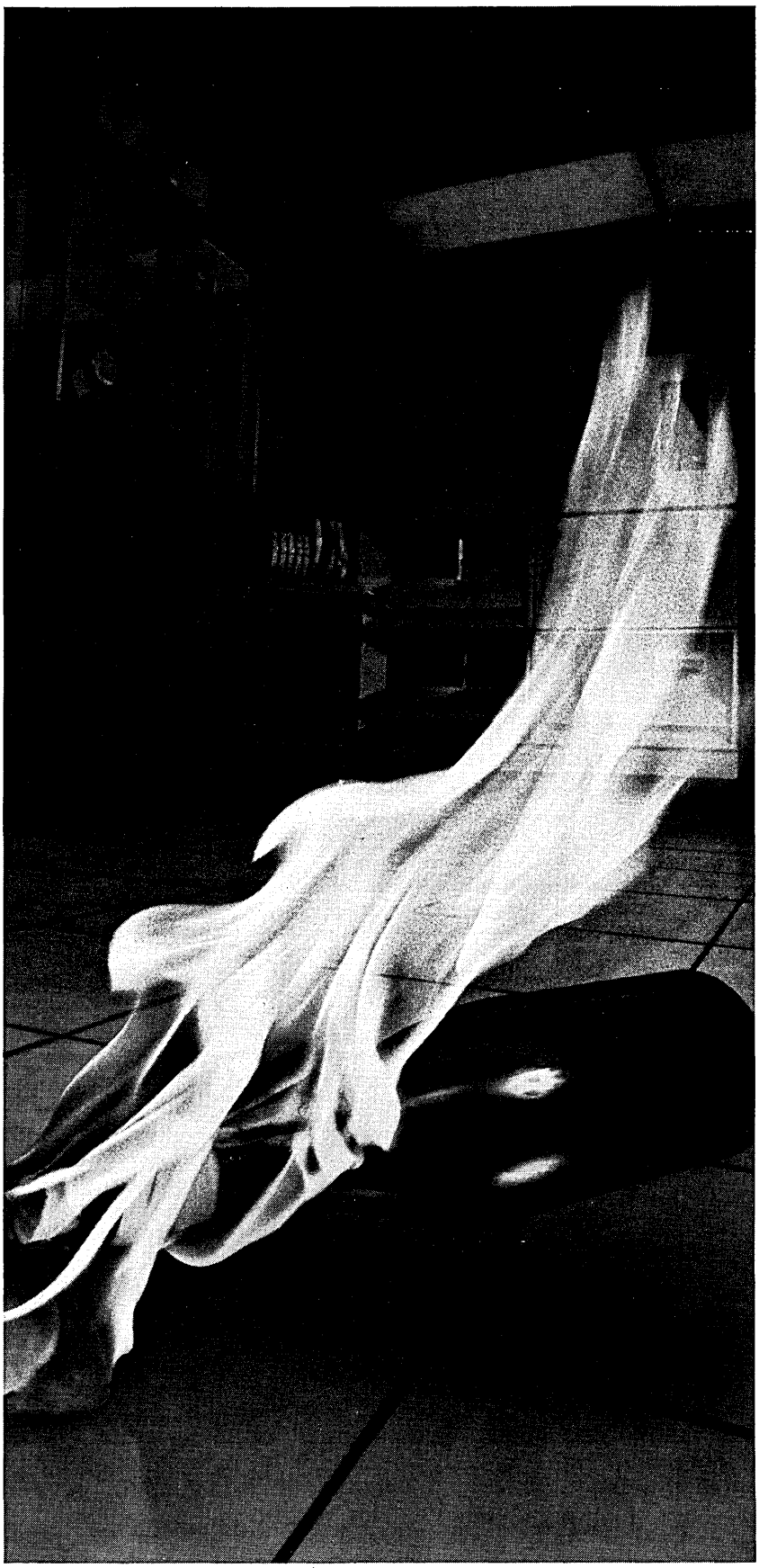
Investigate the NCR Century 300. You'll see how you can take advantage of more power, more speed, higher reliability and unlimited expandability. For less cost than you may think!

For the specifics about "Big Brother," and how it can go to work on your biggest information jobs, call your local NCR office. Or, contact NCR EDP Products and Systems, Dayton, Ohio.

CIRCLE 37 ON READER CARD

NCR
Computers & Terminals

We've tried every trick at setting off computer room fires.



We know what fire, smoke and water can do to your irreplaceable tapes and records. Even if they don't totally destroy them, they can shut you down for weeks, if not months.

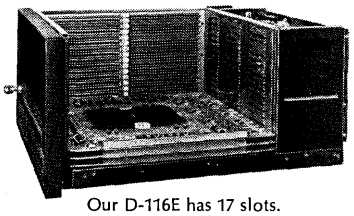
So, to probe the causes, effects and characteristics of fires damaging computer rooms and peripheral service areas, we literally stop at nothing in the Fenwal Fire/Explosion Test Site. Here, Fenwal engineers actually make a career of arson, studying how to design the fastest, most effective systems for stopping fires dry in high value areas. Using Halon 1301, a clean, safe-for-people, dry suppressant, our system can snuff out a fire in seconds, leaving the entire area ready for immediate reuse. We're years ahead of everyone in the field of fast fire suppression. In fact, we're the only ones capable of stopping explosions after they start. If you want the best in Fire Protection Systems,* call us. We'll be pleased to arrange a showing of our color film "The Fireaters," featuring our systems in action. For a free copy of the Harvard Business Review Report on Safeguarding Computers, write Fenwal Incorporated, Ashland, Mass. 01721. Phone (617) 881-2000. Division of Walter Kidde & Co. Inc.

*FM approved—UL Listed

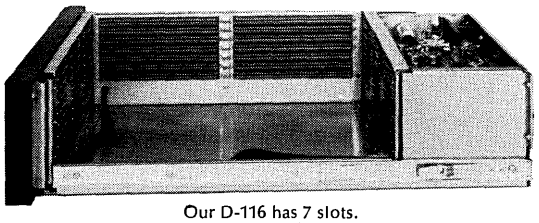
In fire and explosion suppression systems, Fenwal has more experience than any other company in the world.

FENWAL

Our slot machines.



Our D-116E has 17 slots.
(Nova's 1220 has 10).



Our D-116 has 7 slots.
(Nova's 1210 has 4).

As you can see, our fully compatible D-116 series of 16 bit minicomputers gives you a lot more slot space than their 1210 and 1220 counterparts.

About 40% more, in fact. The D-116 has a 32K capacity plus one extra slot while the 1210 has only 16K capacity with no extra slots. And that means a whole lot in terms of versatile options and peripheral interfaces that can be ordered with our D-116 series.

How did we do it? By keeping our power supplies modular (and replaceable). The 1210 and 1220 power supplies, on the other hand, are hardwired to the backpanel. It takes a major overhaul just to replace one. (Ours is a snap).

Other features? How about no audible frequency noise from the power supply, reduced conducted RFI from the AC line plug, and cooler air for the logic and memory boards. (Boy, does it get hot with the 1210/1220 power supply under the boards).

And that's the story of our slot machines. Except for one thing. Their price. Twenty percent lower on quantity one! Twenty percent.

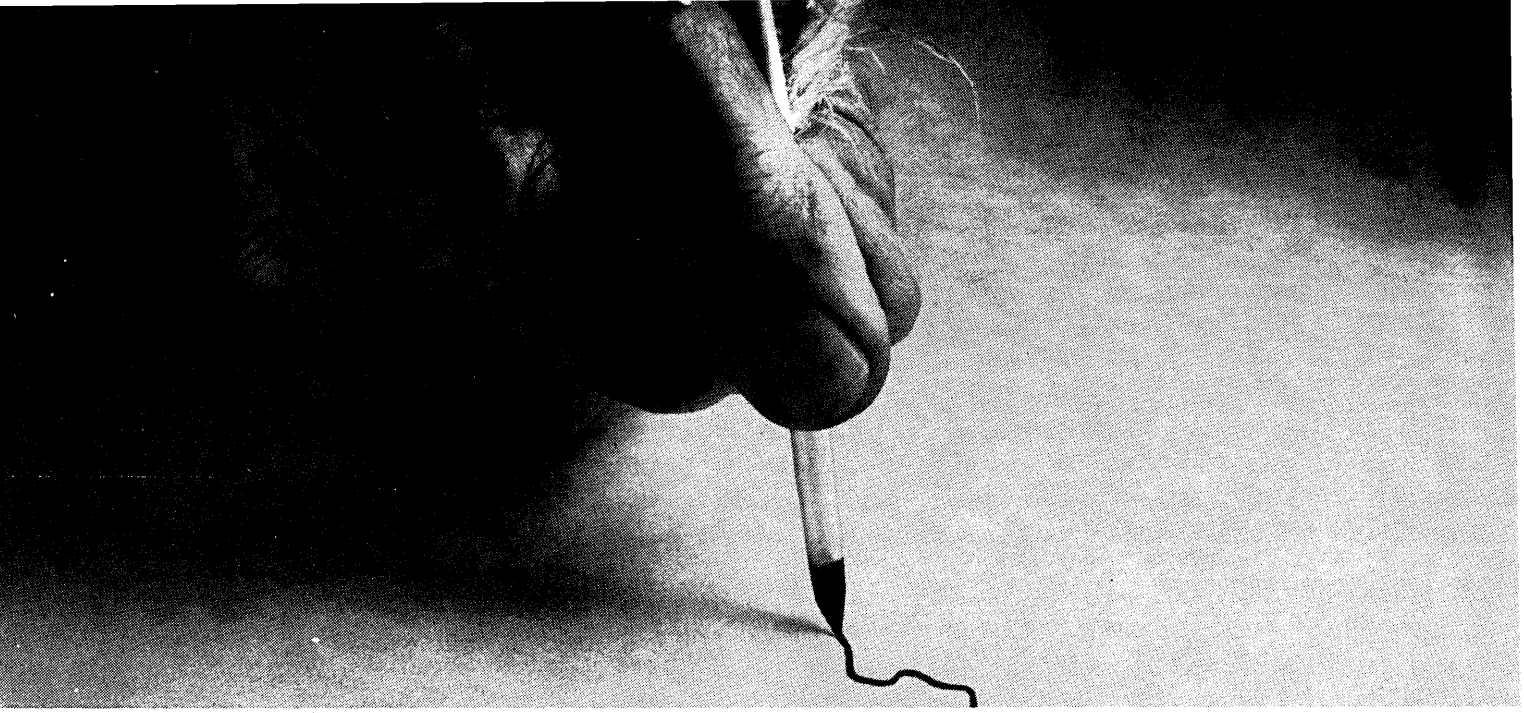
This time you really hit the jackpot.

Digital Computer Controls Inc., 12 Industrial Road, Fairfield, New Jersey 07006. Phone (201) 227-4861.

DIGITAL COMPUTER CONTROLS INC

Coming up fast.

Northeast: P.O. Box 209, Wakefield, Massachusetts 01880. (617) 245-6240; Southeast: P.O. Box 1041, Longwood, Florida 32750. (305) 834-6699; Southwest: 777 So. Central Expressway, Richardson, Texas 75080. (214) 234-3222; Southern California: 16661 Ventura Blvd., Encino, California 91316. (213) 990-1550. Northwest & Northern California: 20430 Town Center Lane, Cupertino, California 95014. (408) 255-6690.



Once maps were made by hand.

But why today?

Once, a man told another of what he'd seen and that man drew a map that all others could follow.

All of that was done by hand. That was then.

Today, a man takes a picture from an airplane of what he sees. And a second man prepares a manuscript from these photos. And then, this manuscript is transferred to film.

And then—incredibly—all of the lines that will make up the map (the rivers, the mountains, roads and streets) are *scribed* onto a negative master. By hand.

Finally, a swivel knife is used to cut outlines of specified areas. By hand. In the seventies of the twentieth century.

Someone doesn't trust someone.

We, CalComp, have told cartographers that our 745 flatbed plotter will scribe lines equal to the tolerances and standards of the most skilled mapmaker's hand.

Cartographers have told us that they tried plotters once. And the lines were not accurate. And they were uneven. And wiggly.

The CalComp 745 Plotter is accurate to a rate of plus or minus .001 inch. The lines it scribes or cuts are smooth and even. (Their step size is only .0001 inch.)

And our 745 plots at a speed of 4.2 inches per second. No hand alive can do that accurately.

If you make maps by hand, call us. We'll help you get from here to there.

Write us at California Computer Products, Inc., Dept. DM-11-72, 2411 West La Palma Avenue, Anaheim, California 92801. Or call (714) 821-2011.

CALCOMP

At the American Management Association's three-day session on networks and decentralization, minicomputers came in for lavish praise

AMA Conference: Distributed Computing

by Edith Myers, Associate Editor

"I took the largest on-line inventory I know and figured out how to do it on a bunch of minis," Commander Grace Murray Hopper told an American Management Assn. three-day briefing in the Los Angeles area on "Systems of Computers: The Dispersal of Computer Power."

It was a briefing that made a strong case for distributed computing and increased use of minis in distributed networks. And there was a general feeling that the time for it is now. Max Beere, manager, Telecommunication Systems, Tymshare, Inc., looking into the future of the mini in terms of systems environments, saw networks becoming easier and cheaper to put together, "but adequate facilities exist today. You don't have to wait. If you wait you're foolish."

Charles Hoffman, Lockheed Electronics, whose topic was "Knowing When to Apply Minicomputer Technology," said "the rate of change in small computer technology is so great that if you wait for it to stabilize, you'll wait a long time."

Commander Hopper, citing a Parkinson's law that the ultimate end of complexity is chaos, called for the breaking up of massive files on parallel access systems and for getting rid of operating systems, data base management systems, and management information systems which are adding to computer overhead. She cited one Navy program she said is 80% overhead.

Computer systems, she said, will be replaced by systems of computers "and we'll need a new kind of person, a systems architect, and we'd better start training him now." She said too a new kind of math will be needed, parallel instead of serial, "and we'd better hurry up."

For managements who still want to think they have a big computer, she suggested "a big gray wall and flashing lights."

Where's the computer?

But a trend toward hiding the computer was more widely advocated. Hoffman told of a mini-based system his firm had put together where "we spent more time figuring out how to keep this from looking like a computer than on any other aspect."

Douglas T. Ross, president of SofTech, Inc., whose topic was "Software: Overcoming the Major Obstacle to Systems of Computers," said "most users aren't really interested in computers as such." He said general-purpose languages, such as COBOL, FORTRAN and BASIC, let too much of the computer show and this problem is aggravated when computer power is dispersed, placing a premium on languages which relate to problems and hide, as completely as possible, the computer characteristics.

He advocated predicating system design on use of a specialized Problem Oriented Language (POL) and modular software in which the modules are machine independent and portable. Where a network includes a big computer at the center, he suggests that be the "software factory" using cross compiler technology, in which a single standard compiler for the language used by the software technologist in creating the system operates on the large computer, generating equivalent machine language outputs for a variety of other computer types, including minis.

"And the name of the game in the terminal systems environment is minicomputer," said Beere. He described a mini as basically a transducer, "a badly needed transducer that can couple industry's changing need to the information network that is its nervous system."

As a front-end preprocessor, he said, a relatively low-cost mini can take over the job of handling all the communications protocol for a host system and can also be used as a controller for other peripheral devices. "There is much software and hardware available that can be used off the shelf to solve rather complex telecommunication needs. The software of the mini can be changed with relative ease and without disturbing an on-going system. Thus new needs can be implemented into the system as required."

Because of its adaptive capability, Beere noted, the mini "can interface and handle different transmission speeds. Thus, it is an ideal controller for remote terminals."

Since it can be a rather powerful computer in its own right, he said, the mini is very useful as a data base front end. "If the need is to retrieve information from a data base or to cause information to be placed in storage, a fairly low-cost mini can be a worthwhile investment. As the magnitude of the data modified by the mini increases in complexity, so then does the sophistication of the mini, and the cost goes up."

Beere sees as "a very interesting and potentially vast market for the minicomputer," the microfiche area. Such applications, he said, "are characterized by the need to find and display data that does not need to be processed or changed by the computer, although a great deal of processing may occur in finding the correct page to display."

Bargains ahead

Lynn Hopewell, vice president, Network Analysis Corp., predicted the mini will have "probably the most impact on the future of data communications." He said the least expensive minicomputer, which today costs about $4,000, can be expected to decrease to about $800 by 1980. "Memory will be so cheap, at 2¢ a bit, that it will almost be considered free."

The decreasing cost of minis was cited many times during the briefing as a big reason why they will proliferate. Commander Hopper said minis someday will be available for as little as $500 apiece and she would like to see them "treated like typewriters."

But Tom Sherman of Digital Equipment Corp. sees an imminent leveling off of mini prices and said "in fact, they're starting to level now." He noted that in any mini system, the cost of peripherals far exceeds that of the cpu.

Donald Henley, president of Informata, Inc., an Encino, Calif., firm which specializes in the design and implementation of information manage-

ment systems, said he currently is working on a mini application with 2314 discs where the mini cost $3,000 and all periphrals $50,000. But, in his presentation, "Expanding the Minicomputer with Peripheral Equipment," Henley looked "with gratitude toward lower costs and better performance" of peripherals for minicomputers. He predicted an increase in the number of peripherals supplied by mini manufacturers through acquisition of peripheral companies and in-house development and an expansion of product lines of peripheral suppliers through the same means. He also looks for a growing number of inexpensive mini configurations "put together for you," citing the Basic/Four system (June, p. 47) as an example.

Henley analyzed three major ways of procuring mini peripherals. He said procuring from the mini manufacturer means you can hold one firm accountable; some form of nationwide service is available; all components will be packaged compatibly; and the greatest amount of software will be available. He said the disadvantages are that you pay more and the variety of peripherals available is limited.

Dealing directly with a peripherals manufacturer, he said, might pay off if you're doing several systems. However, he noted, this involves dealing with several vendors, developing your own interfaces, providing your own service, integrated software, and diagnostics, and worrying about delivery dates.

The third method he looked at was using an oem systems house, which he called the gap between the first two. With this method, he said, you can hold one firm accountable, you don't have to wrry about staffing for development, and you get a turnkey operation. He cited as disadvantages the possibility of paying more and the danger of dealing with a firm that might be incompetent "and sometimes you don't know."

The enigmatic user

Another "don't know," in this case a "never know," was brought up by Ray W. Sanders, president, Computer Transmission Corp. Sanders said "no matter how well we think we understand, we really don't know what the user will want a month from now, a year from now." He warned against "sawing off potential alternatives" in developing a computer network.

Sanders offered some do's and don'ts for selecting network elements. The do's included: choose terminal equipment which can be upgraded to faster response times as communication facilities improvements become available; choose multiplexors and other distribution hardware which can be reconfigured at minimum expense; choose network hub locations which will be able to make use of transmission facility alternatives to be available over the next few years; choose computer hardware which can easily and inexpensively accommodate different numbers of terminals operating at different data rates; and choose a system design with great modularity (software as well as hardware) which can easily be upgraded or downgraded as requirements change.

His don'ts were: don't invest in data sets which are forever going to constrain a system's error performance (bits transmitted in error compared to total bits transmitted); don't invest in minicomputer solutions which force software investments that can become obsolete; don't settle for polled network solutions unless there is a substantial promise that higher data rate multidrop facilities will be available at low cost; and don't constrain a network design to an optimization method based on current tariffed offerings of the common carriers.

Sanders was emphatic in stating that costs of transmission are going down. He was joined in this opinion by Hopewell of Network Analysis and Gene H. Whitaker, special representative, Advanced Communications Division, Pacific Telephone Co. Both based their opinions on the expectation that Bell will go to route pricing as opposed to averaing costs of transmission over all routes and pricing accordingly. Route pricing would mean lower prices for heavy traffic routes but wouldn't help remote areas.

"But what about us?" quipped an oil company representative attending the session. "God didn't put oilfields along major trunk lines."

Not everyone at the briefing was convinced communications costs are coming down. Cochairman Ralph Berglund, Berglund Associates, Inc., doesn't think that route pricing is imminent. "In my opinion," he said, "communications costs will remain where they are for the next five years."

In spite of this, Berglund thinks systems of computers will be the thing in the '70s because "there is going to be a constantly increasing demand or requirement for more data processing . . . and with systems of computers, machines can be devoted to processing rather than to processing *and* management of processing."

His cochairman, Adrian Bos, vice president, western operations, Univac, agreed. He went on to project that what we now call the central processor will, in itself, be a system of computers. This, he said, could eliminate systems overhead inherent in complex operating systems. He looks for replacement of sections of operating systems with minis to keep overhead from feeding on itself. "Why should we have a main processor going through tons and tons of code just to see what caused an interrupt?" □

"According to our research department, our public opinion polls, our sampling of potential users, our forecasts of marketing trends, our estimates of consumer reaction, and our statistical model manipulations, we overcooked the vegetables."

Is your minicomputer on this list?

PDP-11/ PDP-15/PDP-12/PDP-9/PDP-8/ 800/1200/Nova/Super Nova/800/810/ 812/CIP 2100/CIP 2200/216/208/CF 16/ CE 16/SIGMA 2, 3 & 5/516/316/112/ EMR 6130/Spear 3000/Varian 620i, L/ Hewlett-Packard 2114, 2115, 2116/Tempo Mod I, II/DSC, META 4/GAI, SPC-12/ and many more.

Congratulations. You just won a total data system. For under $8 K.

Here's how. Our total tape system includes a PI-1400 IBM compatible digital recorder and a hardware/software interface with your favorite minicomputer.

Plug it in. Your mini is a data-handling giant. Store as much as you need. Retrieve it fast. Communicate with your main computer.

A proven system. We've been delivering packages like this for over two years. Integration with your present system is easy. Use existing diagnostics and routines. Or we'll give you a utility package.

Special bonus. The tape unit delivers 800 bpi NRZI and 1600 bpi PE, read/write dual density. Optional data buffer memory zooms at 0–500K char./sec. Asynchronous transfer rates. All this and the most rugged transport casting in the business.

Complete hardware/software interface. Phase encoding won't obsolete this system. Expandable. Upgradable.

Collect your total data system. For under $ 8 K. From Precision Instrument.

PRECISION INSTRUMENT

3170 Porter Drive, Palo Alto, California 94304
Phone (415) 493-2222 TWX No. 910-373-1752

See you at booth #4514, FJCC in December.

Exhibitors show "unavailable" products at the International Computer Exposition for Latin America

Report From Mexico

by Phil Hirsch, Washington Editor

Mexico's annual expenditure for "computer activities" will increase 60% in the next three years, said the president of the Mexican Society of Electronic Computation at the Second International Computer Exposition for Latin America, which was held recently in Mexico City.

About 75 exhibitors leased 8,000 sq. ft. of floor space at the show, reported the society's director general, Emilio Ferstl. He estimated attendance at 11,000. All three figures are approximately the same as last year's, Ferstl added.

Progress and policy

A detailed analysis by the U.S. embassy, prepared last June, suggests that the U.S. share of the Mexican dp equipment market is slipping, although we still sell more than all other foreign suppliers combined. (1971 U.S. sales amounted to approximately $11.5 million.) The report mentioned several trends that could shape Mexico's demand for computers and related products in the immediate future. For example:

The country's data communications capability is growing; five high-capacity microwave systems, providing up to 960 telephone channels, were placed in operation during 1971 by the semi-private National Telephone Co. Also, "limited local assembly of minicomputers may begin shortly." But existing local assembly is "still at an infant stage for computers and most peripherals." The report added that "several dozen firms" are now marketing computers and related equipment in Mexico, and there has been a "considerable" increase in the number of minicomputer firms represented. As a result, the government has clamped a "severe" limit on imports of used computers and has limited the amount of new dp equipment which can be imported by distributors. Direct purchases by users, though, are not affected.

Additional harbingers: a recently signed World Bank loan for modernization of Mexican railroads includes "as much as $8 million for imported signaling and communications equipment." The railroads will spend the equivalent of $34 million in addition for locally sourced equipment and support. Meanwhile, bidding is expected in December for computers, closed-circuit tv, and other monitoring equipment needed to support a new traffic signal system in Mexico City.

Time-sharing in Mexico "received a setback in early 1972" when the government issued regulations banning users from sharing their channels through resale agreements. But "further clarification" of this policy is expected.

On the floor

At the exposition, officials of Kronos, a large domestic dp consulting firm and off-line service bureau, reported plans to establish the country's second on-line service bureau by December. It will compete with a Honeywell-Bull facility that went into operation early this year. The new Kronos system will be supported by a 370/155. Another source added that Sanders will begin marketing its Mod 804 terminal in Mexico through Kronos, starting late this year.

A Burroughs source said his company is installing an on-line credit authorization system, worth about $700K, for El Puerto de Liverpool, a Mexico City department store. Some 60 terminals will be connected to a B3500. This will be the ninth on-line system in Mexico, and the first retail trade application. Burroughs recently won another order, from "a Mexican government agency," for a 6700; it's to be delivered in December.

Vague rumors floated around the exhibit floor about Japanese plans to begin manufacturing minicomputers somewhere in Mexico. Several Japanese visited the show, which may or may not be a related fact. Also, ITT and Siemens were rumored to be planning the manufacture of modems in Toluca, near Mexico City. These developments, if they materialize, could close the country to foreign suppliers of similar products,—thanks to a Mexican law that already has produced a monopoly for at least one domestic dp equipment manufacturer, Industrias Ransom Busicom. The company makes calculators, including a mini that sells for $500. Despite the import ban, however, Hewlett Packard showed its new Mod 35 "shirt pocket" calculator at the exposition; this one sells for $395 (in the U.S.) and has many more features than the Ransom machine.

A Mexican visitor to the H-P booth, when asked why he was interested in a product that couldn't be purchased in Mexico, said: "There's nothing to prevent me from buying one on my next trip to the States." So much for Mexican import restrictions.

Most of the hardware shown at the exposition has been available in the U.S. for some time. But Olympia, a Telefunken subsidiary and one of the few foreign exhibitors not from the U.S., displayed its TE3000 office system, an off-line keyboard with attached paper tape punch and reader, which is not being marketed in the United States.

Burroughs, which had one of the larger booths, showed its new 1700. IBM, working out of an even more impressive display, demonstrated the 2780 and 2265 remote terminal systems; both were connected to a 370/155 at the company's new Mexico City headquarters. These headquarters, incidentally, encompass more floor space than the U.S. embassy.

Personnel shortage

IBM used the 2265 to show the CICS (Customer Information Control System). RJE, TSO, and APL were also on display. Reportedly, the 2770 and 3270 terminals will be introduced in Mexico shortly.

Another exhibitor was VAI de Mexico, a recently formed joint venture between Advanced Systems, Inc. (ASI), of the U.S., and ICM (Institute of Computation and Mechanization), reportedly Mexico's largest programmer training organization. They're offering ASI's video-tape programmer instruction course.

The market for programmer training aids is apparently large. Señor Diaz, the president of the Mexican Society of Electronic Computation, said in his opening-day speech that about 70% of Mexico's expenditure for computer activities is for salaries, and this ratio will remain the same as the total investment grows during the next three years. "We must put special emphasis on the training of technical personnel," he added. □

SCANDATA

introduces the first big idea in data entry for the Seventies:

the 2250 Data Entry System

The first data entry system to perform a universal range of data input requirements

Integrating, for the first time, scanning and keyboarding, to provide direct page and document reading, handprint reading, multifont typewriter reading, rejected character entry, and production keyboarding and key verifying in a single system

Delivering lowest cost, accurate, timely, complete data entry

More than OCR. Data Entry.

CIRCLE 49 ON READER CARD

Scan-Data Corporation
800 East Main Street
Norristown, Pennsylvania 19401
215-277-0500 Telex: 846485

You don't have to marry us.

Converting from DOS to OS operation is risky. Ordinarily, once you get into it there's no easy way out.

Well, we have an escape clause. Our software program, DUO 360/370, virtually eliminates risk.

With it, your DOS programs operate under OS control without conversion, and they fully access OS features.

So you get pure OS production now, today, and yet you can still reprogram at your leisure—without overtime or extra personnel.

DUO reduces your OS test time as much as 90% in some cases.

And, you get added features — like automatic console control—which make your life even more blissful.

But look. We'll let you try the whole thing free, without commitment, just to prove it to yourself. And if it's not everything you expected, you can send us home to mother.

Fill out the coupon, or call me, Sterling Williams, Product Manager — Special Products. (214) 637-5010.

free trial.

Mr. Williams: DUO 360/370 interests me. I'd like:

☐ more information

☐ a free trial on my equipment

Name _____

Firm/Title _____

Address _____

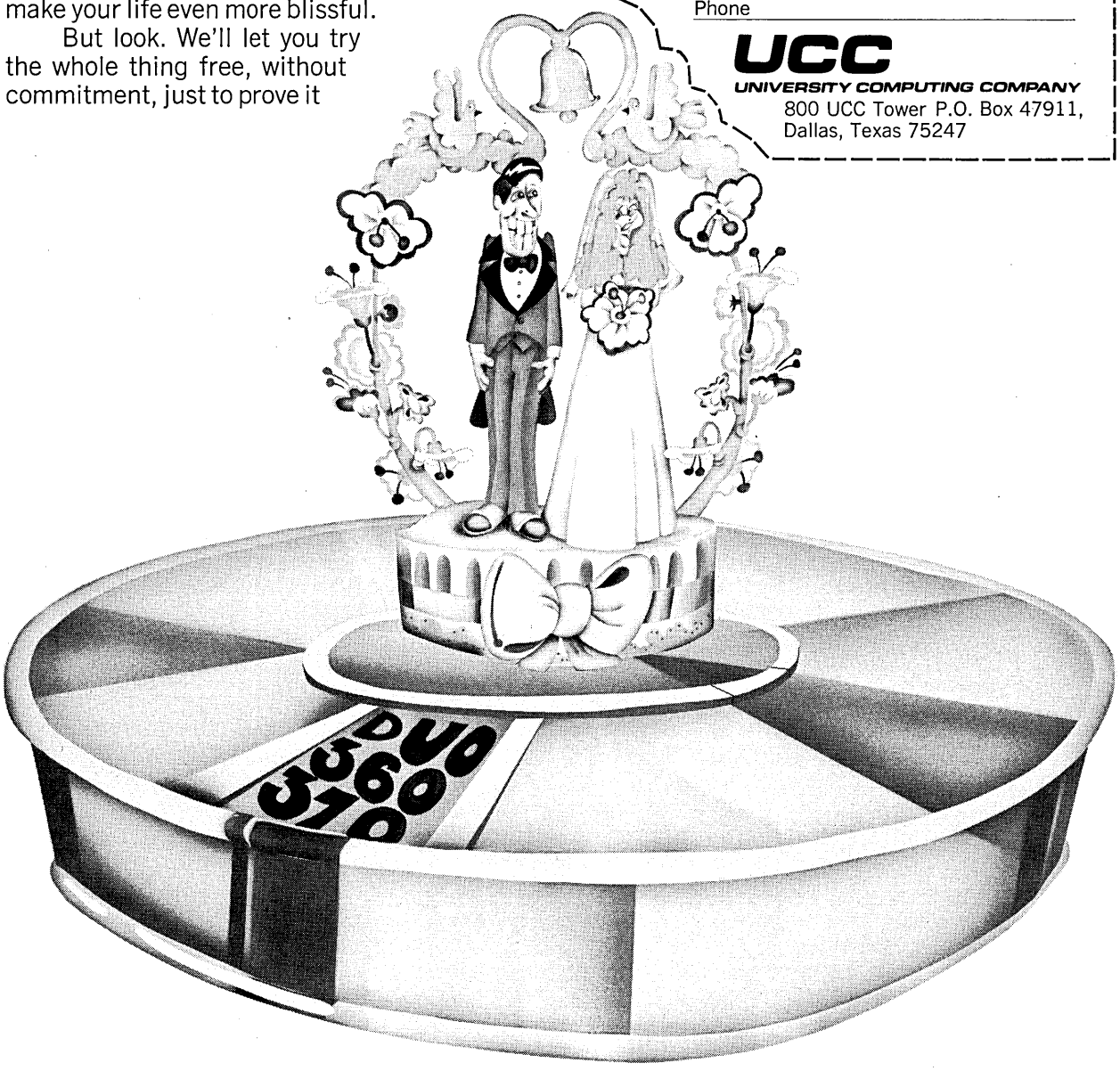
City/State/Zip _____

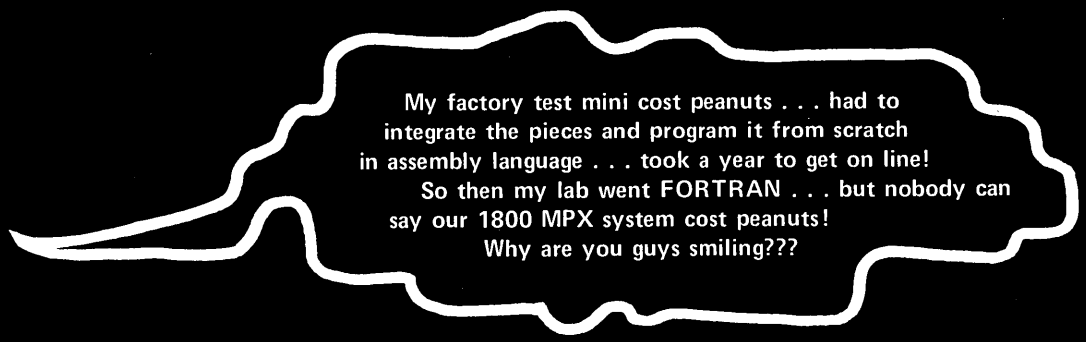
Phone _____

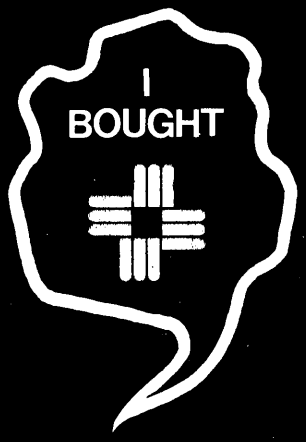
UCC

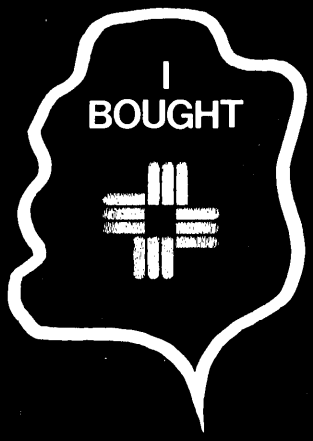
UNIVERSITY COMPUTING COMPANY

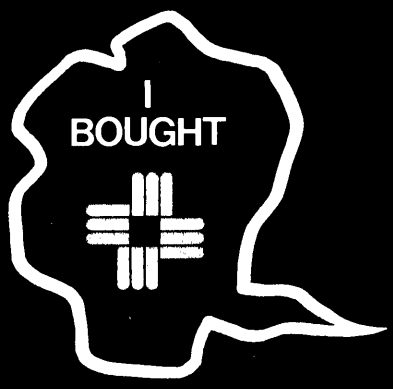
800 UCC Tower P.O. Box 47911,
Dallas, Texas 75247





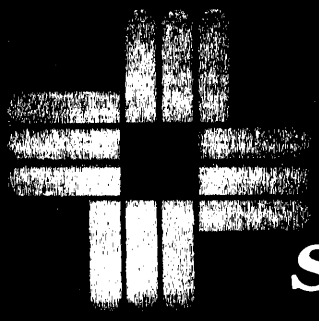






The MODCOMP II, newest MODCOMP family member, is a 16-bit, 800 nanosecond computer with FORTRAN IV that operates under the MAX III foreground/background executive. A system configuration with 16K words of memory is listed at $9500.

The MODCOMP facts are available on request . . . for further enlightenment



modular computer systems

1650 West McNab Road, Fort Lauderdale, Florida 33309
Telephone: 305 974-1380 TWX: 510 955 9820

CIRCLE 31 ON READER CARD

Diablo's delivering now!

10 megabytes for small systems

New 200 Tracks Per Inch Diablo Disk Drives

Diablo is first to deliver such high performance specifications for small system applications. Our Series 40 drives now are offered in 200 tracks per inch capacity, a fact made possible by the degree of quality and high performance capabilities engineered into our original Series 40 drives. The new 200 tracks per inch drive is designated Model 44 and has one removable and one fixed disk (capacity is 100,000,000 bits).

In addition to increased capacity, performance characteristics include 38 millisecond access speed, 2500 Khz transfer rate and 2400 rpm disk speed. Operating temperature range is 50° F to 104° F, permitting use in normal office environments. The new drives use the 5440

cartridge, achieving compatibility with IBM System/3. And, reflecting the performance and quality heritage from which they sprang, new Series 40 double track density drives offer the same compact, cool, quiet operation and maintenance ease characteristics of Diablo Series 30 disk drives. For a complete technical presentation of our new 200 tracks per inch drives: call, wire or write to Diablo Systems, Incorporated, 24500 Industrial Boulevard, Hayward, California 94545, phone 415-783-3910; 15910 Ventura Blvd., Suite 800, Encino, California 91316 phone 213-986-9876; 800 E. Northwest Highway, Palatine, Illinois 60067, phone 312-359-9383; 2000 Commonwealth Avenue, Newton, Massachusetts 02166, phone 617-332-4694.

Diablo

Diablo Systems Incorporated
a Xerox Company

SEE THE NEW 200 TRACKS PER INCH DIABLO DRIVES AT FJCC BOOTH #3006-3008-3010.

CIRCLE 26 ON READER CARD

News in Perspective

One effect of IBM's recent reorganization will be to strengthen its communications-oriented systems (page 148). Some observers speculate on a plan somewhere in the future for terminals with hundreds of thousands of bytes . . .

What are Frank T. Cary's challenges as the new top man at IBM? They're not unlike those faced by T. Vincent Learson, although the style with which they're met will contrast with Learson's "action man" image. Page 151 . . .

Although IBM aims its newest data entry system at overseas markets, perhaps the most attention the 3740 is getting is in the U.S. (page 152). In fact, IBM once considered marketing it here . . .

California's first try at a "checkless society" began quietly on Oct. 16 (page 155). But it's an evolutionary process . . .

What ever happened to Computer Output Microfilm (COM)? After two years of massive disinterest, dp users are taking another look. Page 166 . . .

The New York Times' ambitious automated information bank has been something of a bomb (page 169). But optimism is still high for eventual implementation of an emasculated system.

Retail

Supermarkets Seek Systems Solutions to Profit Squeeze

A steady decline in net income with increased payroll expenses is causing supermarket executives to cast desperate, hungry eyes at automated check-out systems as a possible solution to their dilemma and to take steps themselves to adapt their operations to easy automation.

An industry report released last month showed that food retailers' net earnings in fiscal 1972 dropped to an all time low of 0.82% of sales, 5% below the year before and down 37% from six years ago. At the same time payroll expenses moved to an all time high of 11.4% of sales, up 5% from 1971. And chain stores throughout the country are wallowing in red ink.

Given limited ability to raise prices or cut labor rates, the markets are looking instead to cut labor requirements, and automation of their front-end operations (check-out stands) is an obvious answer.

But the supermarket business is complicated, and while point-of-sale systems for check stands have been a someday thing since the late sixties, to date only one supplier, Nuclear Data, Inc., of Palatine, Ill., has production systems installed. Numerous others are under test in stores.

"Most POS suppliers have zeroed in on department stores," said J. Roger Moody, vice president and general manager, retail systems division, of Nuclear Data, "because there are more cash registers out there and they're simpler." Moody says the average supermarket cash register has 10 times as many fixed characters as one in a department store.

And the average supermarket stocks some 10,000 different items out of 100,000 available to it, noted Gary Liebl, vice-president, marketing, of MSI Data Corp., Costa Mesa, Calif. MSI's ASTROS (Automatic Store Reporting and Operating System) is in a test installation at a Schnuck's store in St. Louis.

Most supermarket POS systems, whether they use keyboard entry or optical scanning, depend upon some kind of product coding to achieve top efficiency, and with 100,000 available items, many involving multiple suppliers (producers, packagers, distributors), coding becomes a formidable problem.

First, a standard

It's a problem the grocery industry has chosen to tackle. An ad hoc committee of top management people representing all parts of the grocery manufacturing and distribution industries is working on development of a Universal Product Code which would be machine readable. Items would be source marked to save grocery chains the expensive, time-consuming task (roughly $5 per thousand units) of either code or price marking items at the store level. And, of course, the UPC would greatly facilitate check-out automation.

The UPC standardization program is being financed by each of the top 20 supermarket chains, which have contributed a total of $750,000, and by grocery product suppliers, who have contributed a total of $250,000. Aim of the committee is selection of a universal symbol by March 30, 1973.

The symbol would be a 10-digit code with the first five digits identifying the product manufacturer/supplier and the second five, the specific item. Cost of source marking would run roughly 33¢ per 1,000 items, according to Larry Russell of McKinsey & Co., consultants to the UPC committee.

Prices would be kept inside a store's computerized cash register and would be referenced automatically when the UPC was read at the check-out counter. Russell said that once source marking is used for more than 50% of grocery product units having nonvariable weight (nationwide, $5-17 million worth at any given time), the savings from elimination of in-store marking alone would be enough to justify cost of a computerized system. "I can see 10 to 20% of the units being source marked initially," he said.

Equipment suppliers were encouraged to develop and submit symbols for evaluation, and, at writing, seven were in — from Charecogn Systems; Singer Co.; RCA; Pitney Bowes-Alpex; IBM; Scanner, Inc.; and Litton/

Zellwager.

Some of the companies will put their symbols to laboratory tests. Some are conducting or will conduct store tests, and some will simply submit specifications. And some will do all three. Russell said the committee is prepared to receive submissions through March 29.

The laboratory test program was developed for the committee by Battelle Memorial Institute. Following draft of an initial test plan, participating companies were given an opportunity to suggest revisions. Actual tests started last month. Symbols are being tested in a controlled environment both for overall efficacy and to determine if a scanner actually exists which will read them as they are printed according to vendor print specifications. These specs could be a 50-page document, said Russell. Vendors who had signed up last month to participate in the lab test program, which means paying the costs of their own tests — approximately $40,000 — were IBM, RCA, Singer, Pitney Bowes-Alpex, and Litton/Zellwager. Scanner, Inc., a small firm formed specifically to develop a scanner for this market, was considering it.

Bulls eye at Kroger's

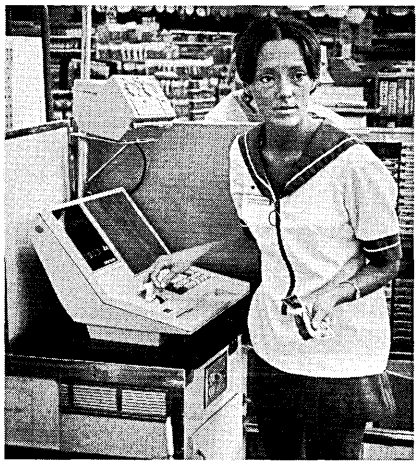
RCA is testing its "bulls-eye" symbol in a Kroger's store in the Cincinnati area. It's a circular bar code that can be read omni-directionally around 360°. The test began in July when POS units were installed in five check stands over a three-week period. Bob Cottrell of Kroger is pleased. The store is operating with the five automated lanes where seven conventional lanes had been required, and "there has been a significant increase in throughput per check-out lane. He said customer reaction has been "very good, and there has been an increase in store sales, but I can't say for sure that this is a direct result of the system because other things have been happening in the marketplace too."

Kroger's already has some source marking through RCA's Banquet Foods subsidiary and its own coffee packaging plant but, for the most part, the bulls-eye symbols are applied at the store. For packaged goods priced by weight, they have a Hobart computer scale tied into their system which comes up with an appropriate bulls eye. There are things which can't be labeled, says Cottrell, like watermelon and cantaloupe, and those which would be impractical to label, like individual packages of gum and cigarettes. To these they assign a two-digit velocity code which can be keyed in.

The Kroger system uses a fixed-slot scanner, imbedded in the conveyer belt, and is based on a dual mini-processor for redundancy. Cottrell couldn't comment on any potential expanded use of the system in its 1,355 stores in 22 states. "RCA hasn't even made a decision on production yet. A lot depends upon what happens next year with the UPC."

In another in-store test of a scanning system, the supplier is committed to the market no matter what happens with UPC. "We're interested in the UPC idea, but we haven't submitted our symbol," said George Ettelson of Dymo Industries Inc., Emeryville, Calif., which,

USING this voice-activated supermarket check-out system (VACS) developed by Threshold Technology, Inc., a checker can bag and input price and product data at the same time. The counter-top screen assures customers the right data is going in.



NATIONAL SEMICONDUCTOR'S Datachecker, in use in El Rancho Market, Huntington Beach, Calif., was designed to functional specifications developed by Certified Grocers, Inc., a cooperative organization of small grocery chains.

in late September began installation of a complete point-of-sale system for a Safeway store in Alamo, Calif. Full-store conversion was completed by mid-October, and Creighton Peet, a Safeway vp, said at that time it was too early to make an evaluation, "but the checkers think it's great." This is Safeway's first test of a system using scanning. The company ran a test in a Fremont, Calif., store with IBM in 1969, but that was a manual entry system and the test was run mainly to determine consumer reaction. It was positive, Peet said.

Peet believes "you have to have scanning" for a supermarket POS system to be really effective, and "it's practical even if labeling is done at the store level; though, of course, it would be more practical with universal symbol source labeling."

Label and scan

The Dymo system uses a hand-held scanner. A lightweight, hand-held labeler is used to print and apply a bar-coded, pressure sensitive label to each item. Dymo is a producer of embossing tools, metal price markers, and hand-held price markers for supermarkets. As with the RCA system, provision has been made for velocity-coded keyboard entry for items it would be impractical to label.

SCHNUCK'S market checker keys in a grocery order on an MSI Data Corp. ASTROS system. The larger keyboard on the right is for high-volume items which can be entered via a single key. The display screen on top, pointed towards the customer, shows her what she's getting and for how much.

The Dymo system is based on a minicomputer the firm developed, and whether systems will contain one or two "will depend on the store's operating philosophy," said Dr. Bill Mullen of the Dymo technical center, "but I suspect most will want two."

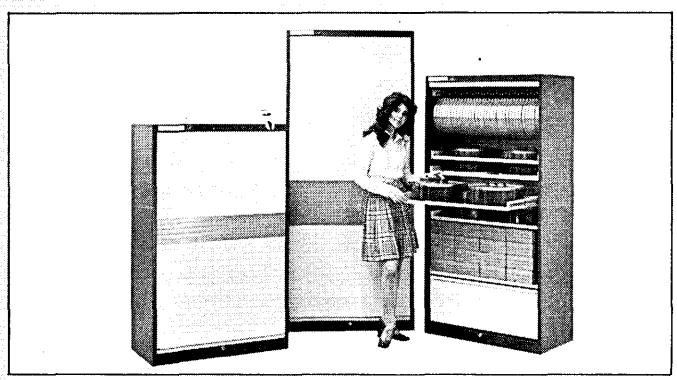
The system has no price tag yet. Dr. Mullen said he believes the test will go on for five months. "The first two months will have to be shake-down, getting out the bugs and overcoming the curiosity factor."

All POS systems offered to the supermarket field, in addition to streamlining check-stand operations, produce a variety of management reports on things like inventory, sales rates, and checker productivity; and, while emphasis in the industry seems to be on

Any media storage cabinet you buy now may be obsolete before it is delivered...

before you buy, find out about the improved storage effficiency and cost advantages of new optimedia™ cabinets

Two years ago we decided that it didn't make much sense to keep designing cabinets that were locked-in to the storage of cards only or tape only or one type of disk pack. So we studied the total media storage problem from all angles and came up with what we believe is the ideal solution, optimedia™ coordinated cabinets can store all types and sizes of data processing media. They can store them in virtually any combination you desire, and — when your storage requirements change, optimedia cabinets can adapt to the changes. They're sort of a "living" storage system that won't become obsolete or leave you with excess capacity for one medium and not enough for another.



optimedia™ coordinated cabinets have other benefits such as "Action Level" storage that lets you place all media at the most convenient retrieval height, smooth operating roll up doors that open all the way leaving the entire inside fully accessible, and up to 20% extra storage capacity when compared to other cabinets with the same outside dimensions.

So . . . hold up that purchase requisition until you can hear the full story on optimedia™ coordinated cabinets. That way you may avoid buying something that's obsolete before it's delivered.

For the complete story on optimedia™ coordinated cabinets, call your local Wright Line office. You'll find it listed in the yellow pages in all major cities or contact us by writing direct or circling the readers' service number. Wright Line, a Division of Barry Wright Corporation, 160 Gold Star Boulevard, Worcester, Massachusetts 01606.

Wright LINE

MEDIA MANAGEMENT SYSTEMS

CIRCLE 79 ON READER CARD

check-stand speed-up, these are important too.

One test, in a Lucky supermarket in San Leandro, Calif., was stopped after three days because the store wasn't getting the reports it wanted. Ken Cope of Lucky said the Pitney Bowes-Alpex system would be reinstalled "once the software problems are worked out." A similar system in test at a Chatham Complete Food Centers store in the Detroit area was "performing well" last month, and Chatham is committed to install systems in 15 more stores next year.

"The terminals were working fine," said Cope of the Lucky system. This is a keyboard entry system which will lend itself to use of scanning "when its time comes."

And the leader in the supermarket POS field is ready for that time too. Nuclear Data's Moody said his firm's systems, which now use keyboard entry, can accommodate either a hand-held wand or a fixed scanner and can handle any scanning rate. Moody believes universal source marking, and with it widespread use of scanning, "will come to pass, but it's a little presumptuous to think we will have it by next year." Nuclear Data won't develop its own scanner. "The winning scanner will have to either be oem'd or offered on a licensing basis, so we'll just sit back and wait to see who wins."

Pay backs in a year

Moody sees scanning as "simply an addition" to a supermarket POS system. "You're always going to have to have minis, communications lines, cash drawers, and keyboards." Nuclear Data's systems are based on their own ND 812 minis, and they use three for every store. For a 10-terminal store with three minis, all interfaces, disc file, and program license, a system would cost $45,000. "The larger the store, the bigger the savings," said Moody, "but our customers have been experiencing complete pay back (recovery of system cost) in from three-quarters to a year and a half." He said it would take sales of $25,000 a week to justify a system, and most of their customers do more than this.

Nuclear Data's first installation was in a Jewel store in September 1971. At the end of this September it had installations in 30 Jewel stores and was installing in 12 more in October. Also last month, Nuclear Data shipped systems to Dominick's in Chicago; Stop & Shop, Boston; Weingarten's, Houston; Wegman's, Rochester, N.Y.; and Acme, Philadelphia.

Acme also is talking about a possible in-store test of a system with Litton/Zellwager, a joint venture of Litton Industries and Zellwager which has in-store tests going in Switzerland.

The Schnuck's test store for MSI's ASTROS was a brand new store with seven check stands which, after 10 days of operation, was doing $100,000 per week in sales. A second system was to be installed in an older store this month. Doug Brookings of Schnuck's said his company, in deciding to go to point of sale, was trying a whole new concept of front-end operation. The experiment, at writing, was too new to evaluate, but Brookings said "so far it's up to expectations." He said the reason Schnuck's decided on MSI was "MSI had a system today that met our needs today and has the ability to grow as technology grows, into scanning and other areas."

"When the time comes"

MSI tested its system for five months at an Alexander's market in Los Angeles and in-house in a mock store before that. MSI's principal product is a portable data entry unit for which 86% of sales currently are to supermarkets. MSI president Bill Bowers said his firm spent one year just trying to determine what tangible benefits a supermarket POS system should offer to customers.

Like the Nuclear Data systems, ASTROS is based on keyboard entry, and Bowers, like Moody, feels universal source coding is a few years away; but ASTROS can accommodate scanners "when the time comes." The MSI test systems have used a Computer Automation Alpha 15 mini, but when the system gets into production, the company will develop and build its own.

The system has a electronic scale attachment that weighs produce and records the price automatically. Its display shows product name, price, and weight. The computer stores check-cashing information so checks can be verified automatically at the stand, in minimum time. Registers have automatic checkwriters into which customers insert their checks after the checker has keyed in the amount (either purchase price or more) and the unit fills in the rest, including endorsing information. All the customer has to do is sign and pick up change, if any. A variety of versions of ASTROS will be priced from $30,000 to $60,000 when the system is in production.

A system that already is, offered by a company which expected to be No. 2 behind Nuclear Data after the first of this month when its first production system was to be installed, is called Datachecker. Produced by National Semiconductor, Santa Clara, Calif., its price runs roughly $30,000 for an eight-terminal system with two minis.

The first production system will go into an El Rancho market in Huntington Beach, replacing a test system which was National Semiconductor's first. El Rancho is a member of Certified Grocers, an organization of smaller grocery chains. Certified had studied POS for several years and developed a functional description of what was needed. The organization approached National Semiconductor, and, said Tom Anthony, director of marketing for the POS system, "we put our technology together with their description and came up with the Datachecker."

Anthony said the test system utilized a basic processor with conventional medium-scale integration (MSI), but the production versions feature dual processors built around five large-scale integration (LSI) chips which afford low price and high reliability, and "the processors were designed specifically for the supermarket application."

National is involved in a joint venture with Scanner, Inc., through which it will produce scanners to Scanner's functional specifications. It expects to offer these early in 1973 and to be in volume production by next summer.

National will install its second production system in an Alpha Beta market in Irvine, Calif., this month and is planning installation of five more production systems by the end of the year.

Then there's a system that doesn't depend on coding or scanning and probably couldn't care less if a UPC is adopted but might be adversely affected by a checker with a bad cold. It's VACS, the Voice Activated Checkout System (see July, p. 102), developed by Threshold Technology, Cinnaminson, N.J. The company's first market test system last month went into one check stand in one Southern New Jersey market of a large chain headquartered in Philadelphia. If that works out, said TT's Michael Nye, the store will install systems in all of its 14 check lanes, and ultimately, he hopes, it will be installed chain wide.

Input for this system is via a micro-

phone the checker wears, similar to those used by telephone operators. The checker verbally identifies items and prices and bags groceries at the same time. Key to the system, said Nye, "is our preprocessor which breaks down speech characteristics into digital signals." An eight-station system would have eight preprocessors and one mini. The preprocessors are TT's, and the mini, a Nova 1200. Price of a system will range from $65,000 to $75,000.

And it might pose a problem for a checker who likes to chat with customers. Could this conversation ring up a package of cigarettes?

Customer: "It's a nice day."

Checker: "True."

—Edith Myers

Companies

IBM Regrouped — What Now?

Will Frank T. Cary's ascendency to the chairmanship of IBM mean a "new face" for the giant? What does the reorganization of the Data Processing Products Group — one of the last legacies of T. Vincent Learson's regime — mean to IBM's direction? The industry mused when the announcements of change were made in September.

The questions themselves provide one answer. Although the new chairman of the board will undoubtedly put his personal stamp on the organization, the wheels for change have been in motion for years, and Cary has long been in a position to direct them.

In that context, the reorganization holds more immediate interest for the IBM customer and competition. IBM has created new divisions to replace the former Components, Systems Development and Systems Manufacturing Divisions. They include the System (without an "s") Development Div., "responsible for the systems definition, architecture, and systems management of IBM's principal computer product lines and for systems programming. It will also develop and manufacture communications products, terminals, and displays." As with the previous SDD, Bob. O. Evans is president.

The new System Products Div. is responsible for the "development and manufacture of central processor products, including main storage, logic circuitry, channels and cables." Theodore C. Papes, Jr., is president.

The General Products Div. is responsible for the "development and manufacture of computer tape units, disc files, and printers," and is headed by Dr. Arthur G. Anderson.

Response to changes

IBM explains the move as a "response to changes brought about by fast-moving technologies and the evolving needs of the marketplace." The new System Development Div: (SDD) is a unification of "systems architecture and systems management . . . to preserve systems integrity, while giving individual business units full responsibility for engineering and manufacturing a particular product — from the drawing board to the loading dock."

SDD obviously is the power behind IBM's technological future, and reflects many things about its possible direc-

tions. The word System, rather than Systems, seems to denote integration of hardware, software, and "firmware" — or "soft goods," a new designation. It could also symbolize IBM's desire to eliminate the multiple operating systems that boggled the 360 era.

And it could also indicate that IBM's breakthroughs in circuitry and its production will someday mean just one computer system for large and small users alike. As IBM brings down the price and increases the density of each chip, it may become cheaper to put all available functions into all machines, simply making some functions unavailable to the smaller user until he "moves up." Perhaps the point is better made by recalling that the original 370/145 had relocate functions already built into it; the user didn't know how to get at it until IBM announced that facility for the virtual storage 145 this summer.

Finally, System may mean that IBM won't have multiple competing projects scattered all over its divisions — such as the three different supercomputers in development a few years ago.

The only products SDD will both develop and manufacture are communications products, terminals, and displays. These products are a major area of emphasis with IBM. It found in the down economy that its batch market was becoming saturated, we're told, and its users have long held that IBM was woefully lacking in communications-oriented systems.

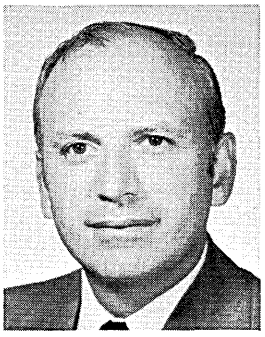
The diminishing cpu

Rough and tumble SDD president Evans is said to be adamant about the importance of the intelligent terminal, the special-purpose intelligent terminal. If one thinks about a terminal sitting on bigger and bigger memories, perhaps with hundreds of thousands of bytes, on smaller and smaller chips, it is easy to see that the central processor must diminish in importance in many applications. Some also speculate that the location of terminal manufacture in IBM's design and architecture arm makes it more difficult to tear out into a subsidiary, by court order.

System programming is also firmly esconced in Evans' shop. During the helter-skelter 360 growth, IBM was plagued by the splinter software groups that developed in the marketing arm, Data Processing Div. (DPD), and in other divisions to develop special software systems. The reason was that the general-purpose software wasn't doing the job. The time-sharing virtual storage CP/CMS system, an answer to the

BOB O. EVANS
The importance of intelligent terminals.

ARTHUR G. ANDERSON
Primarily a research background.



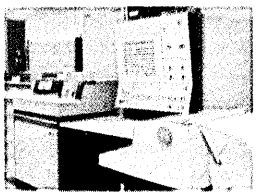
THEODORE C. PAPES
Central processor products.

Extend a little, replace a lot,

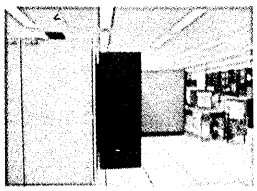
Model 65 – extended from 256K to 512K.
Western Airlines
Los Angeles, Calif.

360 users get any size they want with Fabri-Tek 360 core.

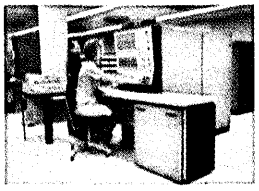
Model 40 – extended from 32K to 384K.
University of South Dakota
Vermillion, South Dakota



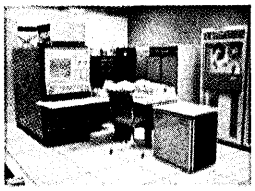
Model 22 – extended from 24K to 64K.
United Farm Agency
Kansas City, Missouri



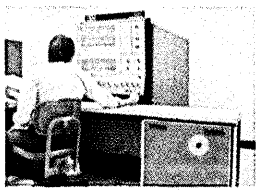
Model 50 – extended from 512K to 768K.
University of Wisconsin
Madison, Wisconsin



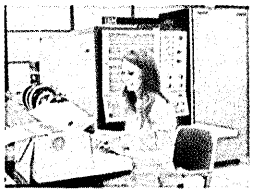
Model 30 – extended from 32K to 64K.
Chi., Mil., St. Paul & Pac. R.R.
Chicago, Illinois
Leased from Dearborn Leasing



Model 22 – extended from 32K to 64K.
Computer Graphic Systems
Toronto, Ontario, Canada
Leased from Greyhound Leasing



Model 30 – extended from 32K to 64K.
Medtronic, Inc.
Minneapolis, Minnesota



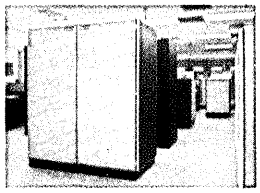
Model 30 – extended from 64K to 128K.
American Broadcasting Company
Hollywood, California

Model 30 – extended from 8K to 64K.
Gant Shirtmakers
New Haven, Connecticut
Leased from Rockwood Leasing

This could be **your** installation.
We've got any capacity you need.

Model 30 – extended from 64K to 128K.
XCS Management
Vancouver, British Columbia
Leased from National Computer Rental

Model 40 – extended from 64K to 128K.
Further expansion to 192K planned
Graco, Minneapolis, Minnesota



Model 50 – extended from 256K to 512K.
State Comp. Insurance Fund
San Francisco, California

Model 30 – extended from 64K to 96K.
Toronto School Board
Toronto, Ontario, Canada
Leased from Greyhound Leasing

To date, Fabri-Tek has over 150 installations of 360 extension memories. And, IBM has agreed to maintain all these CPU's which have been modified by the addition of Fabri-Tek extension core memories. For a complete customer list, call (612) 935-8811 or write FABRI-TEK INC., 5901 South County Road 18, Minneapolis, Minnesota 55436, leader in Memory Technology For Over A Decade.

FABRI-TEK®

360 CORE YOU CAN TRUST

poor TSS progress, was developed by five men, originally, at the DPD Cambridge center. It now forms the basis for Virtual Machine 370 and is under SDD control. The data base system, IMS, was also developed in DPD for one customer; now it and the CICS and GIS systems are at SDD. With unbundling, compilers, sorts, and other systems programs became program products and were shifted from SDD to DPD last year; they are now back at SDD.

IBM's overall goal is to make all software easier to use, applications and systems control programs. How it will be done on the system programming level is yet to be seen, but the man who has become software czar at SDD is Ted Climus.

Computer lifeline

One facet of the System Products Div. that interests some analysts is that the Components Div. (which one observer quipped has been "placed on a single chip") has been absorbed by it. Like terminals in SDD, this appears to make it less extractable by the courts. Certainly it is IBM's computer lifeline and one major path into new markets — here and/or abroad.

The General Products Div., with peripherals and printers, raises many contradictory thoughts. Some speculated the whole division could be divested under a consent decree, but what good would that do with more and more of the control unit capabilities residing in the central processor? IBM could be forced to both oem those units and buy its peripherals under competitive bid (as it does with services from Service Bureau Corp.). But even if IBM's oem prices were low enough to be competitive, wouldn't the result be to hurt competition? Seemingly, anything IBM could be forced to do might be short-lived, since someday semiconductor memory prices will have dipped enough to compete heavily with disc and tape. And that could lead one back to the thought that with newer bigger markets on the horizon IBM might be willing to separate this division.

In any case, Dr. Anderson, its president, has primarily a research background, and there's plenty to do in memory technology, like the trillion-bit tape memory. Sigh.

—Angeline Pantages

Cary: a "Careful, Methodical Man"

T. Vincent Learson has been characterized as an "action" man, one who has been able to tackle tough diverse assignments — such as getting IBM into the computer business and turning the run-away growth of the 360 era into organization and record-breaking profits. Rough, aggressive colleagues enjoyed the same character in their boss and his ability to "one-on-one in a discussion and get to the heart of the issue and make decisions fast." Despite the fact that he had executive influence on IBM for about half his 38 years there, his brief 18-month tenure as chairman of the board may be somewhat symbolic of him. It was a highly critical period which required rapid and hard-nosed decisions.

Frank Cary was much involved in those decisions, and the wheels are already in motion for developments and product lines of the future. But in his tenure as chairman, he will be responsible for the long-term tasks of settling with the Justice Department and achieving three goals. Two he has stated: vastly increased ease of computer use for the customer and rapid decrease in hardware costs — both through technological advances. The third is obvious: massively increased consumption to keep revenues and profits climbing.

In this sense, colleagues who like Cary's style think his character is suited

FRANK T. CARY: Right decisions don't come quickly.

to the task. They call him an "excellent strategist, a long-range planner, a careful, methodical man," who doesn't make decisions very quickly, "the way

Learson did," but well. They claim he is the first of the IBM leaders who is a professional manager. Some ex-IBMers who loved the Learson style and dared to square off with him don't care for Cary's cool, careful ways, his propensity for surrounding himself with colleagues in a meeting, rather than engaging in that "one-on-one" debate. But his detractors also point out that their criticism and the praise given by others "aren't mutually exclusive." Cary and Learson are opposites in many ways, and perhaps complementary.

One might view Cary's background as methodical and planned as he himself is said to be. He progressed straight upward in IBM through the sales ranks to operational and corporate posts. He had a solid and appropriate education — a BS from UCLA and an MBA from Stanford. He met his wife, Ann Curtis, in elementary school. There are no really funny or fearsome stories or legends about him; and, in fact, most we talked to about him used adjectives rather than examples. When told this, one source did offer that Cary, while he was a salesman, did turn down several management posts because he was making so much money selling. When he finally took one, he had a hard time explaining at home that it was for less income, "so it wasn't all planned."

A solid citizen

He joined IBM in 1948 as a sales representative in Los Angeles. Tom Holm, a retired IBM salesman who worked with the young trainee, recalled that Cary was a "solid citizen" whom all thought would "go high in IBM," but most forgot to watch him that closely because none envisioned he would go *that* high."

Even if Cary was reluctant to leave his lucrative posts (supplemented, perhaps, by money made in some successful investment clubs Holm said Cary formed), in 1954, he moved on to assistant branch manager in San Francisco. After several sales management positions in the West and Midwest, he was appointed president of Service Bureau Corp. in 1959. In two years he was moved to corporate staff as assistant director, followed by two more years as vice president in field operations and management controls.

With the inauguration of the IBM 360 family, Cary was boosted to president of the Data Processing Div. in 1964. And in the thick of 360 confusion, 1966, he became Data Processing Group executive and general manager. Between 1967 and 1971, he rose from senior vice president to executive vice president and then president in May of 1971; too, he became a member of the all-powerful corporate office with Watson and Learson in 1969 and a member of the board.

Hence, at 51, Frank Cary has been in the uppermost ranks of IBM for more than eight years. He has been in the corporate office for more than three years, and as he pointed out to *Datamation* last year, the legal and competitive decisions of the last two years — which the industry has characterized as IBM's "Jeckyll and Hyde" period — were made "with miniscule disagreement" by the triumvirate: Watson, Learson, and Cary.

While many say that Frank Cary has the calm, relaxed manner of a Westerner and that he is personally a "warm and human" man, colleagues of the present and past point out that he is "tough as Learson," although "he never loses his cool when he's furious."

His brother-in-law Les Curtis did recall a pertinent story for us from years ago. As the "little brother," Curtis got Cary to teach him how to make a rubber gun — then used Cary's head as his first target. "He didn't get all that angry," he remembered, "and we laughed about it." Later, when Cary was on the boxing team at UCLA, he gave Les a "lesson." Curtis threw a haymaker that missed, and "Frank said, 'No you do it this way,' and shot a straight left into my nose. I still feel it."

One shouldn't be lulled into thinking the "Cary years" — probably the next nine years — will pass without the same "punch" that characterized the eras of Learson and Watson.

Data Entry

A Hit Where IBM Would Rather Miss

It wasn't planned that way, but IBM's new 3740 "diskette" data entry system — which it's announced in most World Trade countries — may have attracted less attention abroad than it did in the U.S., where it wasn't announced at all.

The system still could be announced in the U.S. It was developed at IBM's Rochester, Minn., plant under the code name of Project Viking. Furthermore, IBM is understood to have prepared plans for the system's marketing and production in the U.S. — with production slated for the General System's Div. plant in Rochester. Queried about potential plans for the system in the U.S., an IBM spokesman voiced the firm's terse and traditional comment: "We don't speculate on future marketing plans."

IBM has not been anxious to spread the word of the new system throughout the U.S. Three weeks after the unveiling of the 3740 in Europe, World Trade headquarters in New York wouldn't produce press releases or prices for reporters.

Essentially, the system consists of a new mini-disc ("diskette") which stores data from either a single-keyboard (3741) or double-keyboard (3742) data entry station. A crt is provided for error detection and operator convenience. Other features include a diskette-to-tape converter and a line printer. The floppy disc-like diskette can hold 1,898 records of 80 or 128 characters in length — nearly equal to the capacity of 3,000 punched cards.

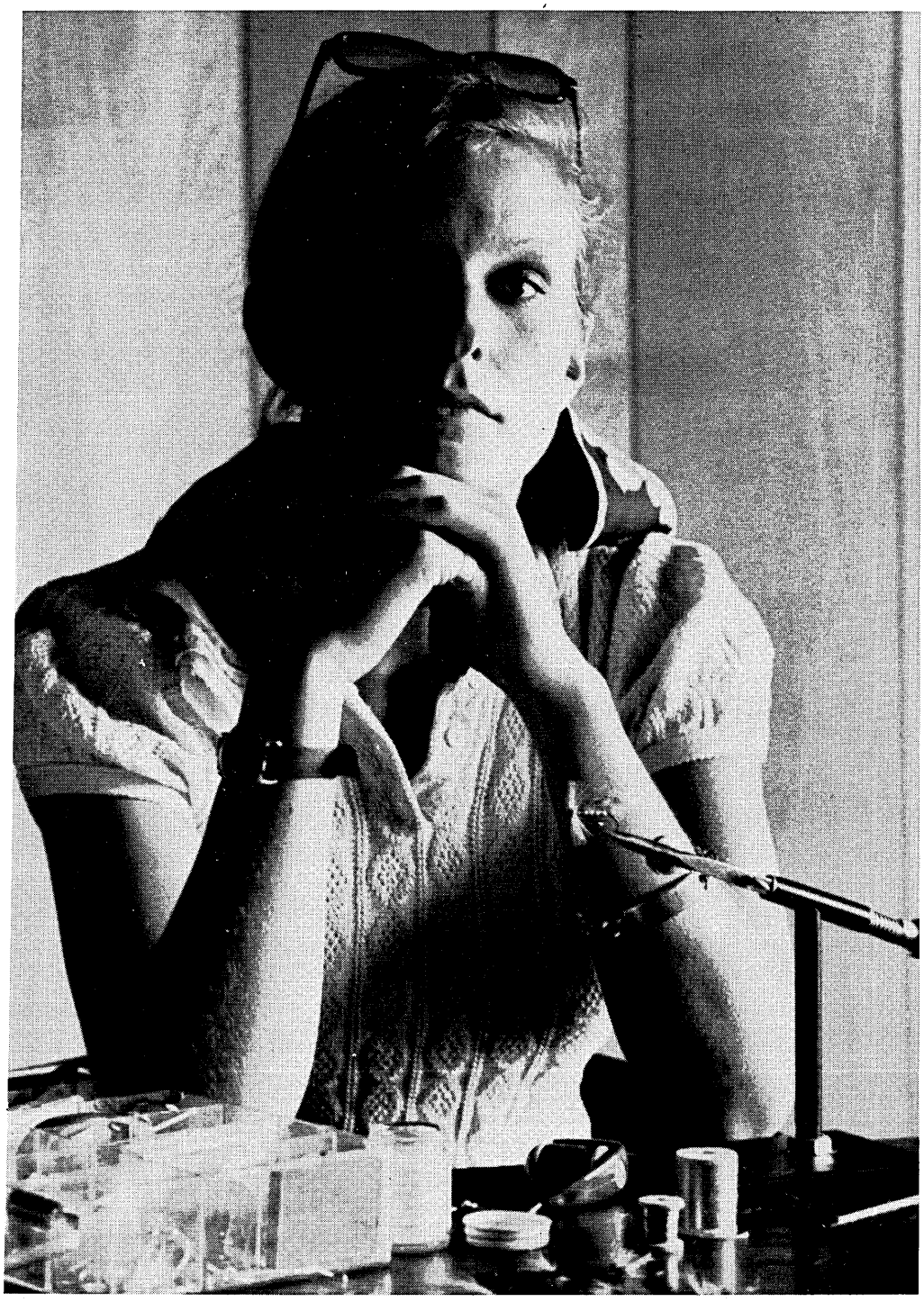
The system is apparently aimed at everything from stand-alone keystation use to large-scale data typing pools. The system has the capability of communicating directly with a cpu, and the diskette is handy enough to be mailed in an 8 x 8-inch envelope. Deliveries are scheduled to begin in July, and production is to be at IBM's Greenock, Scotland, plant.

IBM assumed its customary Sphinx stance regarding the product, and an informal poll of users and competitors shed little light on the product, although many felt IBM was not announcing it in the U.S. because it wanted to protect its domestic keypunch base. IBM's relative strength in keypunches in World Trade countries is generally less than in the U.S.

Wait and see

Many observers see the 3740 as an across-the-board product that will appeal to a wide range of customers for a wide range of jobs. Most observers, however, adopted a wait-and-see attitude, wishing to see how marketing of the product moves along and, more important perhaps, to see what products

I think these people have discovered software lib.



Why did it take so long for a computer maker to realize that software is every bit the equal of hardware, that it deserves a decent place to work and an equal opportunity to be great? Prime must have admitted this to themselves when they began the 200, because they defined the software completely before they built a home for it. The result is the most efficient small system I've ever seen.

DOS, RTOS, FORTRAN, macro assembler, editors, loaders – they're going out with first deliveries. The FORTRAN IV compiler is so efficient you can use FORTRAN as the systems programming language. Then you find that PRIME 200's logic is 100% microprogrammed with a 64-bit-wide microprogram word and you realize your programs are going to fly. It's refreshing to find a manufacturer who knows that memory cycle time doesn't mean much without software to make things happen.

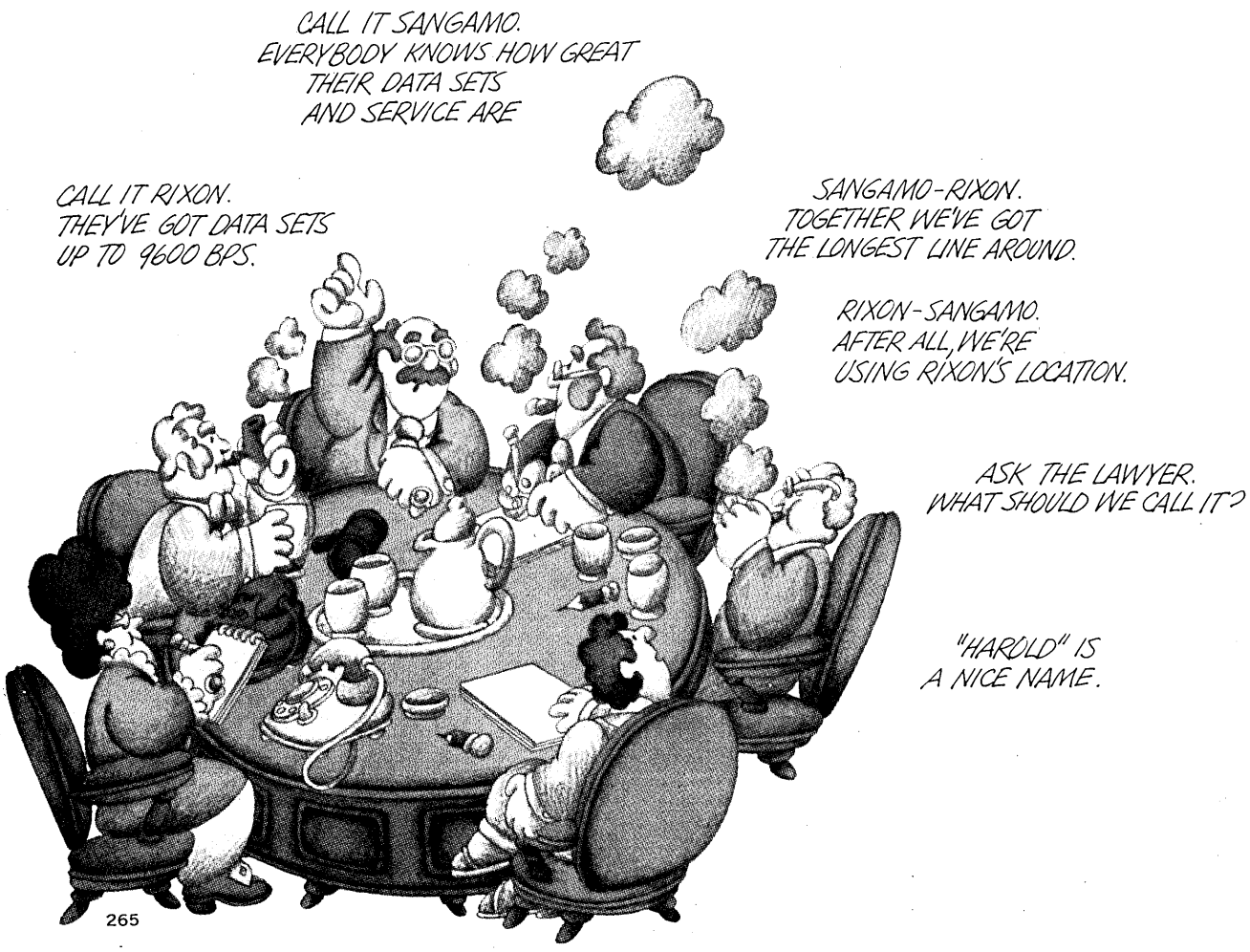
One thing surprises me though – that they should use the phrase "small computer." That's nothing but chauvinistic hardware talk which deprecates the software and system performance. What they mean is, it doesn't weigh much.

The PRIME 200 16-bit computer raises a lot of interesting questions for which we have prepared detailed answers. Let us send them to you. Prime Computer, Inc., 17 Strathmore Road, Natick, Mass. 01760. (617) 655-6999.

Prime 200
small computer

Prime sales offices: Boston (617) 237-4565, New York (212) 896-6262, Washington D.C. (703) 533-9343, Philadelphia (215) 688-0396, Jacksonville (904) 396-5253, Chicago (312) 887-1845, Dayton (513) 435-1343, Detroit (313) 356-4840, Tulsa (918) 663-0518, Palo Alto (415) 968-6003, Los Angeles (213) 881-8433.

Authorized representatives: Phoenix (602) 957-9110, Albuquerque (505) 255-2330, Denver (303) 771-0140, Seattle (206) 454-9332.



THE DECISION IS FINAL!

Rixon is now a subsidiary of Sangamo.

When Sangamo and Rixon came together, picking a name was complicated. But the combination makes buying or leasing data sets uncomplicated. Now you can come to one place for data sets from 150 to 9600 bps—coupler or direct connected, stand alone, card or system configuration. Service from the Sangamo Data Test Center and Rixon's field service engineers. We are maintaining the best of each. Only the name has been changed. Headquarters is now 2120 Industrial Parkway, Silver Spring, Maryland 20904. Telephone (301) 622-2121 TWX 710 825 0071.

Need data? Let's communicate.

RIXON INC.
A SUBSIDIARY OF **SANGAMO**

the 3740 impacts. There seemed to be no indication whether the 3740 would be a revolutionary "big" product for IBM or just another catalog addition.

Pricing remained something of a mystery, although it was evident that individual data stations were not cheap. Estimates from various European companies ranged from about $155 to $180 a month depending on options. Those prices would place the device considerably above the cost of IBM's keypunch and buffered keypunch and above most of the independent key-to-disc manufacturer's prices for individual keystations.

Banking

Paperless Banking — One Small Step

October 16 was billed as a magic day in California, the day when the state would take a step toward the "checkless society."

A press release called it the day "the nation's first automatic paperless deposit and bill-paying services will be launched." A *Los Angeles Times* headline on the subject declared: "Soon You Won't be Seeing Your Paycheck — or Your Bills Either."

Although to a certain extent it marked a culmination of efforts begun in April 1968, Oct. 16 did not loom as that dramatic to members of the Special Committee On Paperless Entries (SCOPE) — representatives of banks, clearing house associations, and the Federal Reserve Board — which developed a system for exchanging paperless credits and debits among banks in California.

A date had to be picked, said a SCOPE spokesman, to permit participating banks to negotiate contracts with companies who would authorize the paperless debits and credits in lieu of payroll and bill collection. "But the process really is evolutionary, and Oct. 16 is just another day. It was selected because it is clearly a day not subject to numerous payroll entries. It will be the first day the system's two automated clearing houses, in Los Angeles and San Francisco, will be available to make entries if anyone wants to. It's hardly like a ribbon cutting at a supermarket."

But SCOPE is satisfied with its system and, in effect, no longer exists. The last SCOPE meeting was held in August, and the committee's last official act was issuance late last month of a revised procedural guide. Its responsibilities have been transferred to the newly incorporated California Automated Clearing House Assn. SCOPE committee members will serve as directors of this association until Jan. 1973 when a nine-man board will be elected, made up of three representatives from the Los Angeles Clearing House Assn. banks, three from San Francisco Clearing House Assn. banks, and three from other participating banks not belonging to either association.

Since the early stages of its development, the system, first of its kind, has been closely watched by 18 clearing house associations around the country who have been investigating paperless entries.

Some agreements

In August the California SCOPE organization had executed a licensing agreement with five Atlanta banks acting for the Atlanta Committee for Paperless Entries (COPE) under which the Georgia group will modify and use the SCOPE software and make its modifications available to other SCOPE software licensees.

A Boston SCOPE which recently enlarged its area from the Boston vicinity only to include parts of adjacent states in the Federal Reserve First District, has indicated it will want a license for the California SCOPE software once it has facilities available to run a system.

The slowly growing California system is running in its early stages on a 360/30 in the Los Angeles clearing house and a 360/40 in San Francisco. The total hardware configuration is somewhat less than was specified by Touche Ross & Co., which designed the system. Initially it was planned to use a Burroughs 3500 in Los Angeles, but the L.A. clearing house found it could not spring this machine from its heavy check-clearing activity. However, because of the slow rate of growth SCOPE expects in the number of regular entries, it feels present hardware will be adequate at least until the end of next year.

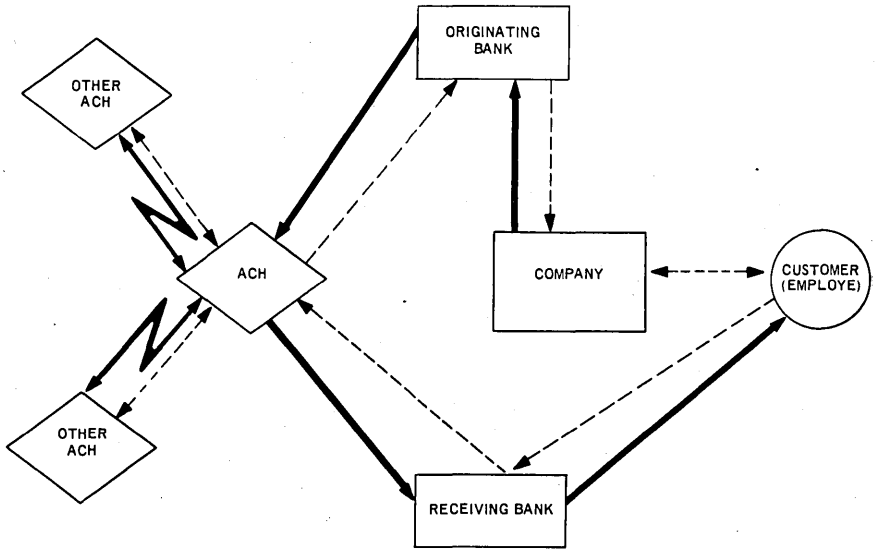
SCOPE accepted the system as complete and satisfactory and made final payment for it to Touche Ross in January. Coding problems had had it running "slower than expected" in early tests late last year, but these were corrected in January to the point of a 40-50% decrease in throughput time.

After that the problems were training and legal matters, and these were resolved by August when SCOPE adopted its implementation schedule, including the "magic" starting date. As anticipated, some 90 banks had officially signed up as participants by this date.

What it does

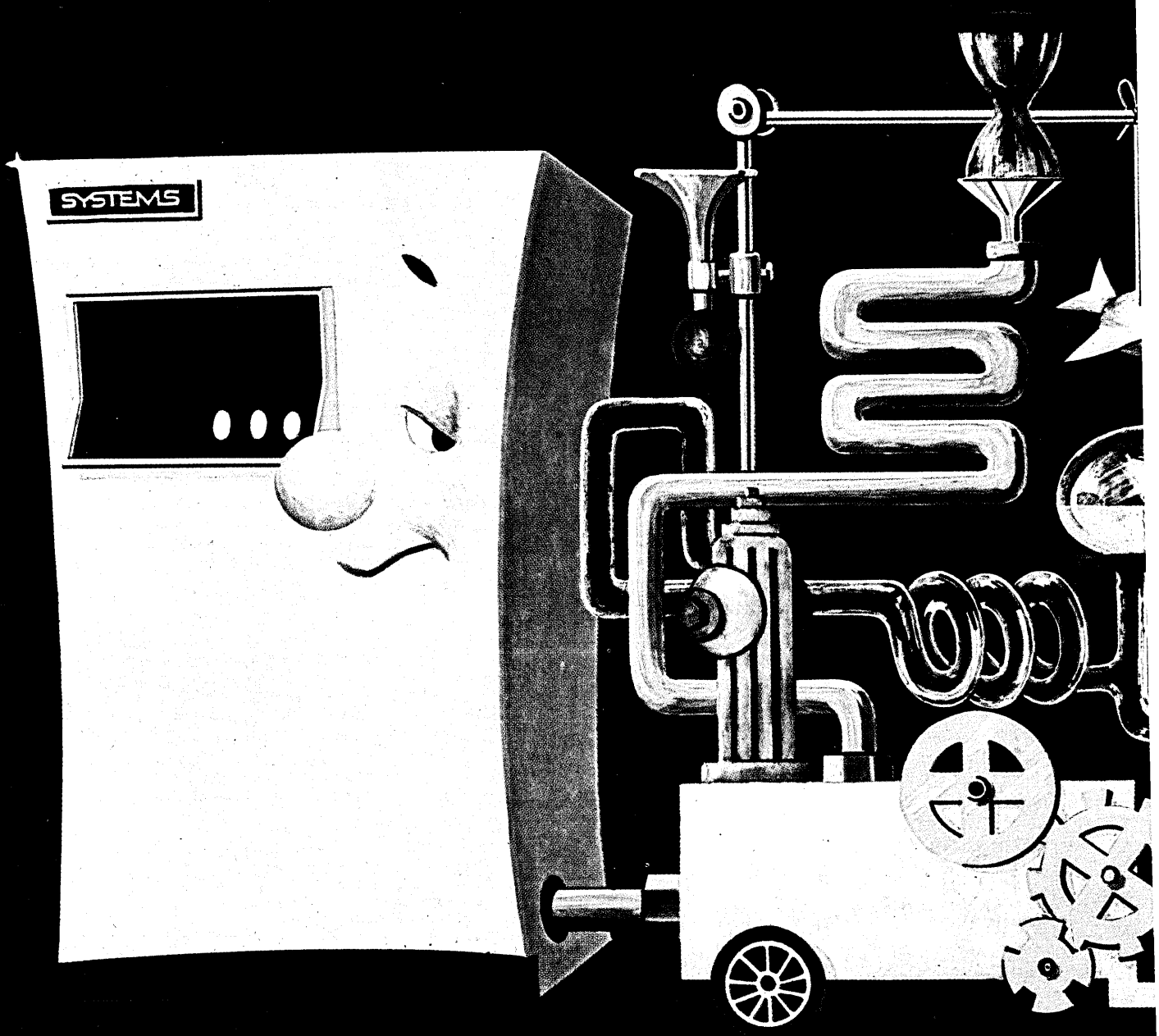
Simply stated, what the system does is this: At the end of each pay period, a participating employer calculates the net amount of wages or salary of any employee who has authorized a payroll deposit. The employer transmits deposit information, which includes

(Continued on page 161)



The processing flow in California's paperless entries banking system. The solid line shows the flow of valid, preauthorized entries, and the broken line, the flow of returned or disputed items. ACH stands for automated clearing house.

Solutions come in a



shapes and sizes.

And contrary to opinion, computers, in and of themselves, are not solutions.

Solutions for application problems like yours require software, front-ends, peripherals, and a host of other gear, not the least of which is the computer.

Then to get your particular job done, there's bound to be some custom work needed. On hardware. And on software. You don't normally find solutions on the shelf.

Solutions are what we know and do best. That's because we are a *computer systems* company. A difference that could mean a lot to you.

At SYSTEMS Engineering Laboratories we design *and* build total systems. Total solutions for all sorts of tough application problems. And because we build our own, it's a competitive edge that separates SYSTEMS from all the others.

For openers, we design and build our own computers. Like the industry's fastest 32-bit processor, SYSTEMS 86. And the industry's lowest priced 32-bit machine, SYSTEMS 85. In the 16-bit range we have the first small computer with virtual memory, SYSTEMS 72. And its all-core memory companion, the SYSTEMS 71. In the same range we have the undisputed price/performance champ, the SYSTEMS 810B.

Alongside the widest selection of standard peripherals and front-end equipment available, we also create our own very special bells and whistles. Custom front-ends. Custom peripherals. Custom software. Whatever special touch you need to get that just-right system.

And, of course, we close the loop. With the installation expertise, the service, and the training. The whole package.

It's this custom capability, this willingness to engineer a new way, that makes SYSTEMS different.

And for you? It's really the only way to solve that application problem. With the solution sized and shaped just for you.

The SYSTEMS way.

To find out more about your solution (in the U.S. and Canada) call or write John W. Schneider, Vice President — Sales. (305) 587-2900. In Europe call or write James Baconnet, Director — International Operations, 85 bis, Avenue Albert 1er, 92, Rueil — Malmaison, France. Telephone 967-83-17.

SYSTEMS

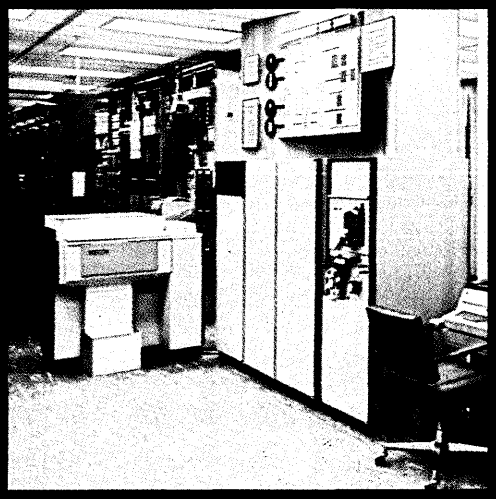
ENGINEERING LABORATORIES

6901 WEST SUNRISE BLVD., FT. LAUDERDALE, FLORIDA 33313

CIRCLE 59 ON READER CARD

At San Antonio's City Public Service Board...automatic turbine startup...monitoring, alarming and display functions...and direct digital control on selected control loops.

At Ford Motor Company's General Parts Division ...partial calibration and total testing of automotive distributors.



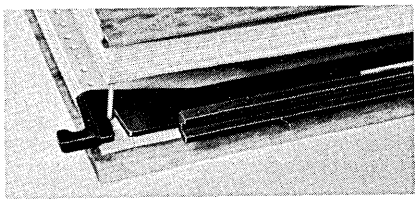
At Bell Telephone Laboratories...R&D. testing the telephone system of the future by simulating hundreds of thousands of calls each hour.

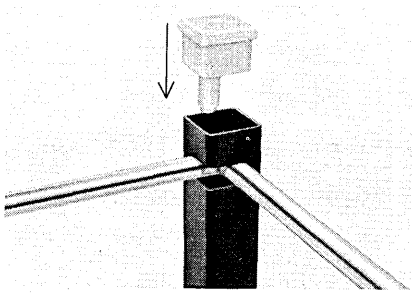

One

If our Data File Module were not significantly better than what's on the market, we would not bother to introduce it. It's that simple. That much better. Data File Module literally puts over 3,500 printouts at your fingertips. Replaces clutter with convenience. Holds both unburst and burst sheets in 14 7/8" x 11" or 11" x 14 7/8" binders. It gives you a compact, satellite reference system that goes on your desk. On the floor next to your desk. On counters and shelves. And on casters wherever you go.

Getting a grip on things.

Some hangers make it hard for you. They don't have a handle. Not ours. We give you something to hold onto. With our handles, you can carry the bulkiest EDP binders with ease. Your secretary can handle them without breaking her fingernails. What's more, our handles are easier to insert into binders. You don't have to remove posts, take off sheets or thread. It's a cinch. Data File Module gives you top filing or, with optional conversion channels, side filing. No new binders or additional equipment needed.



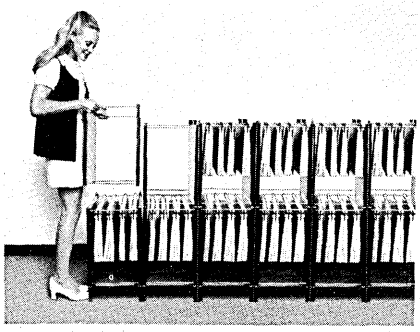


Assembly. Easier done than said.

Putting some EDP racks together puts a lot of people off. It's complicated. But with fewer parts, Data File Module assembles quickly, easily. Anyone can do it. And when you're done, you've got a Module that's sturdy enough to stand on. There's another advantage, too. The colorful vinyl sides are optional. So if you decide against sides, you can save even more money.

It stacks up better.

As your needs change and expand, so will Data File Modules. You can stack Modules side by side, piggyback, pyramid, around the corner, or wall to wall. Build them into a modular system. And with a choice of wood grain, iced blue, beach white and hot orange sides, you can color-key according to subject or coordinate with your office decor. No matter how you work it, Data File Modules stack up beautifully.

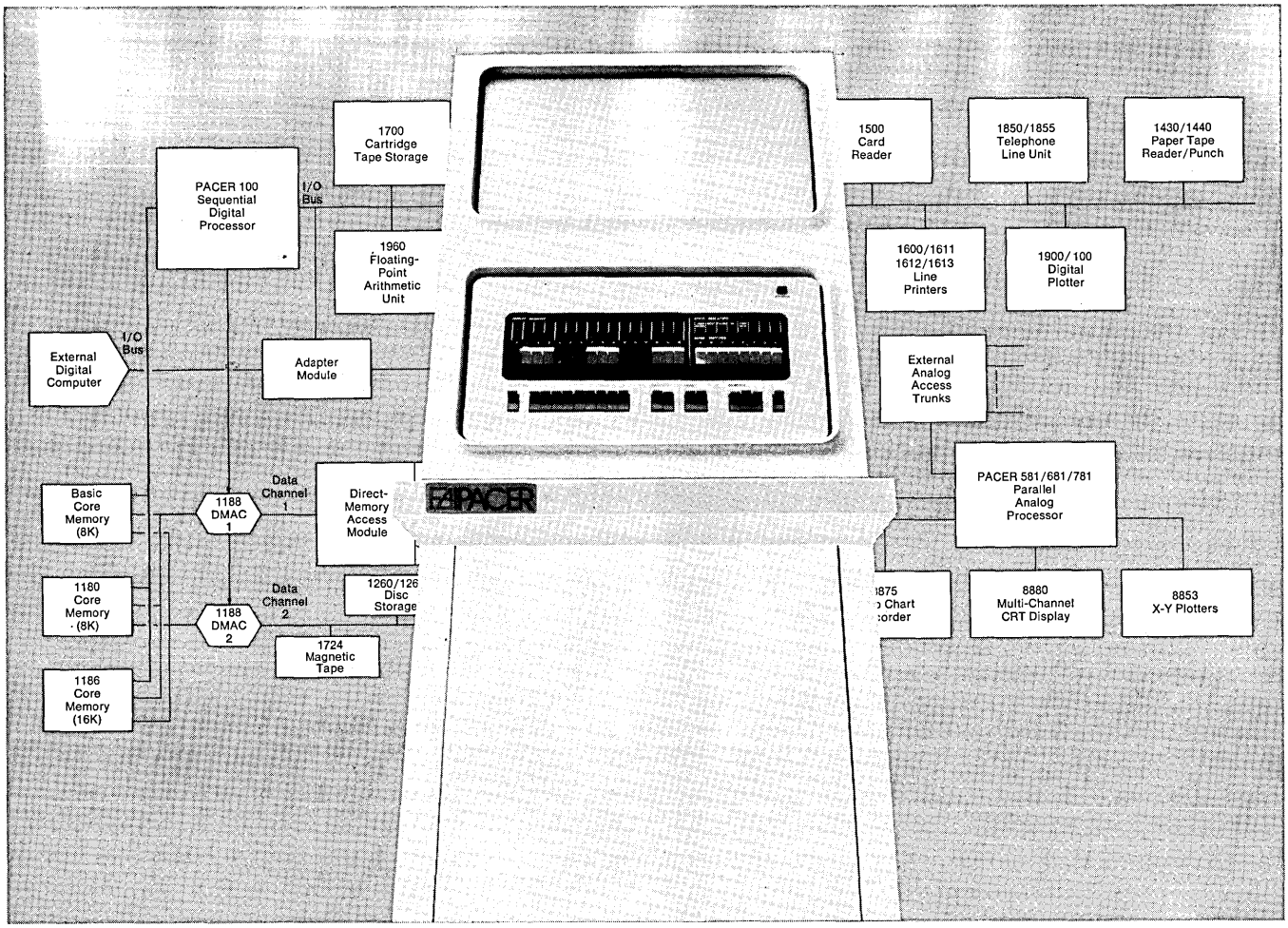


Call your office products supplier now. Or write us for more information. Boorum & Pease, 84 Hudson Avenue, Brooklyn, New York 11201. McMillan Book Co., Inc., 128 Spencer St., Syracuse, N.Y. 13201. Trussell Manufacturing Co., Inc., P.O. Box 911, Syracuse, N.Y. 13201.

Boorum & Pease
McMillan·Trussell

better.

Boorum & Pease introduces the complete Data File Module.™



PACER 100
What a Way to Grow!

It's EAI's digital cornerstone. Our PACER™ 100 is no ordinary computer. It's the beginning of a new growth story, a digital especially designed to work with our new parallel processors. And work it does in expandable systems that provide unequaled throughput in scientific and engineering problem solving.

We put the PACER 100 at the digital corner of three different series of new PACER systems, each larger than the next: PACER 500. PACER 600. PACER 700.

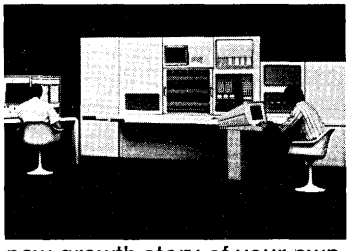
Then we provided options to help you grow, to let you fine-tune your system to exactly the type and scale of problems you face. Up to giant-sized.

At each level, your PACER system can deliver far more scientific and engineering design-problem solutions—per day or per dollar—than any other system available.

Meanwhile, your techniques and solutions will be state-of-the-art in the areas you choose: Optimization. Simulation. Control. Design. Data Reduction.

Further, we have a huge library of software to help you—including a foreground/background Real-Time Operating System. And we have more than 5,000 case histories of applications to prove our software expertise.

As you can see, we make no ordinary claims. Now, thanks in part to our new digital, we can make one more dramatic assertion: PACER systems can offer you performance/price ratios that run to over 100 times those of conventional digital systems.



That's the sort of efficiency that's worth writing home about or, more to the point, worth writing to us. The faster you do, the sooner we can send you more information to help you start a new growth story of your own.

EAI

Electronic Associates, Inc.
185 Monmouth Parkway
West Long Branch, New Jersey 07764
(201) 229-1100

amount due, the name of the employee's bank and account identification, to his (the employer's) bank. His bank transmits entries for depositors at all other California banks to one of the automated clearing houses for distribution to those banks. On payday, participating employees receive the usual statement of earnings from employers indicating gross pay, deductions, and net amount deposited in their own checking accounts.

Payment of routine household bills works in a similar way. A billing company, through its bank, makes arrangements to participate in the service. Then it sends descriptive material and authorization forms to its customers. Those customers who wish to participate in the service for payment of their bills sign these and return them to the company. The billing company then sends the standard authorization agreement to the individual's bank, which checks the account number information and returns the confirmation copy to the company. After receiving the confirmed authorization, the company may then initiate the automatic payments for these routine bills.

As the system went up last month, participating banks were just beginning their marketing efforts, and only a "limited number" of companies had agreed to participate. Most of the banks were concentrating their efforts on large organizations such as utilities and insurance companies.

Procurement

Interface Issue Coming to a Head

Federal efforts to make its computer system procurements more competitive — a struggle that has been waxing and waning for the past several years— has shifted into a higher gear in the wake of some potentially significant developments:

Congressman Jack Brooks of Texas said the ASCII standard covers information interchange applications within installations — i.e., between a cpu and its surrounding peripherals. "If ASCII is considered as only a 7-channel code that does not apply within computer installations, then the impact of the standard will continue to be seriouIsy compromised," he added.

Dr. Ruth Davis, National Bureau of Standards, is "very much concerned about the inadequacy of our standards management." She ordered her subordinates to take actions which may lead to greater use of the ASCII code and may give the bureau more control over federal dp users.

"Several" major systems manufacturers are said to be willing to let independently made peripherals be attached to computers which they lease to Uncle Sam under the Federal Supply Schedule (FSS). Tighter control of sole-source procurements by the General Services Administration (GSA) is also in the offing. So is expanded use of a third-party leasing.

One possible result of these developments is a new FSS contract promising independent peripheral makers a bigger piece of the action. Also, federal agencies that want to continue using machine-dependent codes instead of ASCII may have a harder time doing so. This is not exactly the first time such possibilities have surfaced in Washington, however, and the fact that they are emerging once again indicates what happened in the past. But there are some special factors that make the current opportunity (or threat, depending on your point of view) more credible than its predecessors.

One is the apparent willingness of at least some major systems manufacturers to accept "foreign attachments" on an unrestricted basis. For the past several years, the feds have been able to attach independently made equipment to leased cpu's, but only by getting the manufacturer's prior permission. This qualification has been eliminated from the FY'73 FSS contract. CDC has already accepted the new foreign attachment provision in writing, and it is known that at least four major systems manufacturers are ready to do likewise.

Planting the standard

Another special factor is the emergence of Dr. Davis as a kind of Joan of Arc, determined to push back the forces of incompatibility and plant the ASCII standard deep in enemy territory. In a recent memo to her staff, she ordered them to determine the present use of ASCII by federal agencies acquiring systems after 1969, when the standard became effective. She also asked them to find out, from a sample of the nonusers, why they haven't adopted the standard. "I believe there are absolutely essential steps," she added. "They ... indicate our definite intent to determine the extent of utilization of ASCII by government agencies and to increase ... utilization of ASCII. These actions will indicate to the computer industry our intent of standing behind ASCII as a federal standard."

Concurrently, Dr. Davis announced that a joint industry-government task group would be convened to " ... extend as necessary the implementation of ASCII to meet its intended objectives." After surveying users and system manufacturers, this group will try to measure the impact of the standard, actual and potential, and determine what changes are needed to increase the code's appeal. One possibility is that agencies will be allowed to request extra funds to convert their files to ASCII format. Another possibility is that present waiver provisions — which enable some agencies, legally, to continue using non-ASCII formats — will be tightened.

Soon after word of the ASCII study leaked out of NBS, Congressman Brooks wrote Dr. Davis and suggested that the task group study ways of implementing ASCII within computer sites. Nothing was said about requiring use of the code for files — an idea that makes many cpu makers and some federal users livid — but Brooks clearly had this idea in mind.

The only solution

" ... The ASCII code, coupled with a concept for the independent treatment of data, and the versatility of new computer hardware and operating systems that allow different computers to emulate those of other manufacturers, offers what might be the only affirmative and constructive solution to the imbalance in competition among computer manufacturers that exists today," said Brooks. " ... By this means, the heavy conversion costs and the 'captured user' that have compromised competition in the past would be overcome. The problems confronting the nation's peripheral manufacturers could be eased substantially. Furthermore, the interface between the computer and the user could be improved so as to vastly increase the use of data processing techniques to solve the many difficult social and economic problems confronting society."

The NBS task group includes 12 federal agencies and seven outside groups — ANSI, BEMA, the Computer Industry Association (CIA), ADAPSO, EIA, Bell Labs, and the ACM's Joint Us-

the centronics phenomenon:

after 2 instant successes, could we have 3 more in the wings?

The 101 and 101A. In less than a year and a half, they became the best selling medium-speed printers. Anywhere.

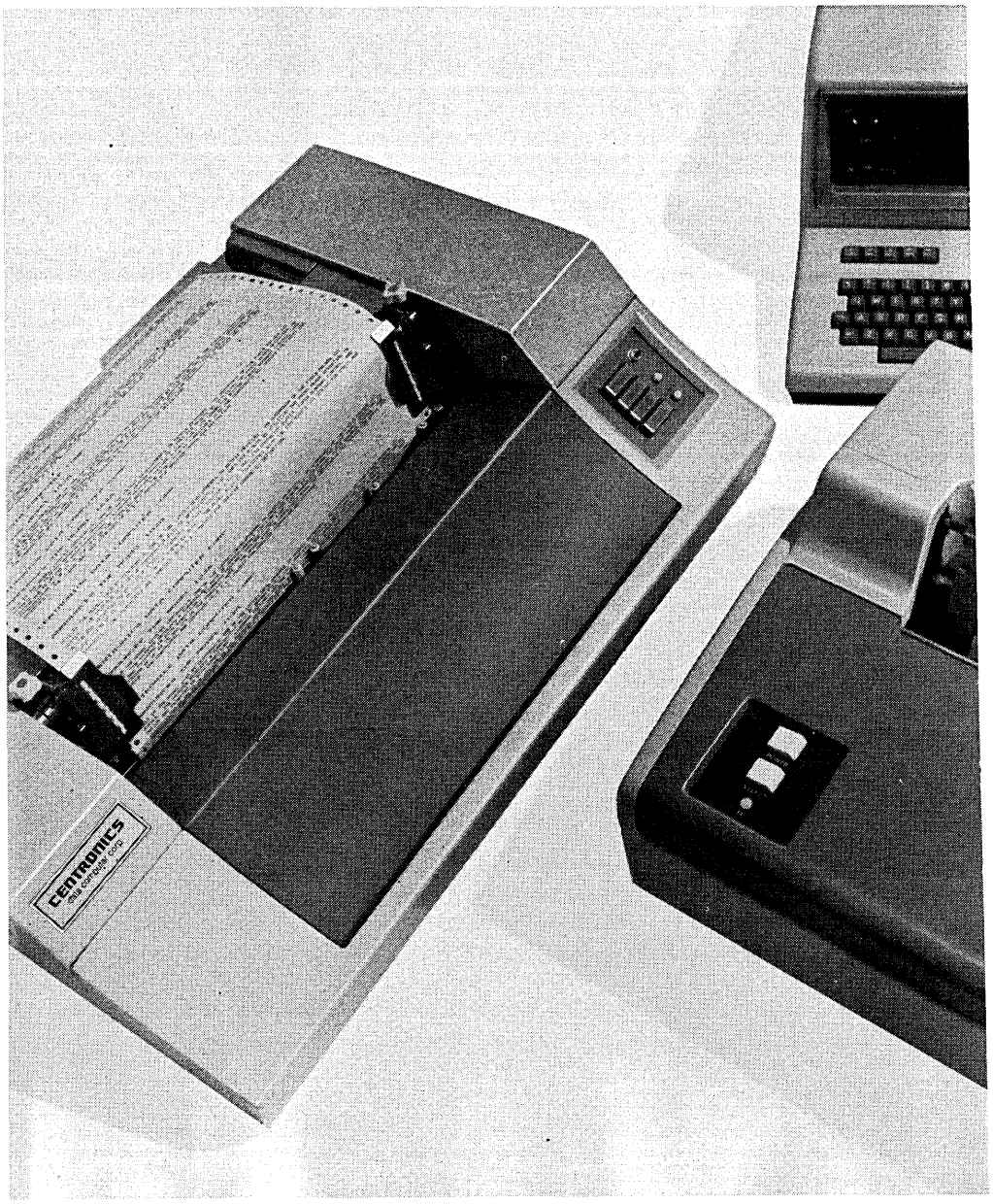
Now, ready in the wings...

The 306. The fastest, low-cost 80-column impact printer. And it's in production.

The 102A. At 125 lines/min., it's twice as fast as our first models. And it's in production.

The 401. A 132-character crt terminal that adds display/editing capabilities to our printers. At low cost. And it's in production.

To get the facts of success, phone or write Department 1047.



CENTRONICS

centronics data computer corp.
one wall street, hudson, n. h. 03051
telephone (603) 883-0111
central region: (513) 294-0070 (ohio)
western region: (415) 228-7178 (calif.)

ers Group (JUG). They meet for the first time this month and are scheduled to submit a final report next May 15. Long before then, GSA probably will sign FY'73 federal supply schedule contracts with the major system manufacturers, permitting unrestricted attachment of independently made add-on memories and other peripherals to leased cpu's. While this would be a major coup, GSA officials admit there would still be "a possibility" of semantic difficulties over clause 7 of the contract; this is the one covering foreign attachments.

One part of clause 7 obligates the vender to "provide the government . . . with available detailed technical information (needed) . . . to permit" the attachment of independently made peripherals. Government negotiators interpret this language to mean the vendor will supply cpu channel interface specs if they're requested. But since that data isn't explicitly mentioned, a vendor could interpret the words differently.

How one sees it

Burroughs is quite likely to come up with a different interpretation, since it has gotten into a bitter fight with Sci-Tek, an independent terminal maker in Wilmington, Del., regarding that very issue (see Nov. 1, 1971, p. 50).

The dispute involves the Phase II Base Level Standardization program, a network of some 300 B3500 computers dispersed around the globe. The Air Force, which wanted to know whether the Burroughs system at a host site could efficiently handle dp jobs generated at smaller remote sites, hired Sci-Tek to test the feasability of this configuration using a new RJE terminal the company had developed. Sci-Tek wanted to interface with a B3500 I/O channel, but Burroughs refused to provide the interface specs. The Air Force sided with Burroughs and Sci-Tek ultimately was forced to interface at the controller. Results of the demo are now being evaluated, and presumably the Air Force will undertake a mass buy when the evaluation is completed.

Sci-Tek says it wuz robbed because interfacing at the channel level would have shown the superiority of this technique and led to savings in the follow-on of "more than a million dollars." The company added that the Air Force, by insisting on the controller interface, has given Burroughs an opportunity to bid its own terminal.

The irony of the whole story is that Burroughs could very well end up bidding the Sci-Tek terminal. Rights to the device are owned by Bryant Computer Products, which recently was put on the block by its parent, Ex-Cell-O Corp. Burroughs reportedly is among the prospective buyers.

Sci-Tek has complained to Congressman Brooks, GSA, the General Accounting Office (GAO), and the Delaware Congressional delegation. All it has gained so far is a statement from GAO saying there is "a possibility" the Air Force follow-on procurement, when announced, "might be structured" in a way that would allow Sci-Tek to offer its channel-interfaced terminal. "To some degree, this will depend on whether GSA will be able to obtain more favorable attachment clauses in its fiscal year 1973 solicitation to industry," GAO added.

In view of this statement, Burroughs has an obvious incentive for not granting the feds more favorable attachment clauses. Other companies have a similar incentive. Recently, the National Bureau of Standards proposed that "the federal government announce its intention to request technical and performance specifications for channel and device interfaces for procurements which will be repetitive and intended to meet a significant portion of government needs. The effective date for this action should be 1973."

BEMA wants a study

The NBS proposal is still in draft form, but it has already upset BEMA. The association's staff has drafted a statement calling for a study of the whole issue before interface disclosure regulation is issued. Among the items to be studied would be the effect of the NBS recommendation on trade secret laws; liabilities "for the government, suppliers, and others" involved in disclosure of interface specifications, and "use and control" of interface specifications once disclosed.

A final version of the NBS proposal probably will be completed before the end of this year. Then it will go to the Joint Economic Committee (which was the inspiration for the project). A spokesman for the Computer Industry Association, after agreeing that his group would like to see interface specs disclosed, said "we expect to be working with the Joint Economic Committee after they get the report."

IBM announces

Virtual storage, which can greatly broaden the range of applications feasible for an IBM System/370 computer, is incorporated in the new Model 125, the lowest-priced computer in the System/370 line.

By freeing programmers from much time-consuming and routine work, virtual storage can increase their productivity. It gives the Model 125 an apparent main storage capacity many times greater than its real main storage.

Other advanced functions offered by the Model 125 include on-line data entry and teleprocessing.

Many companies can now keep all of their data files on line all of the time using the 3330-series, which provides the lowest cost per unit of storage of any IBM disk drive. Directly attached to the Model 125, the 3330-series makes available from 200 to 400 million bytes of information for massive on-line data base applications.

System/370 Model 125 with virtual storage.

This can open up a whole new mode of operation for many users.

And through the 125's teleprocessing capability, access to such a data base can be extended to widely-separated remote locations—company departments, branch offices, manufacturing facilities.

A TV-like screen simplifies the operator's job by replacing most of the lights and switches traditionally associated with computer consoles. The screen displays data and instructions being entered at the console keyboard, as well as desired data in the system.

The new System/370 Model 125. It meets the needs for advanced computer functions.

IBM®

This doesn't necessarily mean the committee will hold hearings on the interface hassle, but it could happen — particularly if somebody can present a reasonable rebuttal to the mainframers' claim that interface specs are "proprietary" and thus shouldn't be disclosed. Sci-Tek may have such a rebuttal. In its complaint to GAO, the company said:

"The term 'proprietary' has no real, legal definition. It is constantly misused when large computer manufacturers do not want to reveal information to the government. Proprietary, when correctly used, refers to information concerning *how the equipment is designed and manufactured.* The only information required by the government, or Sci-Tek, to interface the mainframe is *how it works*... Sci-Tek engineers knew how the (B3500) equipment and software worked. The only reason Sci-Tek needed interface specifications is that Burroughs could, at will, change pin connections or modify the executive system to reject previously compatible equipment. Since Sci-Tek knows that large computer manufacturers *do not want* competitive, low-cost peripherals attached, we felt that detailed, written specifications concerning how the equipment works was insurance against acts of this kind."

— Phil Hirsch

Computer Output Microfilm

COM: The Prospects Take Another Look

Is COM coming back?

Hailed as an obvious growth subindustry only three years ago, the high-speed recording of computer output onto microfilm ground to a snail's pace in the following two years. Lately there are signs that the dp department, which once scorned the injection of messy chemicals into the computer room, now is disposed to taking another look at the economies of speeding up the way computer output reaches those who must use the information.

And this leads the grandaddy of COM, Stromberg DatagraphiX, Inc., with some 300 installations of COM recording and related equipment, to forecast that 1972 will be the best year on record for the industry, which dates to the late '50s when the Social Security Administration first began reducing computer printouts to more manageable microfilm images.

DatagraphiX thinks the COM recording industry — some 20 suppliers — will install 230 systems in 1972, the best year since '69 when 210 were installed. This compares with 194 last year and 151 in 1970, a gloomy year for the industry when General Dynamics was trying to unload its money-losing DatagraphiX subsidiary and the upstarts setting out to displace the San Diego company were either underfinanced or reluctant to commit sales dollars to a potential market that survey after survey found to have an expressed lack of need for COM.

Whether or not this has changed, vendors of COM systems report that today the dp department is "very friendly" to the COM salesman, much of this due to their management's increased receptiveness to cost-cutting recommendations from dp. Reports that can be recorded at speeds from 10 to 20 times that of line printers; reduced 24, 42, or 48 times in size onto microfiche cards or roll film; duplicated and mailed for 8¢ apiece to those who will use the records at branch offices; and stored at a fraction of the space required for paper are hard selling points for the proponents of COM.

DatagraphiX thinks COM sales will more than maintain the 1972 pace, rising from 742 installations at the end of last year to close to 2,000 by the end of 1975, with more than 75% of these having alphanumeric applications, as opposed to graphic systems which accounted virtually for all of COM uses in the mid-sixties. Other surveys support this, but they note that the dollar value will decline as prices of COM systems continue to decrease. The 150 systems installed in 1970 were valued at $25 million, while the 250-300 units expected to be sold in 1975 will represent a sales equivalent of $15-20 million because the average unit price will be between $50,000 and $75,000 compared with the $100,000 units on the market in '70.

While further price reductions are expected, they are not likely to have a major impact on the costs of total systems. Usually, annual expenses for film processors, duplicators, viewers, film, and related supplies exceed those of the COM recorder. Some think, though, that lower prices might help increase the number of sites using more than one COM unit.

The prospects

Suppliers say their prospects continue to be users with multiple line printer installations, such as insurance companies, big banks, and large retailers. In these installations, as in those of smaller users, they are competing with service bureaus and with organizations of-

Microfiche Costs	
1. 9.6 million frames @ $.0065	$ 62,400
2. 13,700 original fiche @ $.14	19,180
3. 54,800 duplicate fiche @ $.125	68,500
4. 9.6 million frames reformatted @ $.0075	72,000
5. C&DP labor (accounting, tape handling, fiche distribution, operations flow coordinator, file maintenance)	50,000
	$272,000
Microfiche cost per page	$.007
Incremental Impact Printing Costs	
1. Paper	$179,000
2. Printers	20,000
3. Print trains	2,000
4. Controllers	10,000
5. Tape drive	5,000
6. Printer labor	24,000
7. Post-processing labor	20,000
8. Tape handling, file maintenance, and controls labor	38,000
	$298,000
Incremental impact print cost per page	$.008

Here is how a unit of Hughes Aircraft compared COM and hard copy costs, based on a projected 1973 volume of 9.6 million pages with four copies (or 13,700 fiche strips and four duplicates).

Only 3 out of 10 jobs are so special they demand a Datacraft computer... but for those jobs you can't beat Datacraft.

Simulation • Process control • Scientific experiments • Data acquisition • Nuclear experiments • Chemical analysis • Engineering problem solving • Medical analysis & monitoring • Training devices • Hospital information system • Supervisory control • Engineering instruction • Numerical control • Avionics checkout • Telemetry • Geophysical research • Traffic control • Simulation • Process control • Scientific experiments • Data acquisition • Nuclear experiments • Chemical analysis • Engineering problem solving • Medical analysis & monitoring • Training devices • Hospital information system • Supervisory control • Engineering instruction • Numerical control • Avionics checkout • Telemetry • Geophysical research • Traffic control • Simulation • Process control • Scientific experiments • Data acquisition • Nuclear experiments • Chemical analysis • Engineering problem solving • Medical analysis & monitoring • Training devices • Hospital information system • Supervisory control • Engineering instruction • Numerical control • Avionics checkout • Telemetry • Geophysical research • Traffic control • Simulation • Process control • Scientific experiments • Data acquisition • Nuclear experiments • Chemical analysis • Engineering problem solving • Medical analysis & monitoring • Training devices • Hospital information system • Supervisory control • Engineering instruction • Numerical control • Avionics checkout • Telemetry • Geophysical research • Traffic control • Simulation • Process control • Scientific experiments • Data acquisition • Nuclear experiments • Chemical analysis • Engineering problem solving • Medical analysis & monitoring • Training devices • Hospital information system • Supervisory control • Engineering instruction • Numerical control • Avionics checkout • Telemetry • Geophysical research • Traffic control • Simulation • Process control • Scientific experiments • Data acquisition • Nuclear experiments • Chemical analysis • Engineering problem solving • Medical analysis & monitoring • Training devices • Hospital information system • Supervisory control • Engineering instruction • Numerical control • Avionics checkout • Telemetry • Geophysical research • Traffic control • Simulation • Process control • Scientific experiments • Data acquisition • Nuclear experiments • Chemical analysis • Engineering problem solving • Medical analysis & monitoring • Training devices • Hospital information system • Supervisory control • Engineering instruction • Numerical control • Avionics checkout • Telemetry • Geophysical research • Traffic control • Simulation • Process control • Scientific experiments • Data acquisition • Nuclear experiments • Chemical analysis • Engineering problem solving • Medical analysis & monitoring • Training devices • Hospital information system • Supervisory control • Engineering instruction • Numerical control • Avionics checkout • Telemetry • Geophysical research • Traffic control • Simulation • Process control • Scientific experiments • Data acquisition • Nuclear experiments • Chemical analysis • Engineering problem solving

DATACRAFT

Datacraft machines are not computers for all reasons.

We make a line of computers for sophisticated applications where a high power-to-low cost ratio is critical. You will most often find Datacraft computers harnessed to scientific applications that require real-time control and complex calculations.

For such jobs you need Datacraft's raw number crunching capability. Jobs that demand floating point calculations. Jobs that are a breeze with hardware square root. Jobs that are just too big for a minicomputer...and too small for expensive large-scale computing systems. Datacraft created computers to bridge that gap.

The demands of this special market dictated the architecture of the Datacraft computer family.

For general purpose applications line printers or cardreaders transfer programmed data in and out as a matter of routine. But, for real-time applications...

You do need the very latest in I/O capability.

You do need the flexibility of Datacraft's priority interrupt system to meet the conditions of your individual application.

You do need our Disc Monitor System to control the prime application in real time while using the background for batch processing. That's why, for example, you will often find 24-bit Datacraft computers used in the nuclear data acquisition and simulation fields.

Do-it-yourself programming is necessary in your work. So we gave all Datacraft computers an optimum 24-bit word length to make them easier and less costly to program than 16-bit machines.

We spent four years to develop and prove our support software under field conditions. It is strongly oriented toward scientific problem solving. MACRO assemblers and diagnostics are provided with all machines. FORTRAN IV is just one of the languages available.

Datacraft's family of computers cost from $10,900 to $51,400. All are I/O and software compatible.

Now, you can make your own evaluation about which Datacraft computer is best for your application. Send for your FREE **Datacraft Discovery Kit** so you can prove to your own satisfaction the advantages of Datacraft computers.

DATACRAFT DISCOVERY KIT
Datacraft Corporation, Rm 201D
P.O. Box 23550,
Fort Lauderdale, Fla. 33307

Datacraft

CIRCLE 17 ON READER CARD

fering COM facilities management services.

Generally, they report, an ideal prospect for an in-house system is one generating from 300,000 to 500,000 pages of printouts a month and producing from 5 to 50 copies of it. Recently, suppliers have been offering "metered pricing" or "usage" plans, in which a user pays a base fee plus a percentage based on volume of use. This makes it feasible, they say, for a customer to turn to COM with as little as 175,000 pages of printout a month.

The most common way to justify the costs of installing a system — provided one is found to be needed — is to pitch it against the line printer. A unit of Hughes Aircraft, which recently installed a COM system under a facilities management contract with Data Copy, Inc., of San Francisco, matched the cost of its projected 1973 output of 9.6 million pages of printer output with microfiche and found that with COM the saving would be $.001 per page (see chart, p.166).

DatagraphiX has studied the costs of its customers and arrived at these figures for a typical user who prints 5,000 pages of data a day and sends five copies to branch offices: Mailing the paper printouts cost $120 a day (vs. 25¢ postage for microfiche cards); labor was $150 (vs. $12.50); and materials $44 (vs. $8).

Retrieval the thing

Cost figures, however, do not take in the most critical requirement for output that is put onto microfilm: its readability and the speed and efficiency with which it can be retrieved. Suppliers admit there is much to be done here, but add that film processing is not a new art. It's been around 60 years. Says one user: "It's a people problem. You're not going to get quality output with a $500-a-month operator."

The new art is retrieval. There are more than 30 manufacturers who make devices for viewing microfilm, and their products range widely in price, style, screen sizes, image magnification, and format handling capabilities. Prices go from a $75 viewer sold in large quantities by DatagraphiX to about $1,800 for units with retrieval equipment. One supplier, Extek Microsystems, Inc., of Los Angeles, has developed a viewer that reads uncut microfiche. Most microfiche viewers will handle only cut fiche that is mounted in carriers for retrieval purposes. This creates problems with jamming — the slightest curl in the fiche will do it. Extek says its system gets around the problem by using a "scroll" of uncut microfiche with up to 200,000 pages of data, backed up with a 16mm file containing updates to the scroll. When an operator accesses the master file, the terminal scans the update file at the same time and if a change has occurred in the master, the terminal automatically overrides the operator's instructions and displays the updated pages. It says the system increases retrieval speeds three times.

The number of companies making alphanumeric COM systems has dwindled in recent years to a handful, the front-runner still being DatagraphiX. Other major suppliers are Eastman Kodak, Memorex, Pertec, Seaco Computer Display (whose systems now are sold by Remington Rand), 3M Microfilm Products, Quantor Corp., Gould Data Systems, and California Computer Products. Also committed to the business are Singer-Link and Information Inter-

national, Inc., the latter with highly specialized equipment, much of it dedicated to the micropublishing business. Information International, which last year acquired RCA's Videocomp business, turned a $1.1 million loss in '71 to a $104,000 profit at the end of its '72 fiscal year last April.

Although users are showing a growing preference for 105mm microfiche recorders, Memorex Corp., devoted exclusively to producing 16mm roll film on cartridges, says its studies show 63% of the market uses 16mm. Without a COM sales manager for seven months until last May, Memorex was said by competitors to be demphasizing COM. A spokesman, noting that the company has some 200 installations, denies this, saying "we're going through a period of superemphasis."

And today, "superemphasis" seems to apply to all the other survivors of a data handling concept that until this year appeared to have come well before its time.

—Tom McCusker

Information Retrieval

All the News That Fits on Fiche

Thus far, the *New York Times* hasn't placed its automated information bank in the category of hot news or even in the category of the *Times'* slogan — "All The News That's Fit to Print." Indeed, the *Times'* information bank has been an embarrassment to the newspaper's management because the system, once touted as "the world's first fully automated general information system," has been something of a bomb.

The system has been gradually emasculated over the past several months and delayed from its initial start-up target date in 1970.

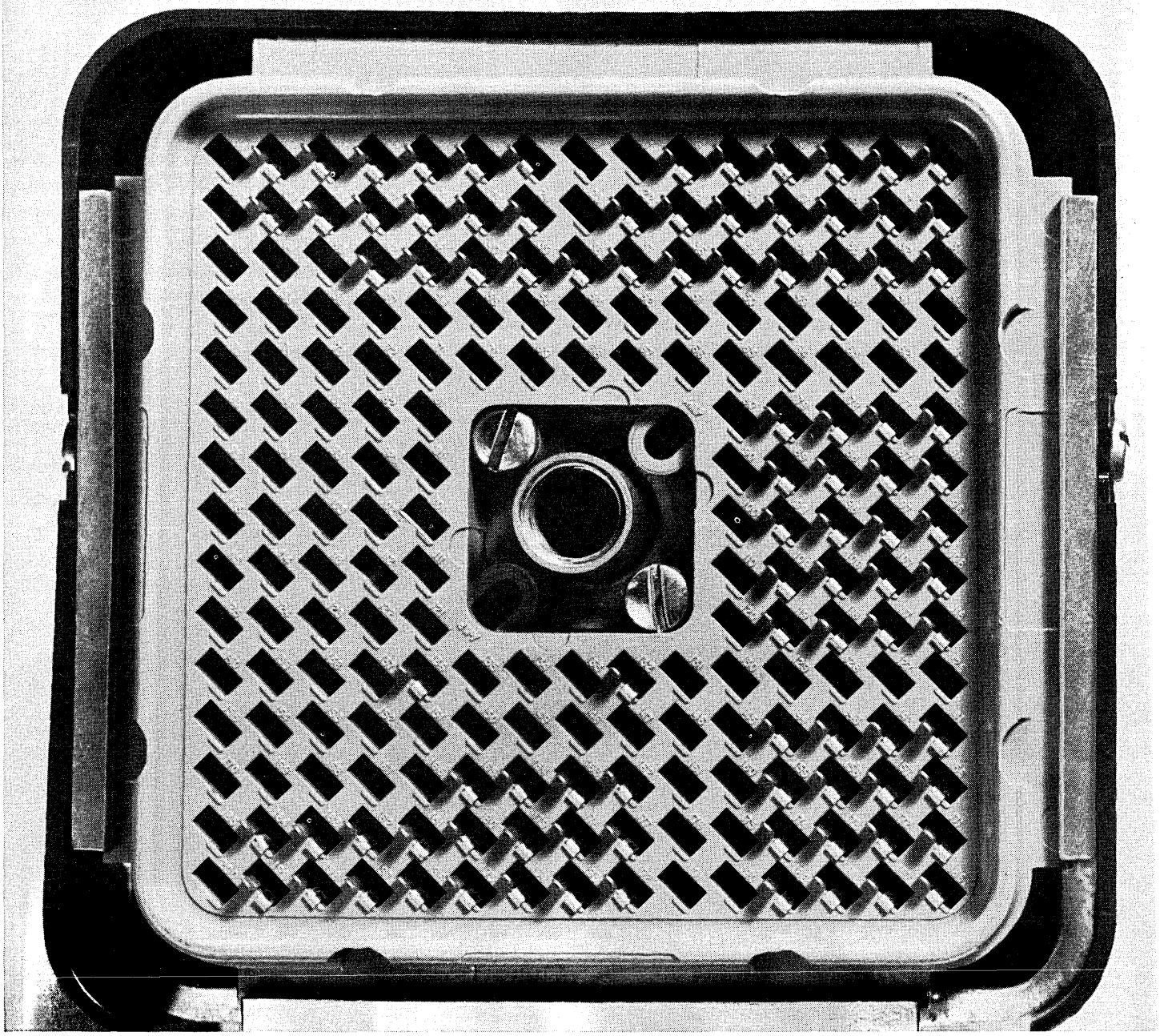
Suddenly, however, there is not only hope but optimism for the system, stunted that it is. The newspaper's famous index has been stored in a computer-controlled system, and if that portion of the system works as well as is hoped, the program offering the index and abstracts of several periodicals could become a big business for the *Times.*

The information bank's other major system — the one featuring full text display and printout of the newspaper's morgue — now uses a semi-automated approach. Initially, the *Times* had hoped to construct two computer-compatible data bases — one based on the index and the other based on the morgue — but this approach proved to be impossible when a myriad of problems developed.

"This whole system has been under way for several years now," said Jeffrey K. Pemberton, marketing manager, at the Information Industry Assn.'s national meeting last spring. "If we're successful, we'll become an information utility. Our ultimate goal is to make it available to anyone with a research task."

The abstracting system is currently on-line at the *Times'* headquarters in New York City, and more than 60 terminals — IBM 4506s — in the building are in use. The editorial staff — which has been grumbling about the automated program — has been trained in its use. In addition, two Incoterm terminals have been installed in the newspaper's Washington bureau, and a member of

Plug in the engineering peripheral leader. TELEX.



excellence of the

ENGINEERING EXCELLENCE in the peripheral industry is the intangible result of pressing the "state of the art" continuously through engineering competence and commitment.

Every time you plug in a TELEX Peripheral Subsystem of Tape, Disk and Printer, and a TELEX Memory, our reputation in the peripheral industry goes "on line." At TELEX we feel the maintenance of a flawless image requires a total dedication to technical excellence.

Remember, there is no monopoly on talent. The TELEX Engineering Staff has set out to prove they have the technical depth and skill necessary to anticipate your requirements in peripheral hardware. And as a result, they have dramatically influenced the direction in which the "state of the art" is moving.

In engineering excellence, the product is a good one if the "price valve" is turned down for the customer. It's a better product if the "performance valve" is turned up and improves his system's through-put. The best product does both—price/performance—while giving the user an exclusive functional capability.

No, engineering excellence is not related to the size of an organization . . . but rather to a sincere dedication and desire to excel by offering the best products that can humanly be achieved. This, at TELEX, is engineering excellence.

Join the hundreds of TELEX users who have found "the deeds are equal to the words." Call your TELEX representative today. Or call or write . . .

where the difference begins

TELEX®

the Preferred PERIPHERAL COMPANY

TELEX COMPUTER PRODUCTS, INC.
6422 East 41st Street • Tulsa, Oklahoma 74135 • (918) 627-1111

TELEX, LTD.
101 Duncan Mill • Don Mills, Ontario, Canada • (416) 445-8050

TELEX EUROPEAN GROUP
213 Oxford Street • London WIR-1AH, England • 01 734-9131
Paris • Frankfurt • Zurich

the information bank staff said the bureau was expected to go on-line soon.

"We have 10 outside customers," the official said. "And all 10 have budgeted for the system. We've limited the number of customers largely because we think we should examine our remote communications capability. We want to make sure it works properly before we make it available to large numbers of customers."

The abstracting system currently consists of the *Times'* index for the past three years. The newspaper will keep the system current — that is, it will add the *Times'* index week by week — and will gradually catch up with past indexes, adding them to the data base. In addition, the newspaper is abstracting some 60 periodicals for inclusion in the system.

Wait for developments

As described by the *Times,* the system appears to be extremely fast, powerful, and flexible. A user types in a subject, and the system — which has a cross-searching capability — can provide the user with the abstracts he seeks immediately on the crt. Things haven't gone as smoothly with the information bank's full-text system. The key problem here was that the company doing much of the key hardware — Foto-Mem, of Natick, Mass. — went into bankruptcy after gaining a brief renown for producing soaring stock prices and products that never quite worked. Foto-Mem's RISAR — a computer-compatible microfiche storage and retrieval device — was the hardware heart of the full-text system, but Foto-Mem couldn't get the system up before going out of business. The RISAR has been largely dismantled, and, as far as visual storage is concerned, the *Times* will probably have to wait for new developments in visual storage state of the art before the full text system can be automated.

The current plan is to utilize a combined automatic-manual system in which the fiche is pulled out by hand and placed before a television camera. Outside customers will receive their own microfiche sets which will be updated at the cost of $75 a month. Customers will use their own microfilm viewers. A typical copy of the daily *New York Times,* can be stored on one 99-frame fiche card.

IBM came to the rescue of the full-text system and has helped devise the makeshift system replacing, among other devices, a Foto-Mem minicomputer with a System/7. The entire information bank system was initially designed to run on a 360/50, but the plan now is for operation on 370/145 when it is installed.

Detailed plans and specifications of the information bank were not available — at least partially because of the rapid and frequent changes in the system — but a recent issue of the *IBM Systems Journal* stated that most of the indexing and abstracting data has been stored on 2314 and 2311 discs. It is expected that the indexing and abstracting data base system will be stored on 3330s when the 145 is delivered. It is understood that the *Times* does not plan to digitize the full-text system, but, as already noted, will likely utilize automated visual storage methods if and when they become available.

Manual drawback

The *Times'* inability to computerize the full-text system has raised some doubts about the whole information bank idea, something like announcing a new high-performance racing car with power supplied by midgets furiously pumping pedals under the hood. Operators must pull the desired fiche out by hand and place it before a television camera which transmits the image to the crt. At any rate, the newspaper thinks that 80% of its information bank inquiries can be satisfied by the on-line indexing system, which means that just 20% of the inquiries are likely to use the full-text system.

Who will be the information bank's first customer? The system's largest initial user, of course, will remain the newspaper itself. Other early customers are expected to be large multinational corporations, governmental agencies, and other members of the media.

The *Times* is figuring on a flat rate monthly charge of $1600 to $1800, which would include the crt and printer and unlimited use of the system. The newspaper has never revealed what it has cost to date for the information bank — one *Times* man working on the system said there is no way of breaking out the precise cost. Knowledgeable observers of information retrieval systems estimate that the newspaper has already spent a few million dollars. Some estimates go as high as $10 million.

Although other information retrieval systems are in use in universities and in governmental agencies, the *Times'* system is by far the most ambitious undertaking in the field thus far. Since the venture is really a pioneering effort as far as a commercially available system is concerned, the verdict on "the world's first fully automated general information system" probably won't be in for several months.

—W. David Gardner

Environment

A Data Bank on the Environment

Congress enacted legislation establishing a national environmental data system last month and sent it to the President.

Basically, the system will be a central repository of environmental information, designed to help federal, state, and local governments develop policy. "Other entities and persons," including academic institutions, will also have access.

The legislation, HR 56, earmarks a total $6 million over a three-year period beginning with FY'73 to establish and operate the data system. First, current information technology will be studied in the hope of finding ideas that can be used by the system's architects. It hasn't yet been decided whether to do this study in-house or by contract.

The Council on Environmental Quality will run the new system through a Presidentially appointed director. He is authorized to provide a number of incentives to users of the data bank, including "exchange of information, sharing of facilities, specialized advice, programs and formats . . ."

Under a separate appropriation, HR 56 also authorizes establishment of state and regional environmental centers, to be located at educational institutions and private or public foundations. Each center will engage in research, investigations, experiments, demonstration of applied technology, professional training, education extension, "and other such purposes." The center is also permitted to make grants, let contracts, and fund — on a matching basis — work performed by outside organizations, including "private firms and individuals." Information and data are explicitly mentioned as one of the "aspects of environmental problems" for which the centers can provide professional training. The education ex-

"SOFTWARE. SERVICE. SYSTEMS SUPPORT. THAT'S WHAT WE NEED WITH A COM."

A COM unit can put your computer tape data on microfilm at fantastic speed, with big savings in paper costs, too.

But even the best COM system is only as good as the manufacturer's backup support. And when you're using a Kodak KOM-80 or KOM-90 microfilmer, it's nice to know that you have Kodak's full resources in software, service, and systems support to call upon.

Want to hear the full story? We're ready for you there, too. Just send in the coupon.

You get it all with a Kodak computer output microfilmer.

Please send me full details on Kodak KOM microfilmers and backup support.

Name_____

Position_____

Company_____

Address_____

City_____ State_____ Zip_____

Eastman Kodak Company
Business Systems Markets Division
Dept DP-916, Rochester, N.Y. 14650

For better information management

Kodak Microfilm Systems

Kodak

tension program of each center must include "reference services to facilitate the rapid identification, acquisition, retrieval, dissemination, and use of environmental information."

The bill authorizes $17 million for the first fiscal year's operation of the environmental center program, $28.9 million for the second year, and $34 million for each succeeding year.

Benchmarks

System Suit Settled: Trans World Airlines came off best in the settlement of its year-old $70 million damage suit against Burroughs Corp. and an $11.5 million countersuit brought by the computer firm. It was all over a massive reservations and management information system TWA chose Burroughs to build six years ago (see Dec. 1, 1970, p. 47). TWA charged Burroughs with misrepresentations and breach of warranties and contract. Burroughs sued for money not paid to it under the contract. Under the settlement, Burroughs assumes — as of June 30, 1972 — all of TWA's rights and obligations under an eight-year lease-back contract with CIT Corp. for the major components for the system. The computer company also is purchasing for $1 million TWA's leasehold interest in a facility housing the system equipment and will purchase software from TWA for $2 million. Burroughs released TWA from the $11.5 million of accounts payable it had claimed, and TWA will return purchased equipment represented by this sum.

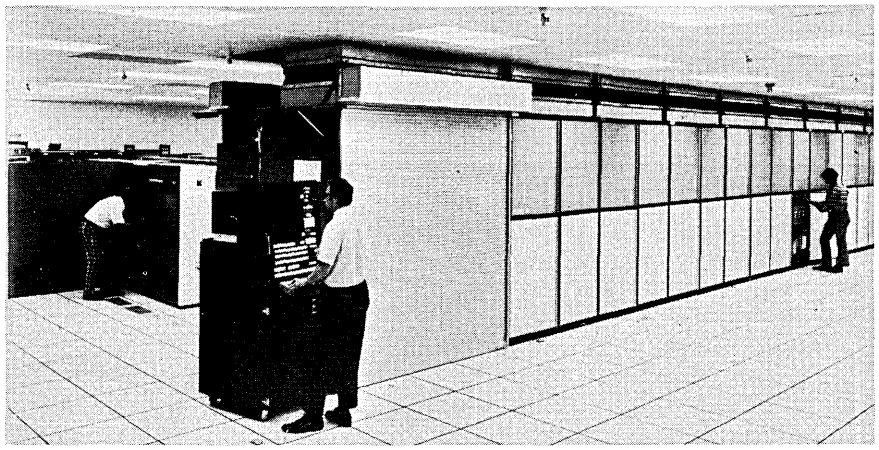
Finally: Computer Sciences Corp., which has been working on New York City's off-track betting system almost since its inception without a contract, now has one. It replaces a letter of agreement dated Oct. 29, 1971, and provides for a cash payment of $2.7 million for development of the system plus a transaction charge ranging from one-third to two-thirds of a cent per transaction depending upon the total number of transactions processed and on the number of betting terminals installed. The transaction charge will be levied on all transactions processed between July 1, 1972, and June 30, 1974. The CSC system currently is operational, with 476 terminals installed in 77 betting parlors.

Infonet's Biggest: The federal government's General Services Administration started using a data and telecommunications service on Computer Sciences Corp.'s Infonet network. GSA looks to the service to save the government some $35 million in direct computer costs over the next four years. Computer Sciences won the GSA contract last March (see May, p. 126). It is valued at $43 million over a four-year period and is the biggest for Infonet to date.

Proliferating Profits: Computer mainframe manufacturing was profitable in the third quarter of 1972 and so, evidently, was the absence of same. IBM, Burroughs, and Control Data reported higher earnings than a year earlier; and so did RCA, whose third quarter '71 earnings of $28.5 million reflected a $9.6 million loss from computer operations. Without these the company earned $37.1 million in the third quarter of '72. IBM's third quarter earnings this year were $320,936,154, up from $266,917,631. Burroughs' profit of $16,384,000 in the quarter ended Sept. 30 compared to $12,677,000 in the same '71 period, and Control Data earned $3.6 million from its computer business in this year's third quarter, against a loss of $10.7 million in 1971.

Control Data's total earnings, including Commercial Credit Co., were $16,655,000 for the current period, up from $337,000 in 1971. Xerox, with an 18.5% gain in third quarter profits, reported a "modest" rise in computer revenue.

Executive Shifts: California Computer Products has made some executive changes in line with its contemplated consolidation with Century Data Systems, Inc., a 94% owned subsidiary, and its planned tender offer to acquire the remaining 6% of Century Data. George M. Canova, Century Data president, was elected executive vice president of CalComp, responsible for overall operations. Reporting to him will be James Payton, executive vice president of Century Data and a newly elected senior vice president of CalComp; Charles Sword, senior vice president in charge of consolidated administration functions; Gene W. Beckman, senior vice president, finance; and Dr. Richard Tanaka, senior vice president responsible for engineering, software development, and manufacturing of graphic products.



ILLIAC IV, the mammoth computer system, is expected to become operational next summer at NASA's Ames Research Center in Mountain View, Calif., where it recently was assembled by Burroughs Corp. Dr. Melvin Pirtle, chief of the Institute for Advanced Computation at Ames, said it is undergoing on-site testing, may be operational in the summer, but it will be "a long time before we have a complete operational mode." Illiac IV uses 64 processors that can execute up to 200 million instructions per second working in parallel. It was conceived six years ago at the Univ. of Illinois and built by Burroughs Defense, Space and Special Systems Group in Paoli, Pa.

Communications Goals: Today's data communications systems were compared to erector sets with every nut, bolt, and cross beam supplied by a different vendor, by Arthur E. Lemay, vice president of Trans Union Systems Corp. in a keynote speech before the first convention of the Communication Systems Management Assn. Lemay said three areas need improvement if data communication is to reach the maturity achieved by today's computers. His must do's: provide a faster, more reliable service; solve the coordination problem caused by multiple vendors who provide interface equipment; and establish an alternate route system to protect from prolonged outages. □

CORRECTION: In the October issue, p. 52, two file management systems were listed with the wrong supplier. Model 204 and IFAM are available from Computer Corp. of America, 565 Technology Square, Cambridge, Mass. 02139.

If he's not one of our computer salesmen, that's the one thing he probably won't bring up.

Because he probably can't bring anybody over to do it for you.

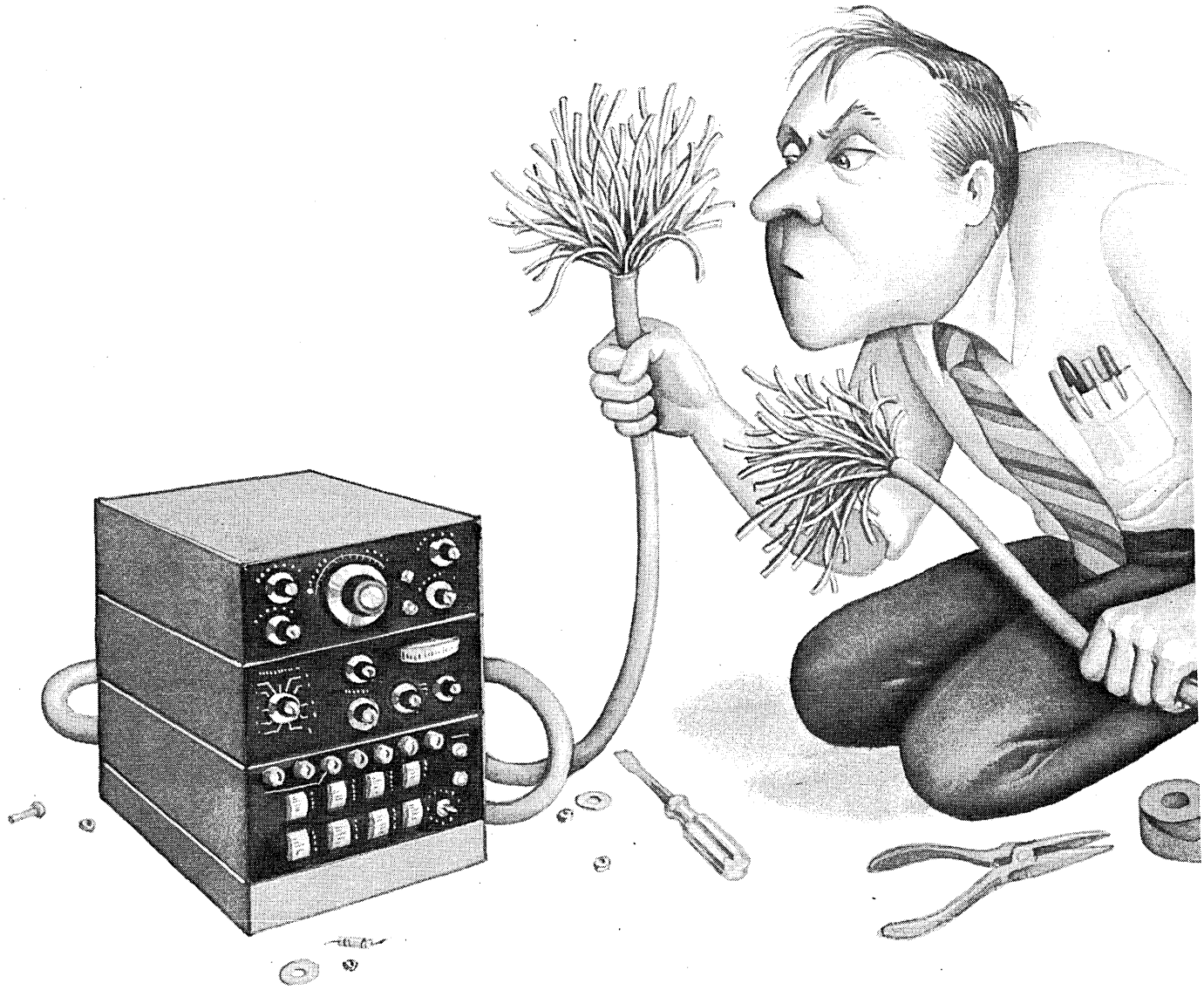
But we can.

And we will.

And we'll bring over all the modules (including special modules), labs, wire wrap service, cabinets, hardware, assembled logic arrays, terminals and technicians it takes to do the job.

For us it's easy, because our Logic Products Group makes it all themselves, or gets what they need from one of our other groups, so it all fits together when it gets there.

When you buy a computer the hooker in the deal can be "Who's going to hook it up?"

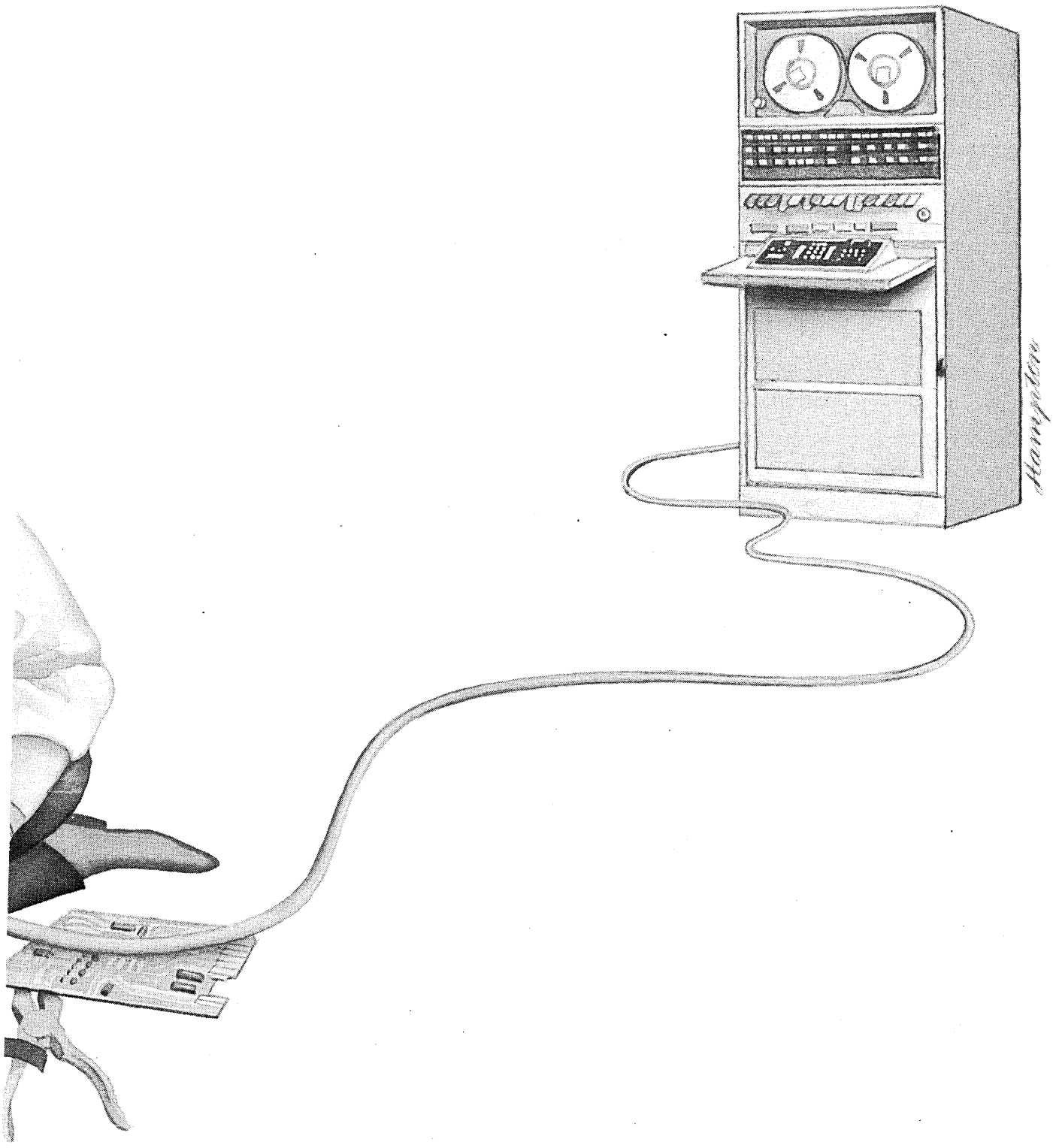


We can do it because we've had, we've got, and we keep getting the kind of designers, engineers and logic people it takes to make and market more kinds of computers, and everything it takes to make a computer work right, right from the start, than any other computer company in the world.

We're the Logic Products Group, Digital Equipment Corporation, Maynard, Massachusetts 01754/(617)897-5111 (Ext: 2785) in the U.S.

81 route de l'Aire, 1211 Geneva 26/(022) 42 79 50 in Europe.

digital



Hardware

Hardware Notes . . .

For additional new products being introduced this month, please refer to the FJCC Product Preview section starting on page 104 of this issue.

"Will somebody please turn off the bubble machine" might be a supervisor's request at Bell Labs now that a minicomputer has been installed to help control bubble size. To make magnetic bubble memories work, it's necessary to have uniformly "tiny bubbles" (typically .0015 inch). Up to now, skilled technicians had to monitor gadolinium garnets during their 20-30 hour growth cycle, with limited success. In the automatic system, the mini is attached to a digital scale which weighs the molten crystal material in a furnace. This information is then used to adjust the temperature in the oven. We'll try to make this the last mention of Bell's bubbles troubles until it uses them in one of its own products, or offers to license the technology to others.

NCR has recently produced its 10 millionth business machine; appropriately, it's a model 280 retail terminal that can trace its descent back to the company's first product. We recently erred in describing one of those 10 million, an ocr line printer (Sept., p. 148). In the ocr mode it prints ocr numerics at 1,500 lpm. If alphanumeric information or ocr separators are in the same print line, the speed is 750 lpm. When switched to the non-ocr mode, the print speeds are 3,000 lpm for numeric information and 1,500 for alphanumeric. Two passes are not required to print both ocr and alphanumeric documents by the printer, which NCR states can be attached to the Century 100, 101, and 300 series in addition to the 200 series.

When a mechanic mentions trap speeds in the Ferrari racing team's pit from now on, he may not be referring to how fast the car is going, but rather how the DEC PDP-8L mini is performing. In addition to providing more accurate timing of its cars, the 4K mini's tty can list out the number of laps completed, the time it took to complete the last lap, and the distances behind the leader for up to nine cars. Ferrari even thinks the mini may help win some long endurance races for them. In the past, races have been lost when cars were not brought in for fuel before running out of gas, because inaccurate lap charts were kept.

The IBM 370 Model 125

New architectures are often shown first in a manufacturer's small machines. IBM did this with the 360/25, the machine that anticipated the 370's integrated adapters, monolithic semiconductor logic, and reloadable control store. IBM is doing it again with the 370/125.

The 125 consists of a main storage element surrounded by a variable number of "satellite" subprocessors. There is no central processor as such, except that one of the satellites can be thought of that way. Each of the subprocessors has its own control store, its

own access to main memory, and its own reason for being. All operate simultaneously and independently.

Four satellites are standard, including the Instruction Processor, the Main Storage Controller, the Service Processor, and an Input Output Processor. The purposes of the first two are evident in their names. The Service Processor supports the crt console, with its "diskette" replacement for a floppy disc, and has microcode for recording system errors. The I/O Processor is there to support the two- to four-pack 3330 disc system. It is standard because the 125 is a disc-oriented machine which runs only under DOS or DOS/VS.

Up to three more Input Output Processors can be added, each to support different kinds of I/O. One can support a single model 1403 printer plus some card equipment. Another is for communications lines. The last is for interfacing a 25KB byte multiplexor channel—which is the only channel offered for the 125, and which is an option.

Two things are important about the IOPs. First, they do not replace the integrated adapters for discs, printers, and communications lines; the adapters attach to them. Second, they are special-purpose processors for particular peripherals. For example, no attachment is provided for 2311 or 2314 discs. Oddly, one optional integrated peripheral adapter doesn't require an IOP, the one for the 3410/3411 mag tape systems.

Except for the Instruction Processor, the satellites have from 4K to 8K 22-bit words of reloadable control store. The Instruction Processor comes with 12K words and can have either 16K or 20K optionally. Multiple Instruction Processors, Main Storage Controllers, or Service Processors are not allowed, at least not on this machine. However, since we know that the IOPs can be field-installed, we can assume that the internal constructions of the other satellites are also modular. This leads us to expect that later IBM computers, the 380 series perhaps, might be able to have at least multiple field-installable Instruction Processors, or even pin-compatible replacement processors for upgrades.

In price and internal performance the 125 is roughly equivalent to two-thirds of a 370/135. IBM compared it with a 360/25, saying it was roughly 2 to 4.5 times as fast internally for commercial applications. That might make it from 1 to 3 times as fast as a 360/30 in commercial work; but again these are only rough estimates, and the numbers cannot be applied to throughput either.

Like the 135, and like other 370s, the 125 has 16 g-p registers 32 bits long, 16 control registers 32 bits long, and a free-option of 4 floating-point registers 64 bits long. It is upwards compatible with the 370s and, except for its optional 96-column card equipment, does not seem to be a transition step for System/3 users.

Cycle times for the processors are 480 nsec. (A fixed-point inter-register add takes about 4.8 usec.) Memory reads and writes take 960 nsec for two bytes.

The 125 gets somewhat better communications capabilities than the 135 does. Its communications processor can handle 16 asynchronous lines from 45.5 bps to 600 bps plus 6 full- or half-duplex synchronous lines from 600 to 50,000 bps. The 135 could only handle eight lines altogether. Either machine can take the 3705 communications front-end.

A few peripherals have been added

to the mix. One is the 3504 card reader. Like the functionally equivalent older 3505, it has selective input hoppers that allow the operator to get a little ahead. An 800-cpm version is available for $20,000 or $470/month; the 1,200-cpm version goes for $21,000 or $570/month.

The second new peripheral is the 5425 multifunction card unit for 96-column cards. In one version it reads at 250 cpm, punches at 60 cpm, and prints up to four lines on the top of the cards at up to 60 cpm. That model runs $18,000 or $570/month. The faster version goes twice the speed for $22,000 or $740/month. (We aren't quite sure how IBM figures purchase-to-lease ratios. The $570/month card reader costs $3000 more to buy than the $570/month multifunction unit. The latter must be on special.)

Also new is the single-spindle version of the 3330 disc drive, which leases for $770/month or sells for $31,000. Previously only multiples of two spindles were available on IBM 3330 systems.

The 125 is offered in two basic versions depending on the choice of main storage size, either 96K or 128K. The smaller mainframe runs $4775/month or $231,600 if you want to keep it forever. The figures for the larger are $4975 and $241,300. Maintenance on the two runs $290 and $295, respectively.

A minimum usable configuration (with either a 360/20 or 1400 series emulator, the slower 96-column card unit, a two-spindle disc drive, and a 600-lpm 1403) would lease for $8207/month and sell for $377,815.

Available for April 1973 shipments, the 125 may be seen replacing anything up to the size of a 360/40 that has not already been replaced by a 135. We expect it to be popular, but its prime importance is as a signal of what lies ahead on IBM's production lines. IBM, White Plains, N.Y. For information:

CIRCLE 219 ON READER CARD

Mini End-user Mtu's

Minicomputers have proliferated to the extent that manufacturers who have concentrated on the oem market have come to realize that the potential for really large quantity orders comes from the user market. This company is a good case in point, as it has decided to supply tape drives to users of PDP-8, 9, 11, and 15; all the Data General product line; the Varian 620/i; the Hewlett-Packard 2100 series; and Honeywell 316 computers—up to and including a turnkey installation.

The tape drive is a new model called the PI-1400, interesting for several reasons. A double-casting design was chosen, with the single capstan and its motor and the head stack on one casting, and the frame casting separate. The purpose was to isolate the drive from shock and mounting stresses. The drive speeds offered are 12.5, 25, 37.5, and 45 ips, with a choice of 7-track 200-, 556-, or 800-bpi NRZI or 1600-bpi 9-track phase-encoded recording. Up to four of these drives attach directly to the data formatter/controller. The system described sells for approximately $8K. Options such as a buffer and analog/digital conversion can up the price to approximately $14K. PRECISION INSTRUMENT CO., Palo Alto, Calif. For information:

CIRCLE 222 ON READER CARD

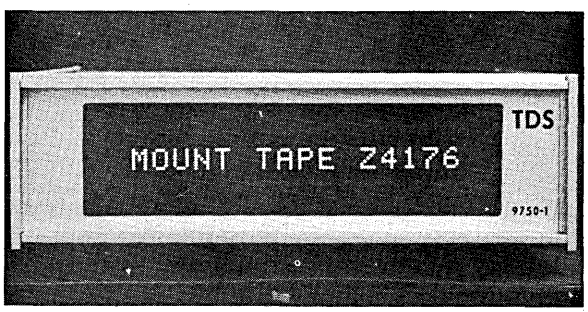
Commo Front End

Univac has come up with a plug-compatible alternative to the recently announced IBM 3705 telecommunications controller. Probably never before has the company made such an overt move to replace IBM peripherals, and it might liven things up for 360 and 370 communications users.

The 3760 is based on one of Univac's regular computers. (Curiously, it wouldn't tell us which one, but it would appear to be the 1616 announced last year. See Dec. 1, p. 55.) The instruction set has been augmented to better adapt to communications line juggling. With a 750-nsec time, 32 general-purpose registers, and from 8-64K 16-bit words, the claim of 10,000 characters per second actual throughput seems reasonable. The controller performs line control, character checking, buffering, polling, and automatic answering for up to 192 full-duplex or 384 half-duplex lines.

Another intent of the 3760 is to replace some of the devices that communicate with 360s and 370s through the IBM 3705, 2701, and 2703 controllers. Initial software releases will support the UNISCOPE 100 crt display terminal, the DCT teleprinter terminal, and the DCT 1000 remote batch terminal. Played down, but also present, is

product spotlight



Operations Displays

Nearly all the products introduced during the last two years have been accompanied by loud claims of efficiency. More efficient software, more efficient hardware—even more efficient hardware and software to monitor how efficient other hardware or software is, or isn't. But one area of the dp function that has been virtually overlooked is the operations aspect. The most efficient peripherals and the cleanest software ever written can still net a cpu meter resting at "O" if the operators can't supply the required special printing forms, tape, and disc files to the proper devices as fast as possible. That is the problem this small Texas firm has tackled, and the solution is logical, simple to install, and what little money it does cost may very well find its way back into user pockets in the form of fewer reruns and better cpu utilization.

The INFORMERS consists of a group of small plasma displays (Burroughs') that can be placed on top of tape and disc drives, and printers. A controller, cooperating with a software module supplied, and looking like another peripheral device to the computer, issues mount messages to these display units. There is a choice of 16 or 32 character displays, and once the messages are issued, the displays do not require refreshing. There are two controllers available for directing up to 32 and up to 64 displays, respectively, and displays can be remotely located from the computer site.

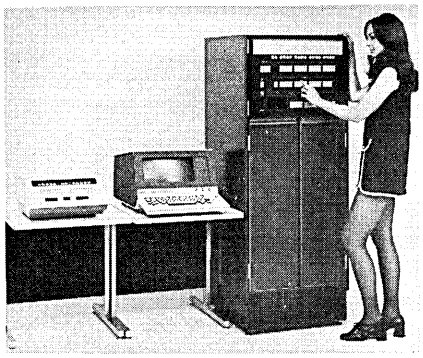
Complete interfaces are available for the Hewlett-Packard 2114 and the Data General Corp. Nova series for process control applications. But the primary market for the 9700 series would seem to be large 360 and 370 OS/HASP installations, and such a system is up and running at Texas A&M Univ. A typical installation consisting of the controller, 10 display units, all cables, and software for local 360 and 370 peripherals is priced at only $5,100. The company is willing to work with non-IBM installations on other interfaces. TEXAS DIGITAL SYSTEMS, INC., Bryan, Texas. For information:

CIRCLE 221 ON READER CARD

software support for IBM and Teletype peripherals, and for mixes of peripherals from the three vendors.

Software packages are being developed to provide network management and control capabilities such as message block processing, error recovery, network control procedures, network statistics, message switching, and store-and-forward operations.

Also planned for the 3760 is a console terminal with magnetic tape cas-



settes for loading programs. The display will be used for monitoring system performance, on-line diagnostic tests, and for changing program parameters in the 3760 memory.

A starting configuration, consisting of the console, 16K cpu, software support for any number (up to 384) of a particular terminal type, real-time clock, three channels for peripheral attachment, and 360/370 channel interface, rents for $1213/month on a one-year lease, including maintenance. First deliveries are scheduled for January. UNIVAC, Blue Bell, Pa. For information:

CIRCLE 220 ON READER CARD

Key-to-tape Data Entry

The Mini-Key is designed to fill the gap between the buffered keypunch and large shared-processor data entry systems. The basic $640/month Mini-Key has four keystations connected to a central storage unit capable of recording data in 7- or 9-track formats.

Each keystation—which can operate independently—has a 256-character crt; either of two keyboard configurations; a dual-cartridge storage unit that can store a full day's work; and a microprocessor for editing, formatting, verification, and control of data. The units have electronic keystroking speeds; variable-length records; sight verification and correction capabilities; unlimited formatting features; extensive operator assistance aids; automatic skipping, paging, and duplicating; and random record search, insertion, and deletion.

The system can be upgraded by substituting the vendor's System/4 desktop computer for expansion of data entry into true source data validation techniques or for operation as a remote batch or on-line terminal, off-line printer, or a small dp system.

The Mini-Key system is being offered in the Northeast only for delivery in the fourth quarter. Maintenance, training, and software support are provided by the vendor. KEANE ASSOCIATES, INC., Wellesley Hills, Mass. For information:

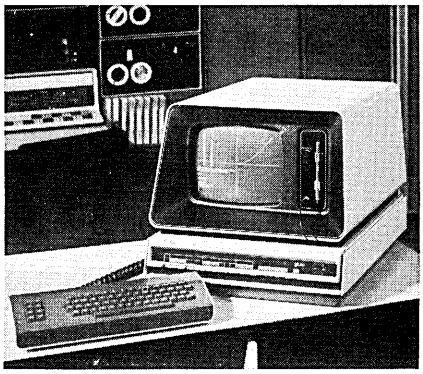
CIRCLE 224 ON READER CARD

Graphics Terminal

By combining a specially designed display processor, a 12-inch diagonal crt, and one of its own PDP-11/10 minicomputers with 4K of memory, Digital Equipment Corp. has come up with a high-speed graphics terminal for on- and off-line applications for less than $11K. The GT40's $10,900 price also includes a light pen, a 96-character ASCII keyboard/character set, a serial communications interface, and 31 mathematical and scientific symbols.

The heart of the GT40 is the display processor unit (DPU). Its purpose is to perform such functions as selective blinking, character (6x8 dot matrix) and vector (26 usec/inch) generation. Information is displayed with 10-bit resolution (1024 x 1024 addressable points) precise enough to allow overprinting. Up to 31 lines of 80 characters of text can be displayed. There are eight display intensity levels and seven programming modes, including character, long vector, short vector, point, relative point, and X and Y axis graph/plot.

The GT40's communications controller allows asynchronous communi-



cation with the host computer at switch-selectable speeds up to 9600 baud, with current loop (tty), EIA, or data set electronics also offered. If the 40 user wishes to develop a very sophisticated graphics capability, a broad selection of peripherals is available for attachment to the PDP-11, and the memory of the mini can be increased beyond the basic 4K ration.

If the GT40 has any weakness, it's the fact that there isn't much in the way of applications software ready to accompany it to its first installations this month. But DEC is sure to release such software in the future. In the meantime, the low price will appeal to users in such areas as engineering, architecture, research, and design who probably want to write their own programs anyway. DIGITAL EQUIPMENT CORP., Maynard, Mass. For information:

CIRCLE 223 ON READER CARD

Honeywell Computers

Two complete computer systems have been added to the HIS 2000 product line, and the small-scale model 58 has been considerably enhanced through hardware and software additions.

The 2040A and 2050A are disc-oriented medium-scale computers that will be primarily pitched to installations that purchased 200 series systems in past years. Both new models are for purchase only, with the 200 user offered a trade-in allowance, negotiated with the local sales office.

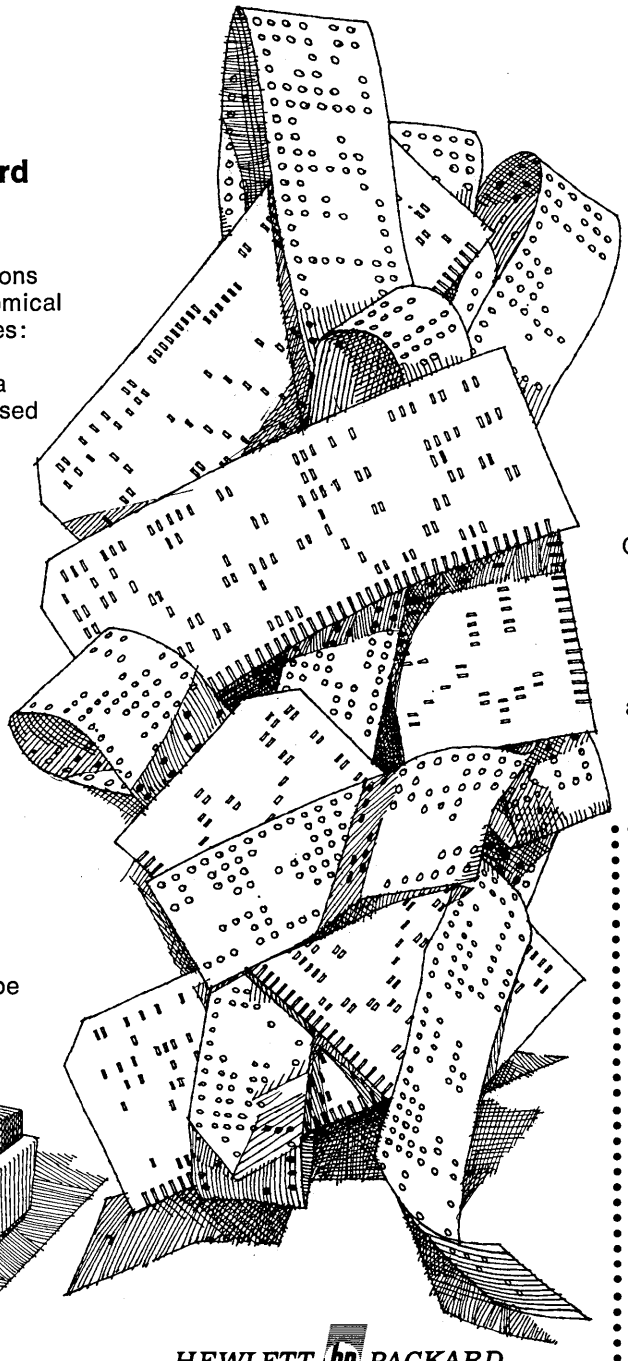
The 2040A in stock form comes with 64K characters of 3 usec memory, expandable to 512K. The cpu fetches two characters (equivalent to two bytes) each access. The standard channel arrangement is 32 addressable devices and an aggregate data rate of one million cps. As computing requirements increase, the 2040A can be upgraded in the field to 2 or 1 usec cycle times, and the channel complement can be expanded to 16 simultaneous I/O operations on 16 channels, 48 peripheral addresses, and a 1.5 megabyte aggregate data rate. A minimum configuration consists of a 64K cpu, reader/punch, 650 lpm printer, three tape drives, and a 36 megabyte disc subsystem. It's priced at $335,000.

The 2050A starts with 128K bytes of 3 usec memory, also expandable to 512K. The 2050's cpu fetches four bytes per access. The memory/cpu performance can also be upgraded to 2 usec or 1 usec performance. Like the 2040A, the 2050's cpu/memory can also be upgraded to 2 or 1 usec operation, but the minimum channel configuration on this system is the largest channel available on the 2040. The 2050 can be field expanded up to 80 addressable peripherals and an aggregate data rate of 2.5 megabytes. A 192K system, card reader/punch, 1100 lpm printer, console, five tape drives, and 128 megabytes of disc storage is priced at $595,000. Delivery on both systems is immediate.

Among the more important enhancements added to the model 58 are communications ability that allows it

There's a hole in your data entry/input system.

Or didn't you know?

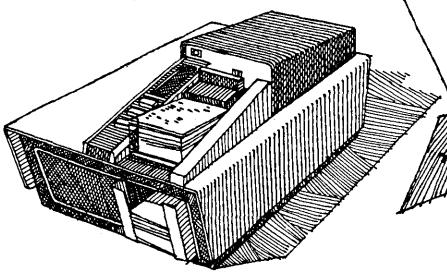


Get your data out of the hole... use one card to do the work of two.

Now you can bypass time consuming keypunch operations with the simplest, most economical of all data entry/input devices: pencil and paper. Start by sketching us your ideas for a tab-sized card that can be used as a data entry form. Keep in mind that once the form is marked in pencil it's going to be used as a data input card, too. That's because the marked card will be read by Hewlett-Packard's Optical Mark Reader, and the data fed continuously, or on demand, into your computer. Quickly and quietly. Local or remote.

A custom card design will leave some punch in your system

We'll study your sketch, then help you get it converted into finished cards. If you like, repetitive data or codes can be pre-punched. The Reader senses holes as well as soft-lead pencil marks.



She's better looking and tries hard, but...

she can't match our desk-top Optical Mark Reader for accuracy, reliability and economy. And if it's not just right for your specific application, we'll customize it. To get a data sheet use the coupon. You may even want to attach an entry-input card sketch.

Hewlett-Packard, Palo Alto, California 94304; Europe: Box 85, CH-1217 Meyrin 2, Geneva, Switzerland; Japan: YHP, 1-59-1, Yoyogi, Shibuya-Ku, Tokyo, 151.

112-04

Send the hole story

Hewlett-Packard, 1601 California Avenue
Palo Alto, California 94304

NAME

TITLE

COMPANY

ADDRESS

CITY

STATE ZIP

☐ My card sketch is attached.

HEWLETT hp PACKARD

Everyone can use an H-P Optical Mark Reader

to talk to most of the larger HIS computer lines, and also in binary synchronous mode to 360 and 370 models, for $236/month on a one-year lease. Also added were the PRT 112 line printer, offered in speeds of 300, 450, and 650 lpm ($675, $835, and $1,055 per month, respectively); a full COBOL compiler for systems with more than 10K bytes that meets both the ANSI and European AFNOR standards (no charge); a MOS extended memory up to 64K bytes in a four-level hierarchy (first 8K $236 per month, each additional 8K $150/month); two additional disc pack drives, doubling the current storage capacity to 23 megabytes (each unit $416/month); and finally a field change to up the current 58 card reader's speed from 100 or 200 cpm to 300 cpm ($86/month). HONEYWELL INFORMATION SYSTEMS, Waltham, Mass. For information:
CIRCLE 225 ON READER CARD

Oem Card Readers

Two card readers that read both punched and mark-sense information photoelectrically have just been announced by Mohawk Data Sciences Corp. The model 6028 reads IBM format 80-column punched and 27 pencil-marked columns and the 6029 reads cards with a preprinted timing track: 80 columns for either punched or pencil-marked information. The units can read the cards face down or face up at a rate of 225 or 400 cpm in bit-parallel, card-image format, with the desired read rate specified at the time of order. A control panel indicates invalid data, picking failure, motion error, and current error. In orders of 50, the 6028 is priced at $2900 each, and the model 6029 at $2780. MOHAWK DATA SCIENCES CORP., King of Prussia, Pa. For information:
CIRCLE 226 ON READER CARD

Remote Batch Terminals

Add the model 1550/2780 to the list of candidates seeking to unplug the incumbent IBM 2780 model 1 from office. Included in the 1550/2780 is a 4K minicomputer controller, an operator's console and work table, 300-cpm card reader, 250-lpm line printer, and interface for 2000-baud (dial-up) or 2400 baud (leased line) communications. Among the other attributes of the contender are EBCDIC transparency, autoanswering for dial-up lines, multipoint operation, multiple-record transmission, and off-line card-to-print capability. The one-year lease rate for the 1550/2780 is $650/month, including maintenance, personal property taxes, and insurance. The purchase price is $23,500, with units available 90 days aro. WESTINGHOUSE ELECTRIC CORP., Pittsburgh, Pa. For information:
CIRCLE 228 ON READER CARD

Mini Memories

Two add-on memory configurations are offered for Digital Equipment PDP-11 and Varian 620 computers by this independent vendor at prices substantially under similar units offered by the respective manufacturers. The MiniCage can be expanded up to 24K 16-bit words in 8K increments for either system, and the VertiCage can go up to 72K. The 8K increments are approximately $4K, including power supply and cabling. Units are available for 60-day delivery. CAMBRIDGE MEMORIES INC., Newton, Mass. For information:
CIRCLE 227 ON READER CARD

Card-Driven Plotter

Off-line plotting with mag tape drives and controllers can be expensive. One way around that expense is with the model 400 punched-card-driven analog plotter. Its resolution is given as one part in 1,024 in each axis, on forms of 10 x 15 inches. Input is from a FORTRAN program that compacts 20 data

points on an 80-column card. Plotting is at 450 points/minute using a fibre-tip pen cartridge. The system is priced at $5800, including the photoelectric card reader. TIME SHARE PERIPHERALS CORP., Danbury, Conn. For information:
CIRCLE 229 ON READER CARD

Real-time Computer

The 6140 is a small-scale addition to Schlumberger's line of real-time computer systems that are actively marketed for data communications, laboratory automation, industrial control, and geophysical processing applications. Up to 32K of 1 usec core is available, as are up to seven direct memory access channels, each of which can support four buffered peripheral devices; up to 40 uniquely addressable interrupts; 16 levels of memory protection; more than 100 instructions; power fault interrupt; a number of peripherals; a complete set of analog and digital devices, and communications controllers.

The real-time monitor is called ASSET, compatible with the more powerful 6145 system, providing users a growth path. There is applications software available for the applications mentioned above. A starter cpu with 16K of memory is priced at $60K. EMR SCHLUMBERGER, Minneapolis, Minn. For information:
CIRCLE 230 ON READER CARD

Cartridge Commo Terminal

3M's tape cartridge is finding a lot of homes, including in this communications terminal. Able to send and receive at switch-selectable rates of 110, 150, 300, 600, 1200, and 2400 baud, the unit records at 1280 bpi using phase encoding. Tape speed is either 30 ips for standard read, write, and search, or 90 ips for tape positioning. Features include an RS232-B/C interface, write lockout, and tape status monitoring. The unit is base priced at $2500 in unit quantities. WABASH COMPUTER CORP., Phoenix, Ariz. For information:
CIRCLE 232 ON READER CARD

MICR Peripherals

This off-line MICR processing station, called MICRCOM, can be used as a remote batch terminal for banking applications. It comes with a model 234 MICR reader/sorter, a 400-cpm card reader, a 300-lpm printer, one mag tape, a single-line 1200-bps communications controller, a programmable central processor, and support software. The station can be linked to any HIS 200, 2000, 400, 600, or 6000 computer, or to any computer that uses binary synchronous communications, such as the 360 or 370. First deliveries begin in the fourth quarter of 1973 at prices ranging upwards from $81,360, or $2150/month on a five-year plan. Options like faster peripherals and line speeds to 9600 baud will be available to increase those base prices.

The 234 MICR document reader/sorter is available as an on-line peripheral for HIS 2000 machines also. It reads documents to 4¼ x 8¾ at up to 830 per minute, sorting them into seven pockets. The 234 and its controller can be purchased for $36,550 or leased for $880/month on a five-year contract.

Also new are 4-pocket, 8-pocket, and 12-pocket versions of the 236 document reader, which runs at 1,625 forms per minute. Previously available in a minimum configuration of 16 pockets, the 236 now is base priced at $70,380 or $1539/month over five years. HONEYWELL INC., Waltham, Mass. For information:
CIRCLE 233 ON READER CARD

Audio Response Terminal

Those who want to hear it directly from the computer can listen in through the IT-160 audio terminal, which is billed as a less expensive but better IBM 2721 replacement. (Priced at from $435 to $490, the 160 is more than $100 cheaper than the 2721.)

Five of the 65 keys are used for local functions like checking the battery; the others are used to transmit an extended touch-tone code. The 160 will feel better to people who like depressable keys rather than the contact-activated switches IBM uses. At 12¾ pounds, the terminal is light enough to carry into a phone booth. TRANSCOM INC., Windsor Locks, Conn. For information:
CIRCLE 234 ON READER CARD

$1900 Mini

The ee 200 minicomputer has seen service as part of a small business computer system for over two years and is now being made available to oem buyers. A universal bus machine, the 200 can be configured with either 200-nsec cycle semiconductor memory or 1-usec core. It understands 69 basic instructions and handles byte and word addressing with them. Two's-complement arithmetic is performed. The machine's architecture is based on a single track concept with fully recursive programming, the vendor claims.

Built into even the most skeletal versions are a bootstrap loader, a tty interface, 15 levels of interrupt (each with its own eight registers), and a tty debug package. Software includes a disc or tape operating system, loaders, assemblers, BASIC, and a 360-oriented FORTRAN cross-assembler. Prices start at $1915 with 4K of core in 100-unit quantities, or $1160 for just the cpu. ELDORADO ELECTRODATA CORP., Concord, Calif. For information:
CIRCLE 235 ON READER CARD

Cassette Drives

Signaling the changing times, this prominent paper tape drive manufacturer has apparently decided to switch part of its line to mag tape cassette transports, called the RCP series. Built to record up to 250,000 characters on an ANSI cassette, the drives pack data at 800 bpi on two perfectly redundant tracks for minimizing errors. The nominal transfer rate of 500 cps follows from a 7.5-ips tape speed. Features include read/write or read-after-write heads, plus the ability to detect clear leaders or the ANSI-proposed end of tape and beginning of tape *holes*, the vendor claims.

Single, dual, or triple cassette versions are available, at a unit price of about $1000 per tape. Byte-parallel output is standard, and minicomputer interfaces for DEC, Data General, and HP run about $1600. REMEX, Santa Ana, Calif. For information:
CIRCLE 236 ON READER CARD

Large-scale Calculator

While computers are getting smaller and smaller, calculators are getting bigger; the 2200, in fact, might even be classified a computer by many. The 2200 BASIC programmable calculator, for instance, features a BASIC compiler that is hardwired into an MOS memory that can be expanded from 4K to 34K

in 4K increments. A crt and a BASIC language keyboard are included for operator ease. A typical configuration consists of the calculator, keyboard, output writer, and crt complete with display and cassette drive. The calculator proper is priced at $3500; the output writer, $2100; keyboard, $700; crt, $1500; and cassette reader/recorder, $1200. Memory is $1500 in 4K increments. WANG LABORATORIES INC., Tewksbury, Mass. For information:
CIRCLE 231 ON READER CARD

Cassette

Before setting up the manufacturing capability for a whole new product line, Digital Equipment engineers were told first to check out what was on the market to see if there wasn't perhaps a suitable device already in existence. Eighteen months of searching convinced them that they'd have to do it themselves to get what they wanted, with the TU60 DECcassette the result. It's a direct reel-to-reel drive unit offered PDP-8 and 11 users, and although at first glance the 60 looks like another Philips-type dual cassette drive, some fundamental changes have been made.

The tape inside the cassette is double the thickness of such cassettes, and one-track phase encoded recording is done across the full width of the tape. These changes are said to increase the number of tape passes from the 10 to 100 users previously realized, to upwards of 3 or even 6 thousand. The 60 is guaranteed for 1,000 passes.

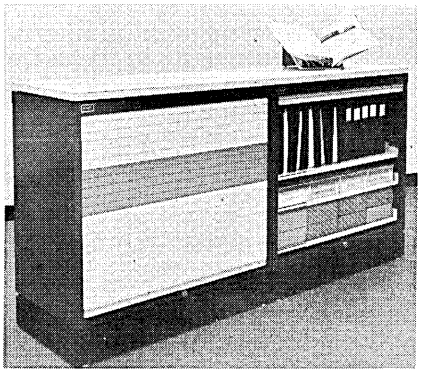
The 60 has an average read/write speed of 9 ips, an average search speed of 21 ips, and a start/stop time under 20 msec. The recording density of 350-700 bpi together with the speed yields an average transfer rate of 416 bytes/second, with a peak of 560 bytes/second based on 128-byte blocks. The data interface is eight-bit parallel with asynchronous program transfer.

Complete with interface for either the PDP-8 or the PDP-11, the TU60 is priced at $3,900. DIGITAL EQUIPMENT CORP., Maynard, Mass. For information:
CIRCLE 238 ON READER CARD

Flexible Furniture

You can design your own carts, cabinets, and counter-height storage from pieces offered in the Optimedia line. For example, cabinet or truck heights of 31, 58, 71, and 84 inches are available; the 31-inch models provide table space, too. Customers can choose from internal components, including bins for hanging binders, roll-out bins for storing binders or cards or disc packs, wire racks for tapes, roll-out shelves for storage, a roll-out writing surface, plus special card drawers. And everything is rearrangeable; nothing is permanently attached.

All units have roll-down doors and



locks. Pricing, of course, depends on design, but as an example, the unit shown includes two 31-inch cabinets (at $101 each plus $13 for each base) one double top ($40), a regular shelf ($12), a sliding drawer ($22.25), and card trays ($8.50 each). WRIGHT LINE, Worcester, Mass. For information:
CIRCLE 237 ON READER CARD

Typesetter

Computer-driven typesetting might be within the budget of small print shops and in-house publication departments with the "Little C/A/T" computer-actuated typesetter. The device puts down lines of type using fonts from 5 to 18 points in nine sizes and four styles. Connected to a Nova 1200 mini, it does much of what more expensive systems do, including full hyphenation and justification (using two exception dictionaries), indents, and runarounds. A reverse leading capability allows for columnar output with varying depth entries. Little C/A/T can produce lines nearly eight inches long, and is rated at 50 newspaper lines/minute. With the Nova, which can support two on-line typesetters, paper tape reader, and software, the system is priced at $25,250 plus $170 for each font desired. GRAPHIC SYSTEMS, INC., Lowell, Mass.

CIRCLE 290 ON READER CARD

Data Acquisition

The model DDS-1103 takes analog data from transducers or other sources, converts it to binary characters, and records it on 7- or 9-track computer-compatible half-inch tape. The basic system records eight channels, expandable to 128 with an input range of ±5V, using a 12-bit converter. The scan rate across the input channels is 40,000 Hz. A basic system for eight channels, with tape transport, is priced at approximately $12K. KINEMETRICS INC., San Gabriel, Calif.

CIRCLE 291 ON READER CARD

Disc Controller

The DC-36 disc controller interfaces up to eight 2311- or 2314-type disc drives to the I/O channels on Univac 418 computers. The unit is interesting from a design standpoint, because it performs such functions as record address verification, cyclic redundancy check code generation and verification, formatting of record headers, reading and writing multiple records with a single command, and write protect completely in the hardware. A basic unit, including a maintenance panel, power supply, and provisions for attaching two files, is priced at $19,200. The vendor can also supply a complete disc system based on the DC-36. TELEFILE COMPUTER PRODUCTS, INC., Irvine, Calif.

CIRCLE 292 ON READER CARD

Teller Terminal

These teller terminals for passbook saving accounting can be used in a stand-alone environment for posting and duplicating, maintaining totals, or acting like adding machines, or they may be connected to HIS 200, 2000, or 6000 cpu's for real money transactions. The difference between them is that one, the 7330, is a fixed-sequence processor, while the other, the 7340, is programmable. The 7330 model will be available next quarter for $7000, or $230/month over five years. The 7340 won't be around until the third quarter. It will sell for $7800, but its lease price is the same $230. HONEYWELL INC., Waltham, Mass.

CIRCLE 293 ON READER CARD

Faster Processor

A new configuration has been added to the DECsystem-10 lineup. The model 1060 uses the faster of the two processors offered in the line, the KI-10, so that the system does not require swapping drum support. A system comprising 64K 950-nsec 36-bit words, 50 megabytes of disc capacity, a tape drive and controller, a 1200-cpm reader, a 1250-lpm printer, a real-time clock, communications equipment for 16 local lines, and software goes for $528,000. DIGITAL EQUIPMENT CORP., Maynard, Mass.

CIRCLE 294 ON READER CARD

Disc Storage

Interdata 3, 4, 5, 70, and 80 users are offered a head-per-track disc storage system available in five capacity levels ranging from 128K 16-bit words to 2 megabytes. The access time is 16.7 msec, and the transfer rate is 125K words/second. The controller has a 64-byte buffer that allows asynchronous data transfers between the computer and the disc system. The controller also handles such chores as generating error check codes, status bytes, a current position status byte, and protecting portions of the memory. Basic subsystems are priced at $9640 and are available 45-90 days aro. DATA DISC, INC., Sunnyvale, Calif.

CIRCLE 295 ON READER CARD

PDP-11 Discs

Putting moving heads over fixed discs yields disc pack-like access times with lower prices in the Data Miser series of PDP-11 disc systems. The model 110, for instance, performs with average random access times of 75 msec and transfers of 100,000 words/second using a 1.25 million word disc divided into 204 tracks. The device and its eight-drive controller are said to be compatible with Digital Equipment's DOS operating system when used as the system disc; they are also supplied with their own DOS software in case the customer wants to use them differently.

Also available are fixed disc/disc cartridge combinations wherein both the drives access data in an average of 60 msec and transfer at the 100,000 word/second figure. Prices start at $4950 for the single fixed-disc drive and controller, and $8400 for the combination. INTERNATIONAL MEMORY SYSTEMS, Scottsdale, Ariz.

CIRCLE 297 ON READER CARD

Message Imprinter

The model 927 CheckSigner/Imprinter is a mechanical device with removable imprint cylinders for printing on continuous forms. It handles form sizes ranging from 5½ to 15 inches in width, and documents from 3½ to 7 inches long. Imprint cylinders are available in various lengths for authorizing signatures, invoicing explanations, or advertising messages. The plates are removable for storing in a safe. The 927 sells for $349. MARTIN YALE BUSINESS MACHINES, Chicago, Ill.

CIRCLE 296 ON READER CARD

Disc Storage

A fixed head-per-track disc memory line for this manufacturer's 620 and 73 series minis is available in four storage sizes: 61K 16-bit words ($7K), 123 K ($8K), 246K ($9500), and 491K ($16K). The average latency is 17 msec, and the transfer rates are all 105,000 words/second. The high-speed units will be used in real-time applications with either the VORTEX or MOS operating systems. VARIAN DATA MACHINES, Irvine, Calif.

CIRCLE 298 ON READER CARD

Printing Calculators

An assault on adding machines and mechanical printing calculators is being led by the models 1000P and 1010P. The 1000P features the four common mathematical functions, plus a grand total memory register, automatic decimal placement, constants, chain calculations, credit balance, two-color printing, repeat add/subtract, automatic retention of last item, and a buffered keyboard for $295. Add $50 to that and the 1010P adds automatic accumulation, negative entry capability, and register exchange. The units measure 9 x 11½-inches and weigh just under 10 pounds, in part due to extensive use of MOS/LSI circuitry. Delivery, depending on quantity, is immediate. UNICOM SYSTEMS, INC., Cupertino, Calif.

CIRCLE 299 ON READER CARD

Facsimile Unit

When talking on-line by phone to a similar unit, the model 600 VRC remote copier can send and receive simultaneously. Off-line, the unit can be used as

a standard office copying machine. For on-line use there are features for unattended automatic answer, receive, and disconnect. Transmission time for an 8½ x 11-inch document is from four to six minutes, depending on whether the speed is set for 180 lines/minute with a resolution of 96 lines/inch (six minutes) or 64 lines/inch (four minutes). The unit sells for under $2K, with leasing available. 3M CO., St. Paul, Minn.
CIRCLE 300 ON READER CARD

Data Input Terminal

Like the other members of the C-DEK data input terminal line, the model 4401C collects keyboard-entered variable data and fixed data from cards or badges entered into a reader slot on the terminal. It is in this reader that the 4401C differs from its predecessors, because it now uses optical reading techniques to reduce the chances of malfunction in the hands-on applications in which the CDEK line usually finds itself: hospitals, libraries, factories, and other industrial locations. The 4401C can be attached to data concentrators such as the Mohawk 4400 using 13- or 15-pair cable in lengths up to nearly a mile. The 4401C rents for $82.50/month on a one-year contract. MOHAWK DATA SCIENCES, COLORADO INSTRUMENTS DIV., Broomfield, Colo.
CIRCLE 306 ON READER CARD

Numeric Keyboard

The ANK-16E is a 16-key alphanumeric keyboard that attaches between a modem and any teleprinter or crt terminal having an EIA RS-232 interface plug. The keyboard has the numerals zero through nine in standard calculator format, plus comma, decimal, minus, carriage return, space, and line feed. The unit has a switch for on-line or off-line operation. Also featured are 2-key rollover, and 300-baud operation, with options available for 110- or 150-baud operation. Any other ASCII characters can be substituted for the standard characters on request. The unit is priced at $145. TTS DIV., REMOTE DATA TERMINALS INC., Santa Monica, Calif.
CIRCLE 301 ON READER CARD

Modem

The Vodat modem has switch-selectable transmission rates of 4.8, 9.6, 14.4, and 19.2 kilobaud. Though developed under the sponsorship of the USAF, the unit is currently being "commercialized." The Vodat is all solid-state construction and has options available for improving the bit-error rate in a randomly distributed error environment, and for multiplexing up to four 2400-baud lines. Though commercial versions won't be ready until around the middle of next year, the price will be in the neighborhood of $20K. Several evaluation units have already been delivered to the Air Force. HONEYWELL INC., Tampa, Fla.
CIRCLE 302 ON READER CARD

Oem Memory System

When the 1¢/bit price barrier for memories was broken several years ago, it was usually for "bare-bones" stacks without complete electronics, and that price was usually quoted for very large quantities. Not so with the STORE/225 core memory, a two-wire, 2.5D unit with a cycle time of 975 nsec and an access time under 500 nsec. It's arranged in 32K 18-bit words; and an order of 10 such systems, complete with timing, addressing, and drive electronics, drops the price to .7¢/bit. DATA PRODUCTS CORP., Woodland Hills, Calif.
CIRCLE 303 ON READER CARD

Laboratory System

Digital Equipment Corp. seems to select and isolate very vertical market

segments and develop special systems for them. The Laboratory Peripheral System (LPS11-S) is a case in point. It consists of a 12-bit A/D converter, programmable real-time clock, display controller, and a 16-bit I/O option that allows typical laboratory instruments to be interfaced to the PDP-11 family of computers. For something under $3K the buyer gets an eight-channel A/D converter and eight-channel multiplexing, with instrumentation cables attaching to the unit through phone jacks. DIGITAL EQUIPMENT CORP., Maynard, Mass.
CIRCLE 304 ON READER CARD

Ledger Card Reader
The performance of very-small-scale office computers is usually determined by the speed of the peripherals attached to them—up the peripheral speed, and the system usually runs faster. That's the case with the P-130 card reader for the Philips P-350 series office computers. It reads magnetic stripe storage cards at 65 cpm. Up to 750 cards can be loaded into the 130, for sorting or selection under program control, with selective printout if desired. The P-130 rents for approximately $145/month. PHILIPS BUSINESS SYSTEMS INC., New York, N.Y.
CIRCLE 305 ON READER CARD

Peripheral Interface
The model 500-05 adapter and model 600-05 interrupt generator allow peripherals such as the Tri-Data Corp. PD20 tape unit, the Centronics 101 serial printer, the Pertec Corp. D3000 disc units, and the Ann Arbor Terminals model A²T206 crt display to be attached to the Digital Equipment Corp. PDP-11. The basic interface sells for $925 with interrupt levels and controllers extra. AVCON, INC., Fort Worth, Texas.
CIRCLE 307 ON READER CARD

DEC Peripherals
A stand-alone data conversion unit is offered to users of the relatively old PDP-8/I and 8/L minicomputers so they can use some of the latest DEC peripheral line and upgrade system performance. The DW8/E interfaces to such peripheral devices as the RK8E/RK05 disc subsystem, the TM-8/E/TU-10 mtu subsystem and a number of other low-speed devices such as card readers and punches currently offered for use with the PDP-8/E, 8/F, and 8/M. The DW8/E acts like an external OMNIBUS for data transfers. It's priced at $1500 and available in 60-90 days. DIGITAL EQUIPMENT CORP., Maynard, Mass.
CIRCLE 308 ON READER CARD

PDP-11 Crt Interface
The model 5300 crt display controller is offered to PDP-11 users capable of installing the pc board into the computer system themselves. Once there, the unit can display up to 3,200 upper case ASCII alphanumeric symbols on a standard video monitor, arranged in 40 lines of 80 characters. The characters are 7x5 dot-matrix displayed in a 10x6 dot-matrix field. An optional 32-character special symbol set uses the full 10x6 matrix to permit the drawing of unique graphic symbols, including continuous horizontal and vertical strokes. The 5300 has its own 2K x 16-bit MOS memory and display logic to reduce the PDP-11 overhead. The price for the basic board is $3K, with options for the monitor and a keyboard upping the price closer to $5K. TECHNICAL ASSOCIATES OF NEW ORLEANS, INC., Metairie, La.
CIRCLE 310 ON READER CARD □

Par for the Course

A linguist thought it a farce,
That memory space was so sparse,
One day they increased it;
Said he, while he seized it:
"At last enough core for the parse."
—Claus Segebarth

A Singer 4300 key-to entry and transmission

Mastercraft Industries, Inc., Denver. One of the largest manufacturers of kitchen cabinets, with facilities and sales offices in Dallas and Phoenix.

Mastercraft's present configuration in the Denv office includes a 4311 Magnetic Data Recorder for dat entry and transmission, a 4301 for data entry and a hig speed line printer. Both branch plants have installed 4311 terminals and high speed line printers.

Ken Sandoval, Mastercraft's controller, says the company switched from an on-line system using a Data-Phone to the Singer* system because it provides preci quantity-item inventory control. However, it is also bein used for accounting functions at all locations, including accounts receivable, accounts payable and payroll. And they're considering adding a magnetic data central pooler for inventory tracking.

Has it made a difference? Sandoval is delighted. "Tape input is much faster . . . We realize quite a savings in expensive CPU time alone . . . and the absence of problems has alone justified the change to the 4300 system."

Southern Electric Utility. 21 offices within a 700-mile radius using a central Data Center for billing, accounting, labor distribution, materials and supply inventory.

The offices and the Data Center are each equipped with a 4311 Data Communications Unit. Data is transmitted over the dial-up telephone network daily.

The average office transmits 156,000 characters—or 8400 record blocks—to the Center every month. The average office can transmit a whole day's transactions to the Data Center in 15 minutes or less: eight times faster than with the previous punched card system. The Data Center recorder is now receiving over 200,000 records per month, and has the capacity for over one million records during any given month.

A printout is produced and mailed to each office daily from the Center.

Input into the Center's IBM System 360 is 45 times faster than with the former card system, which used both a keypunch and card reading terminal at each office. Costly mainframe sorting and conversion has been eliminated.

SINGER Consumer Products, Industrial Products, Aerospace & Marine Systems, Business Machines, Education & Training Products.
***Business Machines Division**–producers of calculators, mailing equipment, computer systems, data transaction systems, billing/accounting systems, graphic arts equipment.*

-tape system makes data this easy for you too:

L. L. Ridgway Enterprises, Inc., Houston. Manufacturer of architectural supplies. 30 retail-wholesale outlets in 15 branches, from Denver to Atlanta.

At each branch, accounts receivable, cash receipts and adjustments are recorded on a 4311 Magnetic Data Recorder. It also creates invoice input and verification for computer invoice printout via a Univac 9300. A branch can transmit its weekly transactions by telephone in 45 - 90 minutes.

Management indicates that the new 4311 terminals were justified on cash flow alone.

4300 Series Magnetic Data Recording System equipment is designed and manufactured by PERTEC, one of the largest manufacturers of key-to-tape systems in the world. The product line is a result of high technology engineering and extensive product testing. Each unit is manufactured in PERTEC's ultra-modern electronic manufacturing facilities under stringent quality controls which assures high quality reliable performance.

For further information, call your nearest Singer Business Machines representative, or write Singer Business Machines, San Leandro, California 94577.

Business Machines
that help you get
down to business.

SINGER

*A Trademark of THE SINGER COMPANY

Software & Services

Software Notes . . .

APL, always popular among its users, seems to be gaining interest among manufacturers lately. Tektronix has gone over its 4012 business graphics terminal to outfit it for APL users and will display it at the FJCC as the model 4013 (see p. 116). And Teletype Corp. has modified its popular 38 series for APL users, adding diamond, right tack, and left tack characters. There is also a new backspace feature allowing the terminal to print the APL overstrike characters. Since the codes for numeric, monocase alpha, control, and punctuation marks are consistent with 1968 ASCII code assignments, the altered 38's can still be used for non-APL applications.

February 29 of this year was a memorable one for University Computing Co. That was the day phone operators were leaping all over the switchboards, trying to handle 50 phone calls from irate customers of UCC's DUO 360/370 package. The submonitor, which allows unaltered 360 DOS jobs to run on OS 360 and 370 systems, contains a security destruct feature tied to the date; but the programmers forgot to allow for the occasional February 29, and systems blew from coast to coast. Instructions were issued over the phone on how to get the computers back on the air.

It's getting more and more difficult to do, but National Semiconductor in Santa Clara, Calif., may have come up with a new application for computers. The company has stored the device parameters for all its transistors in Softech, Inc.'s AEDCAP circuit analysis program running on National CSS's timesharing service. This allows potential National Semiconductor customers to test transistors in their electronic circuits before actually buying them. Long-range plans call for adding device parameters for its entire monolithic IC product line.

"How's business?" we asked Bill Newcomer, executive vp at Dylakor Computer Systems, Van Nuys, Calif. "Very good now that the programmers are moving again." When asked to elaborate, the official for the "dollar-a-day" report writer/data base management systems explained: "During the last two years when programmers couldn't job shop, business wasn't good. But programmers who have used our packages are changing jobs and referring their new managers to us, and business is up!"

Time-Shared TSO

After some searching for a competitor, Allen-Babcock believes it is the only time-sharing service bureau to offer IBM's TSO; and after spending four hard months to bring the system into a production mode, the company understands why other vendors haven't. The user will benefit from the effort in being able to run multiple-task jobs with interleaved compiles, executes, and sorts, as well as editing data and debugging code on-line.

TSO runs under the RUSH proprietary monitor, and is accessed through either low-speed teleprinter terminals (at 10 to 30 cps) or through remote job entry stations. The company provides dial-up services to 10 metropolitan areas and offers batch terminals in Los Angeles, Phoenix, New York, and Union, N.J. There is a batch terminal on order for Chicago too. TSO service is billed at $8/hour for connect time, $5.10/cpu-minute, and $5.10/minute for I/O. Charges are based on "equivalent 360/50 usage." Data storage runs $14/100,000 characters after the first free 100,000-character block. ALLEN-BABCOCK COMPUTING, INC., Los Angeles, Calif. For information:

CIRCLE 260 ON READER CARD

DOS Selector

With Multi-DOS2, an installation can switch between versions of the DOS supervisor without having to bring up the system anew each time. The program gives the operator the ability to choose which version of DOS he wishes to use, then to load another version later by simply rerunning the card deck and making his choice again from the list presented to him. Multi-DOS2 enables the site to maintain up to nine versions of DOS on the SYSRES pack. This will be helpful when making a change to an operating system, or when special versions of the supervisor are required for special jobs, like 1401 compatibility runs. The program borrows 500 bytes in which to execute, and then is overlaid. It is available through the mail for $100. GENERAL ELECTRONICS, Lyons, Ill. For information:

CIRCLE 265 ON READER CARD

File Management Feature

The MARK IV file management and report generation system, billed as "the most successful software package in the world" on the strength of its 500 user installations, has a new option called ESP. ESP allows the program to operate on data bases for which it previously had no interface, including CICS, TOTAL, and AMIGOS files. (MARK IV has always operated on IMS files.) ESP will also allow the programmer to get his hands on the code for the first time; control of system parameters has been primarily through preprinted forms filled in by the end user.

ESP adds $5000 to the $35,000 base price of the program for new customers, but installations that paid the $12,500 entry fee to get the IMS interface will get ESP free. The 30K-plus MARK IV system runs on IBM 360 or 370 gear under OS, DOS, TSO, and VS1 (other new virtual memory operating systems have not been tried), and also under Univac's TDSO for its Series 70 ex-RCA processors. Maintenance is free for the first year and runs $1000/year after that. INFORMATICS INC., Canoga Park, Calif. For information:

CIRCLE 261 ON READER CARD

Mark IV Complement

One mark of success in any industry is when independent vendors begin marketing optional equipment for your product. A case in point is the MARK IV job configurator. Built by a user of the Informatics product, the configurator allows a nonprogrammer to maintain a kind of source library of job inputs and then to call off a report by name. It even generates the JCL for that run.

For operations ease, the configurator automatically initiates processing of jobs in the MARK IV queue and produces reports on job activity and file maintenance.

The license fee for the program will be $7600 in 1973, but a pre-Christmas special cuts that to $6000. The fee includes installation, training, and a year's maintenance. Follow-on maintenance and updating is priced at $250/year. EASTERN AIRLINES, Miami, Fla. For information:

CIRCLE 262 ON READER CARD

DOS Cobol-D Extensions

ANSI COBOL has features that are attractive to DOS COBOL-D users, but its core requirements are high. This vendor says users might be running COBOL-D in 10K while the ANSI version would take 54K. One alternative to the 44K investment is to add the ANSI features to COBOL-D. This can be done for $1500 (or for $150/month for 12 months). The price brings the capability to run programs from private source libraries, dynamic communications with IBM SORT-483, a sorted cross reference list feature, the ability to temporarily update source files at compile

time, and a comment statement feature.

Some of the advantages of the enhancement are that temporary updates are done in such a way that JCL need not be changed for using IBM's MAINT program to make the updates permanent, and that the comments statements can be added even to the DATA Division of the program. Installation is through the mail, and a 30-day free trial is offered. INTERNATIONAL COMPUTER SOFTWARE, Long Beach, N.Y. For information:
CIRCLE 264 ON READER CARD

Display Administration

CAPRI can be thought of as a crt interface to applications programs, as it allows the applications programmer using COBOL or an assembly language to work with logical records in communicating with display terminals. In the past he had to concern himself with control characters, message traffic, handling error conditions, and storing intermediate results. The vendor claims that CAPRI will save an installation hundreds of hours of hex coding in setting up display fields and message strings.

Although not reentrant, the interface program is not limited in the number of displays it supports. It is not a direct replacement for any program product, but the vendor supplied the example that it could do the job CICS would do in a crt-only environment five times as fast and with one-tenth the memory requirement. Offered for Burroughs, Univac 9000, and IBM 360 machines, it requires little more than 7K bytes. It is priced at $6000 plus installation (which might run from $500 to $3000 depending upon the application). UNIVERSAL SYSTEMS ASSOC., INC., Minneapolis, Minn. For information:
CIRCLE 266 ON READER CARD

Census Data Sharing

Census data, from how many people live on a block to the average age of ladies in Pasadena, is nationally available on a time-shared basis for use in marketing studies, factory site selection, and other planning. Developed from government-released data by Urban Decisions Systems, the service is called CENSAC and is variably priced depending on the kinds of census records and the size of the geographic area to be processed. For instance, withdrawing 10% of the general information everyone in Houston supplied might run as little as 0.4¢ per record, while requesting the long-form data (from those extended questionnaires some people fought) for Upper Manhattan might run over $2 per record.

Access is provided through voice-grade lines to 11 major cities, including Boston, Chicago, Los Angeles, and New York, through part of a regular time-sharing computer service. Connect charges are $10/hour, storage runs $20/disc cylinder, and processor time runs 38¢/cpu second on a CDC 6000 series machine. These charges are in addition to the record retrieval fees. NATIONAL CSS, INC., Norwalk, Conn. For information:
CIRCLE 267 ON READER CARD

Savings System

Not counting branches, this vendor estimates there are 5,000 banks in the U.S. with deposits over $10 million. That makes a good potential market for any financial software package, especially for one like Multiple Bank Savings System II that runs only $5000. MBSS can be used for a one-branch bank or for a country-wide operation. It performs the common functions like balancing the savings departments, tracking transactions, figuring any kind of interest, and printing statements, and has the additional advantage that it automatically rebalances the savings department every time an update is run.

Other advantages include the fact that all reports are optional and that interest and control routines are easily changed. Written in COBOL, except for data entry routines, it operates in as little as 24K on a 360 or 370 and accepts both MICR and card input. FLORIDA SOFTWARE SERVICES INC., Orlando, Fla. For information:
CIRCLE 268 ON READER CARD

Line Printer Mapping

Automap II was designed to run on smaller computers than other mapping programs have been able to. Written in FORTRAN IV G for the 360 series, the program puts down characters to produce gray tones using a regular print chain. Maps to 390 characters wide can be produced by laying out three sheets of forms side by side; the program worries about the clipping of lines and other bookkeeping, as well as the overprinting requrred to make the darker tones.

City and county planning departments are the biggest users of such programs, partly because they have the coordinate data already digitized in many instances. The $450 price of the program will not discourage smaller

services spotlight

Super-scale Time-Sharing

Remote batch and computer-to-computer communications are two of the features just added to the world's largest time-sharing service in an attempt to make it even bigger. GE's title of world's largest is backed not only by revenues, but also by the fact that its network services over 250 U.S. cities through regular communications lines plus eight European countries by satellite and transoceanic cable. The international network was a "first" in 1970, just as the Mark I service was a "first" for commercial t-s in 1965.

The remote batch services, not a first for GE, include 2000-baud lines to IBM 2780 or Data 100 terminals or to an IBM 360 or 370 mainframe with os-BTAM. Communications are handled through the IBM 270X or 3705 when an IBM mainframe is involved.

The terminals are connected to a supercenter near Cleveland where 15 H635s and H6070s are linked together through another dozen GE 4020s. The international net links more than 75 computers and communications processors in all.

Called the Mark III services, the offering makes BASIC; FORTRAN IV, and ALGOL available in foreground interactive processing. All of these plus COBOL are available in background batch processing. In addition, a library of over 400 applications programs can be accessed.

The foreground offering is largely the same as GE's older, Mark II service. Four important enhancements are: Commands from Files (a kind of multitasking from a stored procedures file wherein a set of jobs can be run periodically and automatically), Cryptographic Routines (for scrambling and unscrambling data sets), indexed sequential file handling and 2000-baud lines. Also offered is the ability to switch processing from the 635s used in foreground to the 6070s used in background without moving data files.

GE's pricing algorithms are among the most complex we've seen. For Mark III they include: 1¢/320-word page data transfer, 7¢/"computer resource unit," $1.10/1,280-character program storage unit, 50¢/1,920-character data storage unit, and a minimum of $7/terminal connect hour. These numbers are complicated by options for express or overnight processing, among other factors. GENERAL ELECTRIC INFORMATION SERVICES, Washington, D.C. For information:
CIRCLE 263 ON READER CARD

software & services

users, however, and the package will run in 40K. ENVIRONMENTAL SYSTEMS RESEARCH INSTITUTE, Redlands, Calif. For information:

CIRCLE 269 ON READER CARD

Xerox UTS Extensions

Responding to pressures for more real memory, in spite of its support of virtual memory, the UTS operating system has been enhanced to support up to 2MB of core on Sigma 9s (up from an old limit of 512KB). Under UTS, each time-sharing user appears to have a 512KB machine to himself; the new feature does not change that apparent machine size, but increases the number of on-line users. Up to 16 batch programs may now be run at a time.

A second feature enables Sigma 6 and Sigma 9 users to run UTS without having the Rapid Access Swapping device previously required. They can use regular disc drives instead. XEROX CORP., El Segundo, Calif. For information:

CIRCLE 270 ON READER CARD

Data Base Management

The implementation of data base management systems that are structured according to the recommendations of the CODASYL Data Base Task Group will result in two things—the dropping of complicated data descriptions in applications programs and the creation of an "all-powerful" data base administrator. Both should occur for users of DECsystem-10s that take advantage of the DBMS system, as it is said to be compatible with the DBTG recommendations.

Rather than using a Pictures clause to describe data structures, COBOL programmers will be able to refer to data by *name* using a new verb called EVOKE. There are 12 to 15 new verbs implemented in DEC's COBOL that are recognized as related to DBMS. When encountered during execution, they cause references to disc tables which point to working storage.

It makes things easy for the programmer, but puts critical responsibilities on the data base administrator. He has a compiler-level data description language to help him create the file structures and a device media control language to put them on the right physical devices. Both are part of the DBMS offering, along with the new COBOL verbs. The package will be available in late 1973 for $325/month. DIGITAL EQUIPMENT CORP., Maynard, Mass. For information:

CIRCLE 271 ON READER CARD

Accounts Payable

This AP package comes with the recommendation that it was used internally by General Signal Corp. before being released for sale. Written for 360, 370, or Spectra series computers, it runs under DOS and takes up less than 32K. It processes manual or computer checks, calculates discounts and due dates, handles partial payments, and applies credit notes against payments. A payee name and address file and an open items file are kept up automatically. Handles are included for producing even more than the standard 14 reports it generates. The price of $7500 includes a COBOL source, documentation, and 40 man-hours of implementation support. DECISION CONCEPTS, INC., New York, N.Y. For information:

CIRCLE 272 ON READER CARD

Student Test Analysis

Judging from the number of analyses done, the Student Test Analysis and Scoring Program probably does more work on an exam paper than does the student. Among reports the program generates are: a detail item analysis (to see how many students gave which of the possible wrong answers), the item analysis (to compare the number of rights with wrongs), the class analysis (to compare results by age or grade level, etc.), and the student analysis (to measure a student by any set criteria).

The program, which is free to NCR users, since that company is still "bundled," runs on any size Century computer. NCR, Dayton, Ohio. For information:

CIRCLE 273 ON READER CARD

Faster PL/I Indexing

Installations making heavy use of the Index function in PL/I, especially those sites doing text editing or working with other alpha data bases, might consider replacing the built-in PL/I function with INDEXR. INDEXR does the same job as the built-in code, searching character strings and putting the location of a match in an index, but does it in from 5% to 50% of the time.

The function can be called out by adding a single subroutine identification card to each user program that needs it, or it can be linkedited into the system. INDEXR requires 500 bytes of storage, and both a reentrant version and a faster non-reentrant version are mailed for $100. S&B SOFTWARE PRODUCTS, Northridge, Calif. For information:

CIRCLE 274 ON READER CARD

Nova Utilities

To speed both data conversions and some arithmetic operations, Nova and

Supernova users are offered a package of eight utilities. Functions included are: BCD/binary conversions, two-word BCD/binary conversions, multiply two binary words, multiply and accumulate, divide one word by a half-word, and divide two words by one word. Claimed to offer up to a 60% speed advantage over "available code," the eight routines take up 118 words of storage and are priced at $750 including documentation. COMPUTER DYNAMICS CORP., Cherry Hill, N.J. For information:

CIRCLE 275 ON READER CARD

Inventory Management

If buyers purchase on impulses, wholesalers can at least counter by buying on WIMS, Wholesale Inventory Management System. WIMS uses two sets of programs. The first set records least-cost ordering strategy for items, changes in demand, and the total inventory investment for all items. The second set determines how much and when to order. The programs are disc oriented, running on either the Univac 8411 or 8414 Mass Storage Subsystems, and are presently implemented on the Univac 9400. WIMS is free to Univac customers. UNIVAC, Blue Bell, Pa. For information:

CIRCLE 276 ON READER CARD

APT Processors

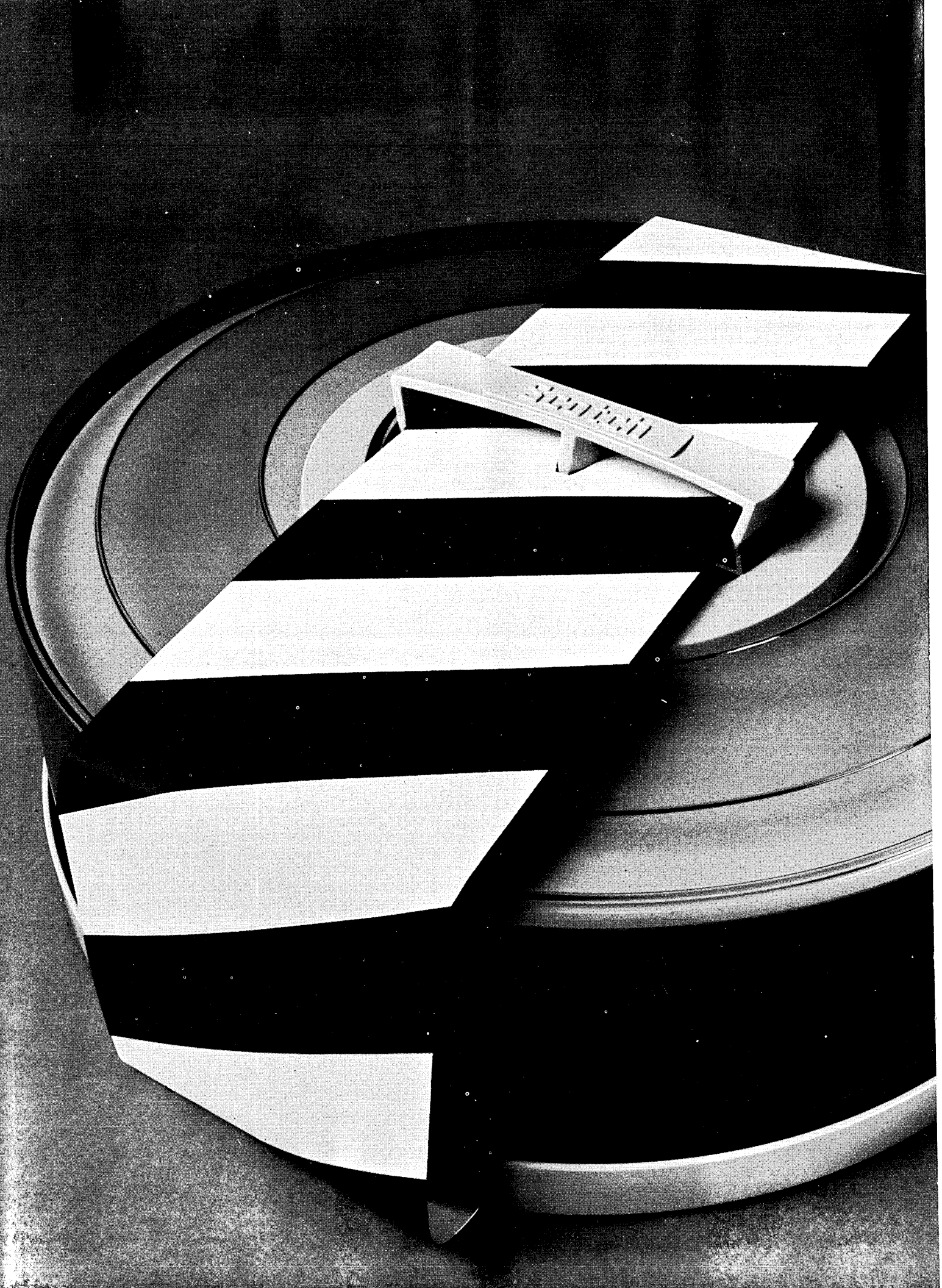
This family of System/370 N/C processors is intended as an upgrade of the OS APT and AD-APT/AUTOSPOT programmed tooling programs in that it is compatible with the older programs in I/O and offers more features and improved performance. The programs feature upward and downward compatibility between themselves, and a measure of flexibility that results from the fact that the less capable processors are subsets of the most powerful one. APT-BP is the minimum program; it features two-dimensional point-to-point tooling with some limited line and circle positioning capablity. APT-IC is a step up; it features 2½-D contouring in that the plane of the tool can be tilted. APT-AC, the biggest of the three, includes all the features of the smaller ones plus 3-D contouring and five-axis swarf cutting. License prices run $150, $300, and $500/month, respectively, and availability is scheduled for the third and fourth quarters of 1973. IBM, White Plains, N.Y. For information:

CIRCLE 277 ON READER CARD

DECsystem-10 Sort

QSORT is a COBOL sort for use on a DECsystem-10. A replacement for CSORT, the new object time routine is said to be from two to four times as fast as the older program. QSORT can also operate as a stand-alone, taking its commands from a terminal rather than from an application program. Unlike CSORT, it operates only on disc files, not tape. It is priced at $125/month. DIGITAL EQUIPMENT CORP., Maynard, Mass. For information:

CIRCLE 278 ON READER CARD □



Crashguard.

Now "Scotch" Brand creates a disk pack coating that protects itself.

[and protects your read/write heads]

Now, from 3M laboratories comes a major improvement in disk packs: Crashguard, an exclusive disk coating that actually guards against the disaster of a head crash on your disk drive. It protects you against lost computer time due to disk pack/disk drive interface problems.

This extra-hard and extra-smooth coating can sustain most head-to-disk contacts without permanent damage to the disk surface.

More importantly, in the event of a severe crash, Crashguard minimizes the after-crash buildup of oxide debris and contamination on the read/write head. It helps to prevent additional crashes, helps keep resultant damage from spreading to other disk packs and drives.

For further information about our latest advances in disk packs, write Market Services, Magnetic Products Division, 3M Center, St. Paul, Minn. 55101.

When more improvements come in magnetic media, you can expect them to come from 3M.

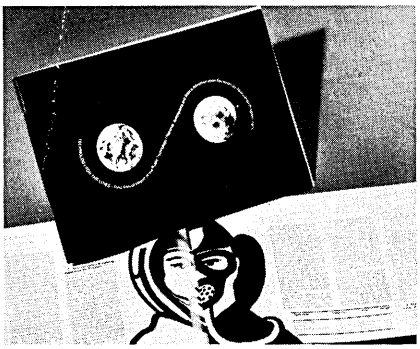
3M COMPANY

We've got a habit of getting there first.

Literature

Technology for Cities

"Technology for the Cities" is the first annual report on a joint program of Public Technology, Inc., and NASA that applies aerospace technology to state



and local government problems. PUBLIC TECHNOLOGY, INC., Washington, D.C. For copy:
CIRCLE 200 ON READER CARD

Communications Buzz Words

"Sherry's Guide to Data Communication Buzz Words" is a glossary of terms which Sherry Moreau, who animatedly staffs vendor's booths at trade shows, says she uses to sound like an expert on data communications when she really isn't. INTERNATIONAL COMMUNICATIONS CORP., Miami, Fla. For copy:
CIRCLE 201 ON READER CARD

OCR Concepts

Aimed at prospective users of optical character recognition, a 12-page booklet titled "OCR System Concepts" covers a variety of OCR applications with and without video display terminals. DATATYPE CORP., Miami, Fla. For copy:
CIRCLE 202 ON READER CARD

Communications Cost Cutters

"Safe and Simple" is the title of an eight-page brochure describing use of multiplexing, particularly time division multiplexing, and port selectors to cut costs and improve efficiency in data communications. INFOTRON SYSTEMS CORP., Pennsauken, N.J. For copy:
CIRCLE 203 ON READER CARD

Portable Terminal

Bulletin describes vendor's Source 1000 portable data entry terminal, a solid-state, hand-held, battery-operated data terminal which can be used at any remote site. Data is stored in a semiconductor memory and transmitted through an acoustic coupler over any standard telephone line to a central data collection station. MSI DATA CORP., Costa Mesa, Calif. For copy:
CIRCLE 204 ON READER CARD

Microwave Control

Use of microwave to provide extended control for financial institutions is the subject of a 10-page brochure which describes how these institutions' problems are being solved through voice, visual, alarm and control as well as data communications linking widespread cities. MOTOROLA COMMUNICATIONS & ELECTRONICS, INC., Schaumburg, Ill. For copy:
CIRCLE 205 ON READER CARD

Training Films

A 60-page "Systems Film Catalog," available for $2, lists some 250 films on flowcharting, systems applications, forms design, computers, data processing, work measurement, communications, and systems management. The films' content, running times, and rental fees are listed. ASSOCIATION FOR SYSTEMS MANAGEMENT, 24587 Bagley Rd., Cleveland, Ohio 44138.

Data Indexing

"Time Code Data Indexing Handbook" covers the theory of data indexing and retrieval of different recording media, including magnetic tape, oscillographs, strip-chart recorders, and camera film. It includes a summary of available time code formats and their application. DATAMETRICS, Watertown, Mass. For copy:
CIRCLE 206 ON READER CARD

Data Communication System

Six-page brochure describes vendor's TCP-64 teleprocessing system as "a versatile and economical general-purpose, stored-program communication control system, utilizing conventional common carrier communications facilities for a variety of digital communications applications." TELEFILE COMPUTER PRODUCTS, INC., Irvine, Calif. For copy:
CIRCLE 207 ON READER CARD

File Management System

The MARK IV file management system is described in a 44-page document adapted from "A Survey of Generalized Data Management Systems," prepared by the CODASYL Systems Com-

literature

mittee for the Conference on Data Systems Languages. Copies are available on letterhead request. INFORMATICS INC. SOFTWARE PRODUCTS CO., Product Services, 21050 Vanowen St., Canoga Park, Calif. 91303.

The "Uncomputer"

"Introducing the Uncomputer" is a bulletin describing what this vendor calls its "super compiler," which it says "drastically reduces" reprogramming costs for computer-based supervisory control systems. QUINDAR ELECTRONICS, INC., Springfield, N.J. For copy:
CIRCLE 208 ON READER CARD

Static Power Systems

A line of fourth generation static power systems and related equipment is covered in a four-page brochure which describes uninterruptible power supplies, static transfer switches, inverters, frequency converters, rectifiers, and battery chargers. STATIC PRODUCTS, INC. Garland, Texas. For copy:
CIRCLE 209 ON READER CARD

Data Management System

"ASI-ST, the Complete Data Management System," describes a system originally designed to process standard data files but since extended with TOTAL and IMS/2 interfaces. APPLICATIONS SOFTWARE INC., Torrance, Calif. For copy:
CIRCLE 210 ON READER CARD

The Urban Environment

"Urban and Environmental Technologies" is a brochure covering vendor's capabilities in city planning, environment, and energy systems. Specific areas covered include: urban renewal, low-cost housing, transportation, highway design, health services, law enforcement, air and water pollution, oil spillage, earthquake engineering, and electric power systems. COMPUTER SCIENCES CORP., Los Angeles, Calif. For copy:
CIRCLE 211 ON READER CARD

Data Entry System

Eight-page brochure describes vendor's CMC 5 KeyProcessing system for computer-controlled data entry. It summarizes the unit's major features and functions and describes software capabilities and hardware elements. COMPUTER MACHINERY CORP., Los Angeles, Calif. For copy:
CIRCLE 212 ON READER CARD □

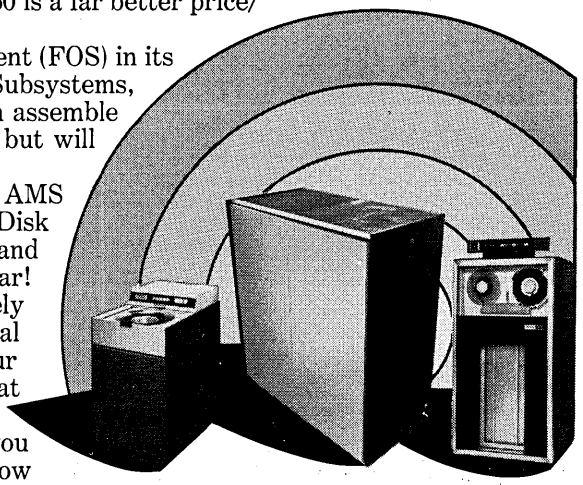
If you think the System/360 is out of date,

let ITEL bring you up to date.

To us, it seems like a lot of people are being coaxed into an expensive System/370 for not very sound reasons. Some are dazzled by its handsome white color. Some, by its monolithic memory. And some are just plain susceptible to that old business of "keeping up with the Joneses." They want whatever's new, because it's new.

Now, we've got nothing against the System/370. (In fact, we have already leased over $60 million worth of them.) But we do know that in many cases a properly equipped 360 is a far better price/performer than a 370. And our team of specialists can prove it!

You see, ITEL has over $200 million of System/360 equipment (FOS) in its portfolio, along with AMS Monolithic Main Memory, ITEL Disk Subsystems, ITEL Fixed Head Files and ITEL Tape Subsystems. So ITEL can assemble a 360 System that will not only outperform its 370 counterpart, but will also assure you substantial savings.



Let's look at an example: If you lease a System 360/65 with AMS Monolithic Main Memory (up to 4 million bytes!) and ITEL 7330 Disk Drives, you get a computer that's equal to or greater in power and performance than the 370/155, at savings of well over $100,000 a year! If you later decide to upgrade to an ITEL-leased 370, you are entirely free to do so. And since ITEL is a single source for both financial services and virtually all major data processing equipment, your installation is covered by a single contract that can be rewritten at any time to accommodate changing requirements.

If you think System/360 is out of date, we'd like to bring you up to date. Send for our 360 Lease Program brochure and we'll show you some surprising facts and figures that can save you a fortune. CALL THE PRICE/PERFORMANCE PEOPLE AT ITEL.

SALES OFFICES—Los Angeles, California (213) 542-4591 • San Francisco, California (415) 956-0444 • Washington, D. C. (202) 333-7167 • Atlanta, Georgia (404) 631-0927 • Chicago, Illinois (312) 263-0314 • Boston, Massachusetts (617) 237-3390 • Detroit, Michigan (313) 355-5151 • New York, New York (212) 486-9170 • Philadelphia, Pennsylvania (215) 839-1320 • Dallas, Texas (214) 528-4980 • Toronto 111, Ontario, Canada (416) 868-0936 • International, London SWIX, 7HQ, England (01) 235-2495

ITEL CORPORATION
One Embarcadero Center
San Francisco, California 94111
Phone: (415) 989-4220

EUROPE.

a one way trip for your computers

Join Datamation's powerful selling tour of all Europe in Fall '73

Five countries in five weeks — The Grand Tour

Datamation, the leading computer publication, in cooperation with the United States Dept. of Commerce, presents a hard selling, end user oriented, series of five exhibitions of U. S. computer equipment in Europe in Fall '73. It's The Grand Tour. The shows are one week apart starting in London in October, then Stockholm, Paris, and Milan. The Tour ends in Munich in November at the European-wide computer show — Systems '73. You are invited to join The Grand Tour of Datamation for an extraordinary opportunity to increase your total marketing program in Europe.

Five reasons for five countries in five weeks:

1. High end user attendance is guaranteed for you! Intensive mailing and advertising program to Datamation's list of over 25,000 qualified European prospects! More mailings and contacts through Dept. of Commerce lists! Assistance of Dept. of Commerce with difficult-to-contact prospects!

2. The Grand Tour will help you to support your present distributors or sales offices all over Europe. Are you looking for distributors? The Department of Commerce will pre-screen them for you for your interviews at Grand Tour Cities!

3. The Grand Tour is compact, yet covers all Europe. Cities were chosen on the basis of EDP buying power concentration. Your equipment is committed for only five weeks!

4. Datamation does everything. You just ship your equipment to JFK and then have your home office people or European salesmen at each city when we open. That's all. A few exhibitors might even retrieve their equipment at JFK at the end of the Tour but we don't expect to return much. We're all going to Europe to sell our computers, not bring them back home!

5. You can't beat this price/performance. Five countries in Europe in five weeks for $9,900! Maximum of forty booths available.

That's The Grand Tour. Call me or write for full details. I'll also send you a special reprint of the Dept. of Commerce's study on the total international market for U. S. EDP equipment.

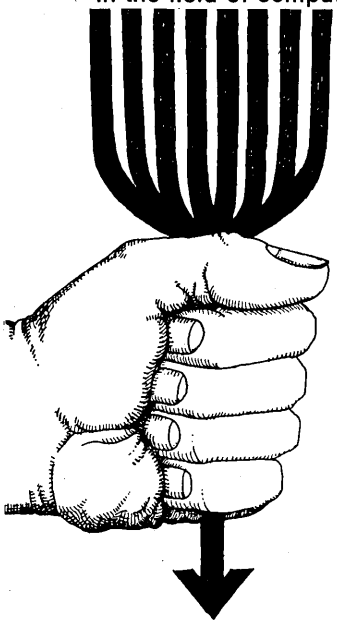
Charlie Asmus, Sales Director, The Grand Tour
DATAMATION 35 Mason St., Greenwich, Conn. 06830 (203) 661-5400

If you use leased lines, we'll help you use the least lines.

What we'll do is design, furnish, and install for you a Time or a Frequency Division Multiplex System. At multiple locations. Anywhere in the world. The whole works.

All of which, by reducing the number of lines you lease, drastically reduces your costs.

The Singer Tele-Signal Operation, a leader in the field of computer-based communications systems, has done this kind of work for years for military, civilian, and international customers.

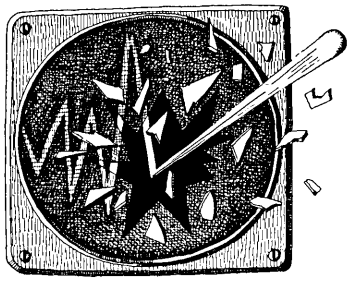


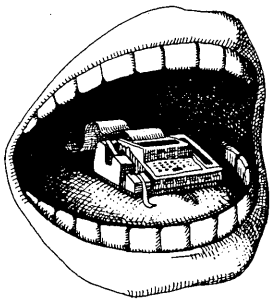
For Time Division multiplexing, we provide plug-in integrated circuit-card assemblies. They're engineered to give you the maximum in bandwidth utilization.

For Frequency Division multiplexing, we offer plug-in assemblies to accomodate a variety of rates to serve almost any teleprinter and/or data modem terminal hub equipment.

Our multiplexing systems reduce your need for leased lines and will concentrate a maximum number of channels into one.

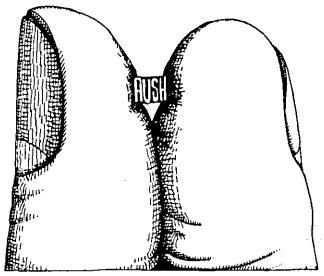
With the multiplexing, you'll need a Data Network Management Center. We'll supply it. A complete monitoring and control facility. One that insures the integrity of the system by rapidly isolating network faults, and thereby increasing traffic throughput.





Some companies require simultaneous speech and data communications (Speech Plus). We'll supply it. Up to eight data channels operating with speech. Or we can quickly tailor a system to suit your requirements.

We also improve the quality of a voice channel over a radio path using our linked compressor and expander (LINCOMPEX). And we have the answer to most of your telephone signaling problems with our universal inband signaling units.



Not the least important part of the system are the modems; these allow your digital devices to talk to each other over telephone lines (leased or DDD). We'll supply them. Many with features not found in their Bell counterparts.

We'll also supply voice privacy equipment, test equipment, and everything else you require to complete your communications system. And we'll provide service and personnel training throughout the world.

We've done all this for such prestigious telecommunications users as RCA Global, American Airlines, Western Union Data Services, FAA, NASA, and the U.S. military services.

So if you're in the market for highly-reliable, complex communications systems and components, check out the Singer line for fast, easy answers.

For information, write: The Singer Company, Kearfott Division, Tele-Signal Operation, 250 Crossways Park Drive, Woodbury, N.Y. 11797 Or phone (516) 921-9400.

SINGER

AEROSPACE & MARINE SYSTEMS

People

University Computing Co.'s service operations suffered stiff losses during the computer recession of 1970-71, and even today the company still owes its profitability to its Gulf Insurance operation, not to computer operations, which still are in the red. But the company thinks its on the road to the black again in computing services through a recently-consolidated University Computing Utility subsidiary, headed by ex-ITT executive DONALD G. THOMPSON. Since leaving Arcata National last summer to become the subsidiary's president, Thompson has moved swiftly to restructure the far-flung, stiffly autonomous service operations.


Donald G. Thompson

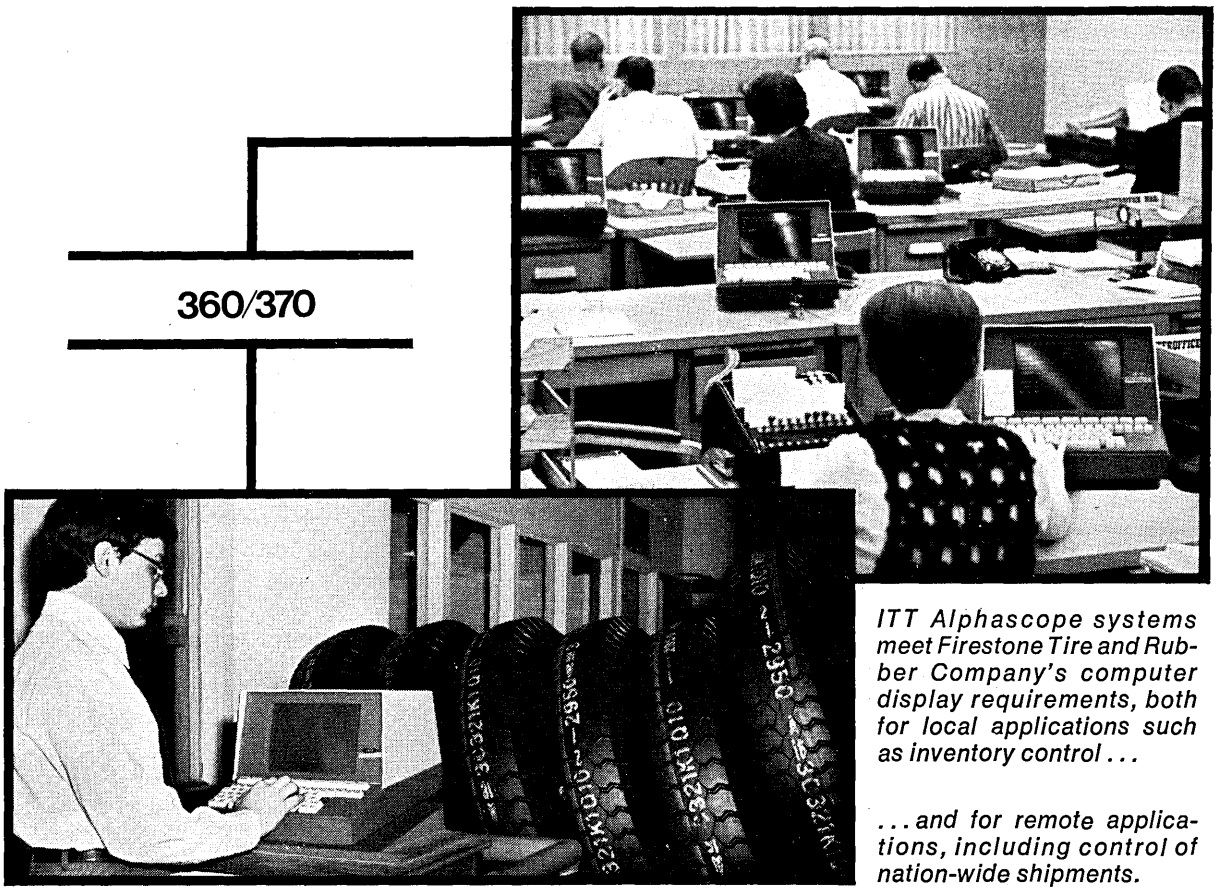
Last September he consolidated computer services into seven departments, each headed by a vp reporting to him. International operations are headed by one vp for Europe and another for the rest of the world. In the U.S., operations are divided into network services and industry services, the latter targeting its growth on specialized services to banks, insurance companies, and hospitals. Network services will operate UCC's computer centers, soon to be tightened by turning 13 centers across the nation into five "supercenters." It also will sell the company's operating software, including the highly successful DUO 360/370 package to run DOS programs in OS environments. (With some 100 customers, UCC's revenue reached the $1 million a year mark last summer from the DUO package.)

Thompson, 42, is a sandy-haired 6'3" manager with a reputation for unusual organizational skills. At ITT he was chief operating officer for the conglomerate's World Communications operation. Friends say that when he decided three years ago to leave to head Arcata's communications products operation, ITT chairman Harold Geneen spent four hours trying to talk him out of it. The head of Harvard's Advanced Management Program (Thompson was one of the few to take it without having a formal university degree) called him "one of the brightest young guys that ever went through my hands."

Thompson plans no further major reorganization. "My job now," he says, "is to convince our people how good they are."

When A. ZETTLER (ZETT) GREELY left a position as vice-president, finance and planning, for North American Rockwell's Electronics Group to take over the presidency of the group's North American Rockwell Information Systems Co. (NARISCO), he didn't, he says, realize how much fun he was going to have. Part of this has come in working closely with the utility industry in development of power monitoring and control systems. NARISCO this month in Philadelphia will cut over to on-line operation the biggest such system ever developed, one based on three B 6700s for triple redundancy. And interest in these systems is worldwide, says Greely. NARISCO is working on systems in Canada and Sweden, and Zett recently returned from a three-day visit to Russia where, as a guest of the Russian government, he exchanged information with Russian power people and learned "the Russians are inter-


A. Zettler Greely



ITT Alphascope systems meet Firestone Tire and Rubber Company's computer display requirements, both for local applications such as inventory control . . .

. . . and for remote applications, including control of nation-wide shipments.

Your 360/370 is only as good as your display systems. That's your best reason for ITT Alphascopes.™

Because Alphascope systems are the only displays produced by a major company that has broad data plus communications resources: International Telephone and Telegraph Corporation, a world-wide leader in telecommunications.

ITT Alphascope display systems are designed to bring out the maximum potential of your System 360/370. They operate economically in remote or local modes, at high speeds. They're completely compatible with standard 360/370 hardware and software. All components install easily, go to work immediately. Alphascope systems can improve your computer's cost performance, too. Compared with the computer-maker's displays, they can save you up to 25% every month. And ITT can be your single source for display terminals, printers, high-speed modems and low-cost 2701 replacement—all supplied as a total package. All supported by ITT.

You insisted on a computer from an industry leader. Shouldn't you demand the same quality in displays? Mail coupon for details.

DATA EQUIPMENT AND SYSTEMS DIVISION ITT

ITT DATA EQUIPMENT AND SYSTEMS DIVISION
East Union Avenue
East Rutherford, New Jersey 07073
(201) 935-3900

Please send me details immediately on ITT Alphascope™ and the following related systems equipment:

- ☐ *Controllers for 16 displays, 16 printers*
- ☐ *Data Printers, 10 or 30 cps*
- ☐ *Modems up to 2400 baud*
- ☐ *Data Adapter (four channel—2701 replacement)*

D-4

NAME_____

TITLE_____

COMPANY_____

STREET_____

CITY_____ STATE_____ ZIP_____

Together, you and Infotron can cut your communications costs.

Custom calls for us to fill this space with words of praise for our various time division multiplexers and Port Selectors.

Custom is wrong.

Because even though we save our clients thousands every month on their data communications costs, we don't know how much we can save you. And we *won't* know until we know your situation.

So, in the interest of effective communications, we're turning the rest of this ad over to you. You tell us the specific problem; we'll give you some specific answers. Just between us, of course.

You cut first.

Infotron Systems

INFOTRON SYSTEMS CORPORATION, 7300 N. CRESCENT BLVD., PENNSAUKEN, N.J. 08110 (609) 665-3864

Gentlemen:

Frankly, I don't know whether you can help, either, but I'm always interested in investigating new ways of saving money. Here's the information you need to get started on my problem.

We ☐ have ☐ are planning a system with a _____ (name and model number) central computer at _____ (location),

and the following terminals feeding into it:

Number	Manufacturer	Model	Type	Data rate	Modems used

These terminals are located at _____

As data lines, we use ☐ dedicated ☐ dial-up ☐ voice grade ☐ conditioned lines.

We ☐ do ☐ do not use any multiplexers at this time.

Anticipated system growth is as follows _____

My telling you all this doesn't obligate me in any way; I just want to make sure I'm not missing out on any savings.

Name _____ Title _____

Company _____

Address _____

City _____ State _____ Zip _____

Phone _____

people

ested and way behind us." But utility systems are not NARISCO's whole bag, says Greely. He sees them as the result of technology transfer from military command-and-control systems and believes "there's no end to areas to which this can be applied." NARISCO is working in environmental control and law enforcement, and Greely sees even supermarket operation as a problem "complex enough for our capabilities."

Dr. JAMES R. SHERBURN is a PhD, not a medical doctor, but his expertise is in medical data processing. And it's that which he hopes will turn Academy Computing Corp., Oklahoma City, of which he's new president, to profitability for the first time in its five-year history. Not that Academy will abandon its original charter of providing remote data processing for business users via its BELSTAR (Business Enriched Language for Storage And Retrieval). That's going very well, says Sherburn, with "350 terminals now on-line in 10 states and all the bugs out." Sherburn and a group he brought to ACC with him from Oklahoma Univ. Health Sciences Center Hospital systems department—where he was responsible for designing, developing, and implementing on-line real-time clinical laboratory drug information and analysis systems—hope to "expand the scope" of ACC into the health care services field, offering "total service" either on a time-sharing, facilities management, or systems design basis. Academy tried to get into the medical field before, he said, but lacked the expertise.

"If I had to pick one area for concentration it would have to be membership services," said DONN W. SANFORD, new executive director of the Data Processing Management Assn. (DPMA) after his first day on the job. Sanford, whose background is in association management rather than data processing, added: "It stands to reason if you increase benefits, you increase membership." DPMA's current membership stands at 28,000. Its new director also feels the association has to do more to entice present members to retain membership "as they advance up the corporate ladder" and to look more closely at the lower end of the ladder, "for today's system analyst is tomorrow's data processing manager." Sanford, 32, most recently was executive director of Independent Garage Owners of America, Chicago. Earlier he was membership director of Associated Equipment Distributors, Chicago, and managed this group's application of dp procedures. He considers his new appointment a challenge in that "DPMA is an organization that has chalked up some accomplishments and one which could and should have done more. It's my job to make it do more."

Donn W. Sanford

Dr. EMANUEL R. PIORE, who at 63 retired last year as IBM's vice president and chief scientist, has his own version of the word "retire." Piore spurned fishing in Florida for work in New York where he's treasurer of the National Academy of Sciences, chairman of the board of the Hall of Science of New York, member of the New York State Science and Technology Foundation and the Sloan-Kettering Institute for Cancer Research. He's also a director of IBM and a member of its Science Advisory Committee. Late last summer, Dr. Piore took on still another job—this time in the financial world as a director of Guardian Mutual Fund of New York. □

After years of sleeping through training films, we woke up with a great idea.

If there's one thing we've learned from data processing training films, it's that there could be better ways of training people.

The average student may begin by being interested. But if he doesn't end up by falling asleep, it's probably because the snores of the other students are keeping him awake.

You could get rid of these problems by hiring a real live teacher. But then you've got another problem. Paying him.

Surely, we thought, there must be a way of combining the economy of a film with the efficiency of a teacher.

We found the answer in something called Responsive Television.™* And we built it into the DPEN system.

With this system, the trainee sits in front of his own color television set.

He presses a button and a training film starts.

But not one that's like the usual boring data processing training film.

One that's specially made to be unboring.

A film that stops and asks questions. Just like a teacher. That demands answers. Just like a teacher. And, if the trainee gets the answer wrong, it tells him so. And gives him the correct one. Just like a teacher.

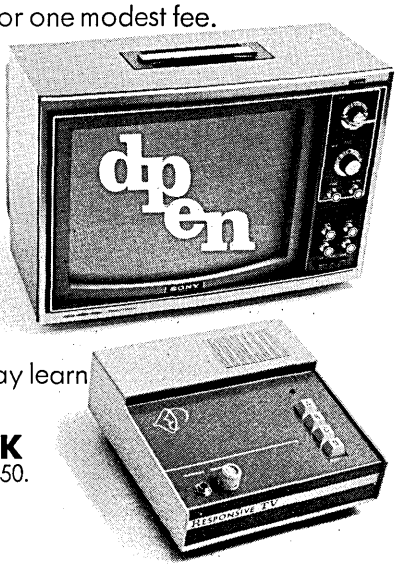
But, unlike a teacher, the DPEN system doesn't cost a lot of money.

The whole system, together with the right to borrow films whenever you want and for as long as you want, all comes for one modest fee.

If you'd like to know more about DPEN, write to us, or call, and we'll send someone over who won't high-pressure you or try to sell you something.

He'll just show you our system.

We think you may learn something from it.



DATA PROCESSING EDUCATION NETWORK
437 MADISON AVENUE, NEW YORK, N.Y. 10022 TEL.: 212-371-3250.

*Responsive TV—is a trademark of Data-Plex Systems, Inc.

Books

The Organization of the Data Processing Function

by Frederic G. Withington
John Wiley & Sons, Inc.
New York, New York, 1972
99 (oversize) pp. $10.95

This is an excellent book. The author knows his subject intimately and presents it in a thoroughly readable style. He addresses important issues, provides comprehensive lists of alternatives for resolving them, and dispassionately discusses the pros and cons of each.

The book, written for "anyone concerned with the planning, management, or operation of an organization's data processing facility," discusses three major topics:

1. System development, including a section devoted to administrative structure and another to project organization.
2. Data center operations, including separate sections on batch processing centers and on-line data centers.
3. The place of data processing function in its parent's structure, including sections on those companies (or autonomous divisions) that have a single data processing activity and also on larger, multidivisional organizations with multiple data centers. A final section treats the trends in parent organizations' structures that can be traced to the evolving data processing function.

The appendix provides illustrative examples for all sections; it presents summary descriptions of 11 actual data processing organizations drawn from the author's consulting experience.

The author opens by pointing out that the structure of the rules governing a data processing organization are fundamentally the same as those governing other organizations. But he goes on to point out that the data processing organization does have certain unique elements: (1) It is purely a service facility, existing only to provide assistance to others in performing the line functions of the organization, and (2) it has a technical character. Nonetheless, he believes that general managers have wrongly elected not to "interfere" with the grganization or management of data processing; he concludes that they often are much better qualified to structure a people-oriented organization than are technicians.

Withington makes an important distinction between development functions and operations activities, comparing the former to an engineering- or product-oriented group, and the latter to production. This distinction is an important one, and failure to recognize it (or failure to deal with it sensibly) has been a prime cause of ineffective data processing.

He argues (I believe correctly) for "very senior" executive involvement in data processing planning. But he recognizes that executives at that level will have relatively little time to spend on such reviews and recommends that long-range plans be reviewed only infrequently (perhaps annually). To prepare for these periodic reviews by the senior executive, the author proposes a steering committee consisting of functional vice presidents or general managers of the activities served and the data processing manager, supported by enough staff to prepare individual studies and position papers; it should meet "periodically" (presumably more often than annually). He also points out the importance of quality staff work to support the steering committee, recognizing that high-level, busy managers should not be asked to perform studies, nor to pass judgment on issues unless adequate studies have been made.

In the section on data processing operations, formal production control and data (quality) control functions are recommended. He also describes an interesting (and, in my experience, unusual) organizational unit called an Inquiry Center that provides rapid answers to users' queries using simple batch-processing techniques. In discussing on-line center organizations, Withington points out that the need for a formal quality control function is even greater than with most batch systems; security is included as one of the responsibilities of the quality control group.

Five alternatives are suggested to which the data processing function might be assigned:

1. Reporting to the financial executive
2. Reporting to a user department
3. Outside the organization's structure
4. Reporting to central management
5. Separate functional division

Following a discussion of the pros and cons of each alternative, the author states that most companies conclude that no one of them is ideal and that compromise is inevitably required; each organization must select the one that best fits its own nature and style and then be watchful for the difficulties that are likely to ensue. Furthermore, he asserts that experience shows that the location of data processing in the organization is likely to change, and that "it moves in only one direction—toward the center and toward the top."

Withington discusses large organizations with semi-autonomous divisions and the conflict between freedom of

books

action for the divisions and the corporate desire to centralize, at least in part. He then reviews in some detail the forces that are leading to centralization and the alternatives most often adopted in practice. At the extremes, one of the functions is completely centralized while the other is left completely free; i.e., operations centralized and systems development left to divisions, or systems development centralized and operations dispersed. Again he reviews the compromises that are found in practice, citing specific examples.

He appropriately recognizes the influence of the parent organization's authority structure on the data processing organization. He also describes the effect of the dp organization on the parent's organization, pointing out that the two are closely interrelated, and the changes in one will (or should) lead to changes in the other.

The author's examples cover a variety of organization structures: a small manufacturing company, small electric utility, small college, medium-sized manufacturer of electrical products, medium-sized bank, large consulting engineering firm, large European bank, large retail chain, large conglomerate manufacturing firm, giant international bank, and giant international automotive manufacturer.

Given the overall quality of the book, I am reluctant to find fault with it, but would like to suggest that the author consider the following additions in the next edition (or in his next book):

How can the transition from development to production be smoothed? In particular, what has been his experience with formal "design release" procedures, akin to those used in well-managed make-and-sell companies to move products from engineering into manufacturing?

What quantitative guidance would he give to companies faced with similar organizational issues, recognizing that general rules for establishing headcounts are dangerous—if not impossible—to specify, given that the appropriate levels vary dramatically in specific circumstances.

How can companies resolve the inevitable conflict between the classical "Communications Department" (usually voice-network oriented) and a data processing department that is contemplating a message-switching network?

Which only goes to say that the number of issues is endless. Fortunately, this book addresses a great many of them and does it well. If you are interested in data processing organization, you should read it—it is lucid, pragmatic, and comprehensive.

—George Glaser

Book Briefs

Factors Inhibiting the Use of Computers in Instruction

by Ernest J. Anastasio and Judith S. Morgan
EDUCOM, Princeton, N.J., 1972
132 pp. $4 (paperback)

Contrary to a widely held belief, the cost of computer systems is not the most significant obstacle to their use in instruction systems. In addition, other factors that severely limit the use of computer-assisted instruction are: the present lack of high-quality course material; the need to demonstrate the effectiveness of computers to educators; the fear of change and staff reductions resulting from the use of computers in instruction; and the lack of computer terminals appropriately designed for educational use. Of these problems, the education of teachers about computer techniques is a prerequisite to full acceptance of computer use in education.

These are some of the conclusions published in a final report of a study conducted by the Interuniversity Communications Council (EDUCOM) under a grant from the National Science Foundation. The study was based on the opinions of 30 authorities from education, publishing, and computing. The report also includes more than 80 suggestions for research designed to help solve the problems preventing the more widespread use of computers as instructional aids.

Contemporary COBOL

by George Woolley
Holt, Rinehart and Winston, Inc., 383 Madison Ave., New York, N.Y., 1971
270 pp. $6 (paperback)
$8.95 (hard cover)

The objective of this book is to provide an introduction to computer programming within the business data processing environment. In presenting the full COBOL language, some typical business applications for computers, and some more advanced programming techniques, the text can be used to provide background information for those specializing in another field, or to train students who will be making business programming their career. All of the program samples have been executed on a computer and the printouts included as part of the text. Each element of the language is introduced with both the related COBOL rules for its use and a concrete example of how it is used to solve a problem in business dp. □

THE PERFECT FRONT END...

FOR THE BUDGET CONSCIOUS CONNOISSEUR WHO NEEDS:

- Front-end support for System/360 CPUs
- Full compatibility with the System/370
- Integral emulator/front-end approach to network control
- Lower cost than equivalent IBM devices
- Host processor overhead reduction and core savings
- Support of a wide range of terminals
- Direct network control from user programs written in COBOL, PL/1 and BAL
- Operation on either selector, byte multiplexor, or block multiplexor channels
- Front-end software generation, loading, and dumping from the host processor
- Operation on standard Digital Equipment Corporation PDP-11 hardware

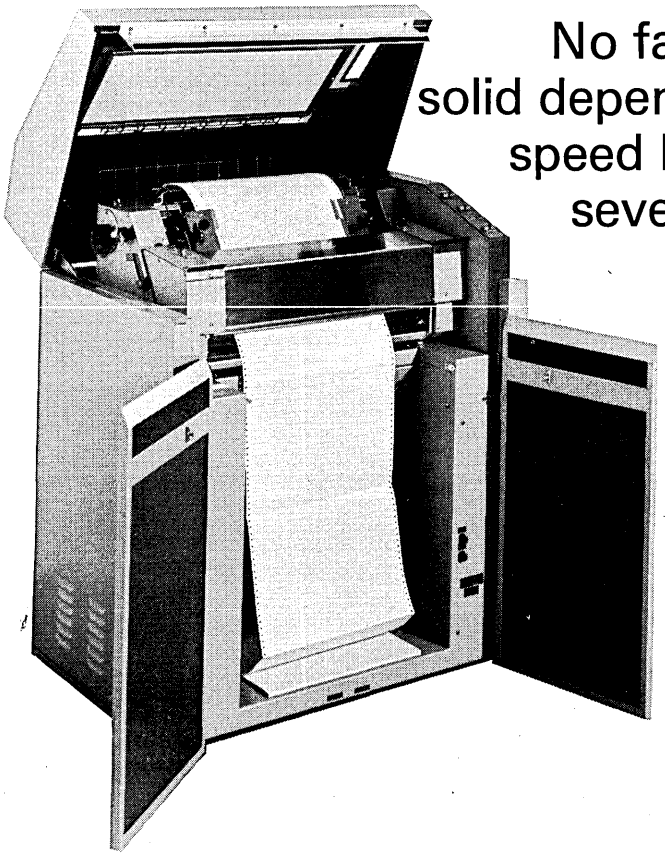
....370Φ™

phi Subsidiary of WANG Laboratories, Inc.
COMPUTER SERVICES, INC.
24 MILL ST., ARLINGTON, MASS. 02174

For more information call John T. M. Pryke at (617) 648-8550

Custom designed Volkswagon furnished by Roy Rioux VW of Westborough, Mass.

Solid workhorse



No fancy frills or gimmicks. Just solid dependability. Work our medium speed line printers 24 hours a day, seven days a week. They won't disappoint you. That's the way we build them. What may surprise you is the low OEM price you'll pay, the beauty of this 600 lpm workhorse is price/performance.

SEE US AT THE FJCC

Data Printer Corp

Executive Offices: 201 Vassar Street / Cambridge, Ma. 02139 / (617) 492-7484 / TWX 710-320-0868

Regional Office: 1110 East Ash Avenue / Fullerton, California 92631 / (714) 871-7665
Regional Office: P.O. Box 578 / Clifton, New Jersey 07012 / (201) 777-0135
United Kingdom: Core / 852 Brighton Rd. / Purley, Surrey CR 2 2BH / England
Europe: Core-Computer Related Equipment Limited / 6000 Frankfurt (Main) / Korberstrasse 12
The Thorson Company / Sales representatives in the following cities:
Albuquerque / Dallas / Denver / Houston / Palo Alto / Phoenix / Seattle

letters

(Continued from page 25)

ity if they did not recognize they were working for a modern industrial corporation. Did they think the book *THINK* was science fiction? Or was it disloyal to read such?

If the logic and analogies of his legal cases are on a par with his pejorations regarding IBM and Mr. Learson, at least regards their validity, I suggest he transfer his interests to the fields of divorce and personal injury, where they would be more appropriate. After all, that's what he's protesting, isn't it? Or is it excommunication?

JOHN SEITZ
Quebec, Canada

Back east

I was delighted to see the reference to SIMSCRIPT II in your department on Software & Services (Aug., p. 102). Your news item, however, has me still

at Consolidated Analysis Centers Inc. CACI and I parted ways in 1968.

For three of the years since that time I served as portfolio manager, and later president, of Arbitrage Management Co., Inc., now a subsidiary of Mack, Bushnell and Edelman, Inc. (member NYSE and ASE). Currently I divide my time between consulting for Arbitrage Management Co. and consulting generally on financial, information system and simulation applications.

To the best of my knowledge, your other information is correct concerning CACI, SIMSCRIPT II.5 and its applications.

HARRY MARKOWITZ
Scarsdale, New York □

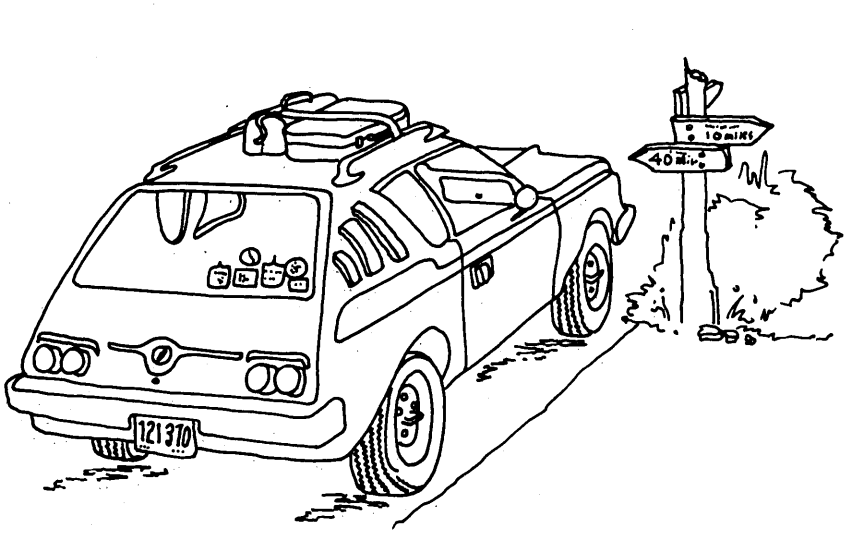
DATAMATION welcomes correspondence about the computer industry and its effects on society, as well as comments on the contents of this publication. Letters should be typed if possible, and brief. We reserve the right to edit or select excerpts from letters submitted to us. Write to 94 S. Los Robles, Pasadena, CA 91101.

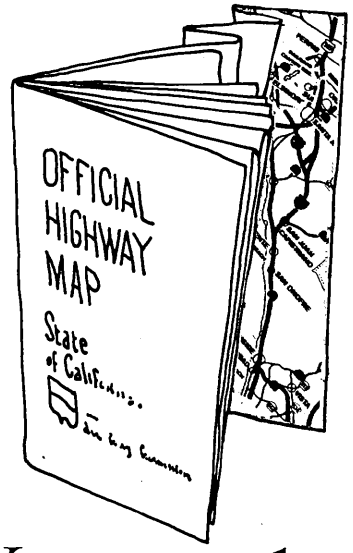
The second edition of our microprogramming handbook is more revealing than the first

The original edition made many microprogramming concepts public for the first time. Now we have an expanded 450-page version with information on the Micro 1600, the mini that makes microprogramming irresistible. Our new paperback covers microprogramming from the most elementary stages all the way up to descriptions of complex computer architecture and special purpose applications.

Everything you need to know is there. Tutorial primer. Glossary of computer technology. Application information. Computer users' reference material. Complete details on hardware, software, and firmware for the Micro 800 and Micro 1600. Even if you already have the first edition, you'll value the second. Send for a copy today. It's free. Write to Microdata Corporation, 17481 Red Hill Ave., Irvine, Calif. 92705, (714) 540-6730.

Microdata





If you want to save time on a trip...

You need the right road map.

If you want to save time selecting computer products and services...

You need the new 1972 EDP Industry Directory from Datamation.®

It's even easier with the new edition of Datamation's directory to find just the product or service you want. We've changed the product groups, based on user experience with the first edition... added states to the consultant and service bureau entries, so you can see quickly if your area is covered... and put product page references for each vendor in the company index.

Most important, the new edition gives you over 20,000 products and services ...2,500 vendors to choose from. All of them are sorted, arranged, and indexed for convenience... in the form of compact listings that show clearly the vital information—prices, maintenance cost, compatibility features, languages. And cross-checking with a company index makes it simple to find out about the seller's facilities and services.

To get your own copy of the directory, send a check or company purchase order for $25,* along with your name, title, and mailing address, to 1972 EDP Industry Directory, Technical Publishing Co., 1301 S. Grove Ave., Barrington, Illinois 60010.

**In the U.S. and Canada; $35 elsewhere.*

Is waiting for the 3270 costing you money?

There is an alternative.

Only Courier can give you 3270 performance and features with 2260 compatibility . . . *now.*

That's plug-to-plug compatibility. No software changes. Remote or local. Or dial-up. Choice of 480, 960, or 1920 screen sizes. Fastest response time in the industry.

Courier is replacing 2260's and 2265's (and others) with Executerm terminals and saving some well-known companies a lot of money. You could be next. A few minutes of your time is all it will cost you to find out.

And isn't it nice to know you have a choice.

Los Angeles (213) 641-6495: San Francisco (415) 989-6580: Dallas (214) 748-5981: Salt Lake City (801) 486-2317: Kansas City, Mo. (816) 561-8785: Chicago (312) 696-4360: Detroit (313) 357-2330: Cleveland (216) 734-4840: Columbus (614) 457-5107: Pittsburgh (412) 931-4116: Philadelphia (609) 795-3348: Washington, D.C. (202) 223-9400: Atlanta (404) 284-2361: New York, N.Y. (212) 758-4955: Boston (617) 890-0020: Houston (713) 225-9561: Phoenix (602) 258-7271: Denver (303) 399-6990: Cincinnati (513) 984-1555

Consider the alternative:

Courier
Terminal Systems, Inc.

A SUBSIDIARY OF BOOTHE COMPUTER CORPORATION

F.J.C.C. BOOTH 1060

2202 E. University Drive, Phoenix, Arizona 85034

Look Ahead

(Continued from page 8)

been taxed in the past, but excludes data base management systems.

Fresh taxes can be imposed in the two-year period says the board (verbally backed up by the state attorney general's office), because limiting assessment to what's been assessed in the past would not be "equal treatment under the law." Whether or not they will be is up to county assessors who generally were frustrated and confused last month as to what to do next. In Los Angeles County, bills which included taxes on software were still being held up pending receipt of guidelines based on the newly adopted definition of "basic operational programs." And one county assessor was wondering how you find the "basic operational programs" to tax if they don't show up on the books.

HELP FOR PROGRAMMING MANAGERS ON THE WAY

A new tool to help technical management figure out just how much their programmers know about Cobol is on the way from Paris. Called Cobtest, the package was developed by Inforama, a French software firm that has used it to test more than 3,000 programmers in the past year. It is being translated into English and expanded to include questions on more complex aspects of the popular programming language. It will be marketed in the U.S. by Information Management, Inc., of San Francisco. Whether IMI president Howard Bromberg, one of the leading figures in the development of Cobol, will take the test himself--or release the results--is not known.

GOVERNMENT GOING THIRD PARTY

Within the next 18 months, third-party lessors will get a chance to supply "hundreds" of dp systems to the feds. The equipment is now on rent--largely from IBM--under 30-day cancellation contracts. GSA is hiring two new contract officers to help agencies ferret out systems that can be replaced with third-party agreements at a 30-50% reduction in leasing costs.

RUMORS AND RAW RANDOM DATA

When Nicholas J. Mazzarese announced he was taking a leave of absence from Digital Equipment Corp. as vp in charge of the minicomputer operation, most people expected to see him back. Now they're not so sure. He's cashed in 18,000 shares of the 23,000 DEC shares he owns... The announcement of a reunion of ElectroData alumni Dec. 4 from 6-8 p.m. at the Disneyland Hotel in Anaheim declares that the former Pasadena computer company will "rise again--as soon as they give us the money to build the 1401"... The first voice recognition systems from two-year-old Threshold Technology, Inc., Cinnaminson, N.J., have gone to United Airlines and TWA for baggage sorting. The handler speaks into a microphone to assign the baggage to a flight via computer... IBM has won the first round of a double taxation suit against the State of California. A Los Angeles Superior Court ruled the company must be given a refund for sales taxes it paid on equipment which already had been assessed a use tax. Now they'll haggle over a dollar figure... North American Rockwell Information Systems Co. (NARISCO), bidding on a contract to build a system for electric power monitoring for Southern California Edison Co., encourages employees to give their all to the effort. Signs posted throughout the plant read: "Socket to 'em."...GT&E wants to revive a much-disputed tariff for big users of telephone lines (e.g., service bureaus). Its Northern Ohio Telephone Co. subsidiary is said to have asked approval for an ISAL (Information System Access Line) tariff that would up the phone bill for these users up to 400%.

Advertisers' Index

advertisers' index

tpc Technical Publishing Company

Arthur L. Rice, Jr., President
Gardner F. Landon, Exec. Vice President
James B. Tafel, Exec. Vice President
Calverd F. Jacobson, Financial Vice President
Edwin C. Prouty, Jr., Secretary and Director of Data Processing

Advertising Offices

Sales Manager and Vice President
John Brennan: Greenwich, Ct. 06830
35 Mason St. (203) 661-5400
Eastern District Managers
A. Treat Walker, Irwin L. Werfel, Warren A. Tibbetts: Greenwich, Ct. 06830
35 Mason St. (203) 661-5400
New England District Manager & Vice President
Warren A. Tibbetts: Manchester, N.H. 03104
112 W. Haven Rd.
(603) 625-9498
Midwest District Manager
John M. Gleason: Chicago, Ill. 60606
205 W. Wacker Drive
(312) 346-1026
Western Manager and Senior Vice President
Hamilton S. Styron: Pasadena, Ca. 91101
94 So. Los Robles Ave.
(213) 681-8486
District Manager
Alan Bolté, Jr.: Pasadena, Ca. 91101
94 So. Los Robles Ave.
(213) 681-8486
Western District Manager
James E. Filiatrault: Redwood City, Ca. 94061
61 Renato Ct.
(415) 364-3171
England and Western Europe
Wallace K. Ponder: Wallace K. Ponder Co.
Pinner, Middlesex HA 5 IJU, England
31 Lyncroft Avenue
(01) 868-9289

Other tpc Magazines

Plant Engineering
Pollution Engineering
Power Engineering
Purchasing World
Research/Development

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

The Forum

Program Modules Proposed

In the June Forum, Paul D. Griem, Jr.:

1. Stated that "the quality of the software produced by our profession is extremely *uneven* . . . "

2. Emphasized the need for the development and use of industry-wide standards for program specifications, design practices, coding preferences, etc.

I wholeheartedly agree that the quality of software being produced today is quite uneven—some excellent, some average and some deplorable and that we have many bridges to cross in promoting standardization in data processing. As professionals we must identify the better qualities of excellently designed systems, publicize their use and potential value (in terms of cost savings and the promoting of standardization) to all data processing installations that can benefit from their application.

There are several generalized program modules which could, and in my opinion should, be used by every medium size or larger computer installation in the country. As you read through the list try to visualize the impact on an organization if all of these modules were operational.

1. *Read/write module:* a generalized routine which does all of the reading and writing of data to and from files. This routine is called by all application programs that need to read or write data on files. This module eliminates the need for writing such instructions in numerous programs, and makes it possible to change a single module in the event one or more data files is changed.

2. *Input validation module:* a generalized routine capable of validating input data simply by having the user specify various characteristics about each field of data (actually a table is built to describe the various characteristics of each field and this single generalized module does the validity testing of all input data for the installation).

3. *Tables on disc:* no tables are maintained in individual application programs. A single generalized program module maintains the tables for all programs on disc. Thus: it is never necessary to recompile a program to add, change or delete an item in a table; users are permitted to update their own tables just as they would any other data file maintained on disc.

4. *Report module:* this module automatically prints the page headings on all reports generated; keeps track of page numbers, line counts, etc.; prints sample data at the beginning of each run for the operator to use in aligning the forms in the printer; prints the recipients of each report so that data control can look at the report and identify who receives each copy.

5. *Calendar module:* this module maintains a three-year calendar on disc (a record for each day of last year, this year and next year) and is capable of making an automatic determination of any of the following for an application program (thus eliminating the need to have the logic in individual programs):

for Standardization

The need to purge a file because it is the last day of an accounting month.

The need to generate payroll because it is the 15th of the month or because it is the first Friday of the month.

The need to skip certain applications because today is a holiday, Saturday or Sunday.

The fact that this year is a leap year and February has 29 days.

In short, the use of this module eliminates the need to write any logic in an application program regarding the determination of whether the time has arrived to activate specific routines within a program.

6. *Record validation module:* this routine automatically feeds only specified types of records to an application program, automatically identifies erroneous types of records and disposes of them as specified by the application programmer. It is thus not necessary for the programmer to write any instructions to determine the validity of records read, or the manner in which erroneous records are to be disposed of, and invalid records are always disposed of in a standard manner.

7. *Input control module:* a single module through which all input data is read, logged as having been present and directed to the various application programs. This module determines when each of the application programs is to be initiated.

8. *Printer output control module:* this generalized module works in accordance with the report and calendar modules and makes all determinations regarding the appropriate time for reports to be printed because of time of day, priority, etc.

9. *Error control module:* this generalized program module handles *all* error transactions detected by application programs. Its functions are to:

Log all such errors onto disc.

Print such errors in accordance with the desires of the application programmer for correction by the user.

Generate a turnaround document onto which the user can write the information to correct the error.

Continue to notify the user daily (or as specified) until the error has been corrected.

Process all data for corrections, build a corrected record and pass valid records (or what should be valid records since this module does little validity testing of the data entered in an attempt to correct an error) back to the input module.

How much simpler would the life of the data processor be if his computer had the capabilities just mentioned. At least the following benefits would accrue to your company:

1. Much of the effort required to write new application programs would be saved. No need to write input validation programs, etc. (conceivably a reduction of 30-50% of programming time, in my opinion).

2. Program maintenance would be reduced since it

would not be necessary to modify a program to change a table or because the format of a master file changed.

3. Standardization of many functions would automatically be accomplished by the use of these generalized modules. Your systems and programming standards manual need only specify that these modules consistently be used.

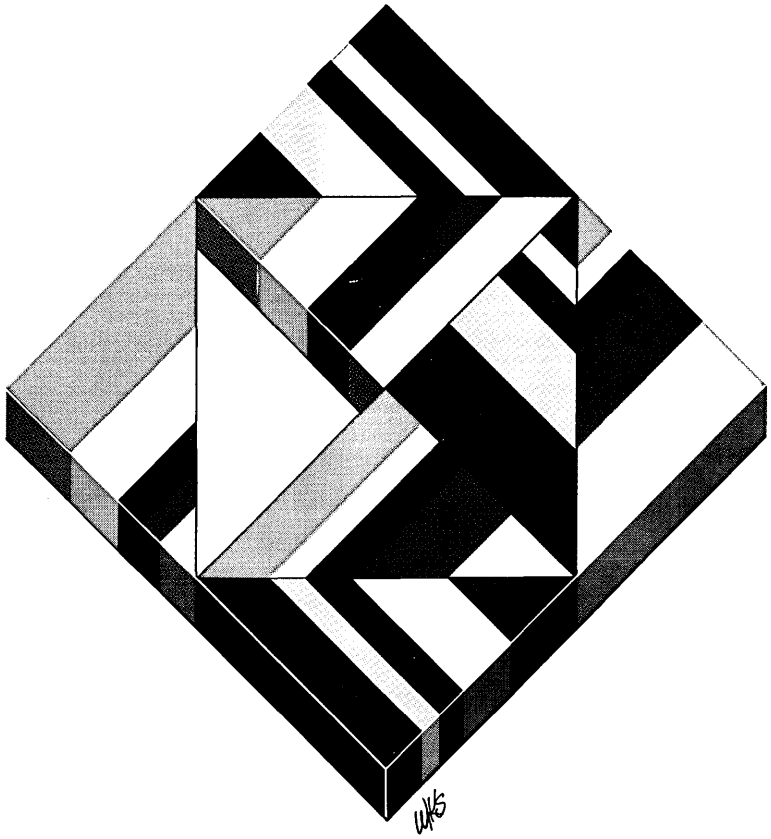
4. Security of data on master files and output reports could easily be controlled since all would be handled by the two generalized modules.

I am in complete accord with Mr. Griem regarding the unevenness of software being developed and the need to promote various industry-wide standards. I believe that we as data processing professionals can do much to promote standardization by identifying those existing successful practices that are worthy of further dissemination so that they might eventually become generally accepted data processing standards.

Each of these generalized program modules has been developed and operational for a year or more (some as long as seven years). These modules (or slightly different versions) could be used by any medium size or larger computer installation in the U.S. The widespread use of such modules (if done without wheel-reinventing) would speed up application development, promote standardization and significantly reduce development costs.

I would be glad to furnish more information about these and other generalized modules to interested readers.

—W. Leon Sanford, Sr.
Touche Ross & Co.
2100 Railway Exchange Building
St. Louis, Missouri 63101



Why Modularity?

Because you've got the responsibility of planning for the future, because assuring online service today for all the users of your company's information processing system isn't enough.

Arm yourself with user studies, industry norms and reports on the anticipated growth of the industry. This data ought to enable you to make a reasonably accurate estimate of your future data comm needs over the next several years.

Historically, our industry has adhered to the monolithic black box syndrome. One unalterable function per black box. So you have two hardware approaches: either squander a small expenditure on the economy-size box that you'll have to replace with a bigger one when your system grows, or make a big initial investment in the big black box that will encompass all your needs for the next several years—that is, providing your predictions are accurate.

You've had to make compromises, of course, whichever way you chose. Because, once you commit yourself to black-box hardware, there's no changing your plans. User requirements may change, departments may upgrade their terminal equipment or eliminate it, but you've got your system. And your users will simply have to conform to its capabilities.

We think, conversely, that hardware should conform to your user requirements. So TRAN has a better way—modularity. Our time division multiplexer, called the Multitran, accommodates changes and upgrading in your users' requirements continually, from day to day and year to year, without becoming obsolescent.

Multitran is an off-the-shelf, hardwired, fully transparent TDM Network Control System comprised of interchangeable modules. So, unlike the traditional black box, now you can buy a simple box with only a few modules, and tomorrow, when you want to change or upgrade or add more terminals, you can buy additional modules and plug them right into the same box.

You never have to buy more hardware than you need right now and you never waste a penny of your equipment budget. Every dollar expended is a long-term investment in a data comm network that can grow and change right along with your day-to-day information processing needs.

Other than reconfigurability, Multitran has many features and capabilities that contribute to its broad applicability as the basic building block for both small and large end-user data comm networks. Like true synchronous and asynchronous intermixing of any and all data rates. Like the combination of trunking facilities—voice-grade, wideband, private twisted pair, microwave. Like switching and drop-and-insert capabilities when you eventually grow into a computer-controlled switched network.

Find out all about Multitran TDM Network Control System and TRAN's entire line of modular data comm equipment. *Because the future is no further away than tomorrow.*

Circle No. 2, write or call us direct:

Modularity

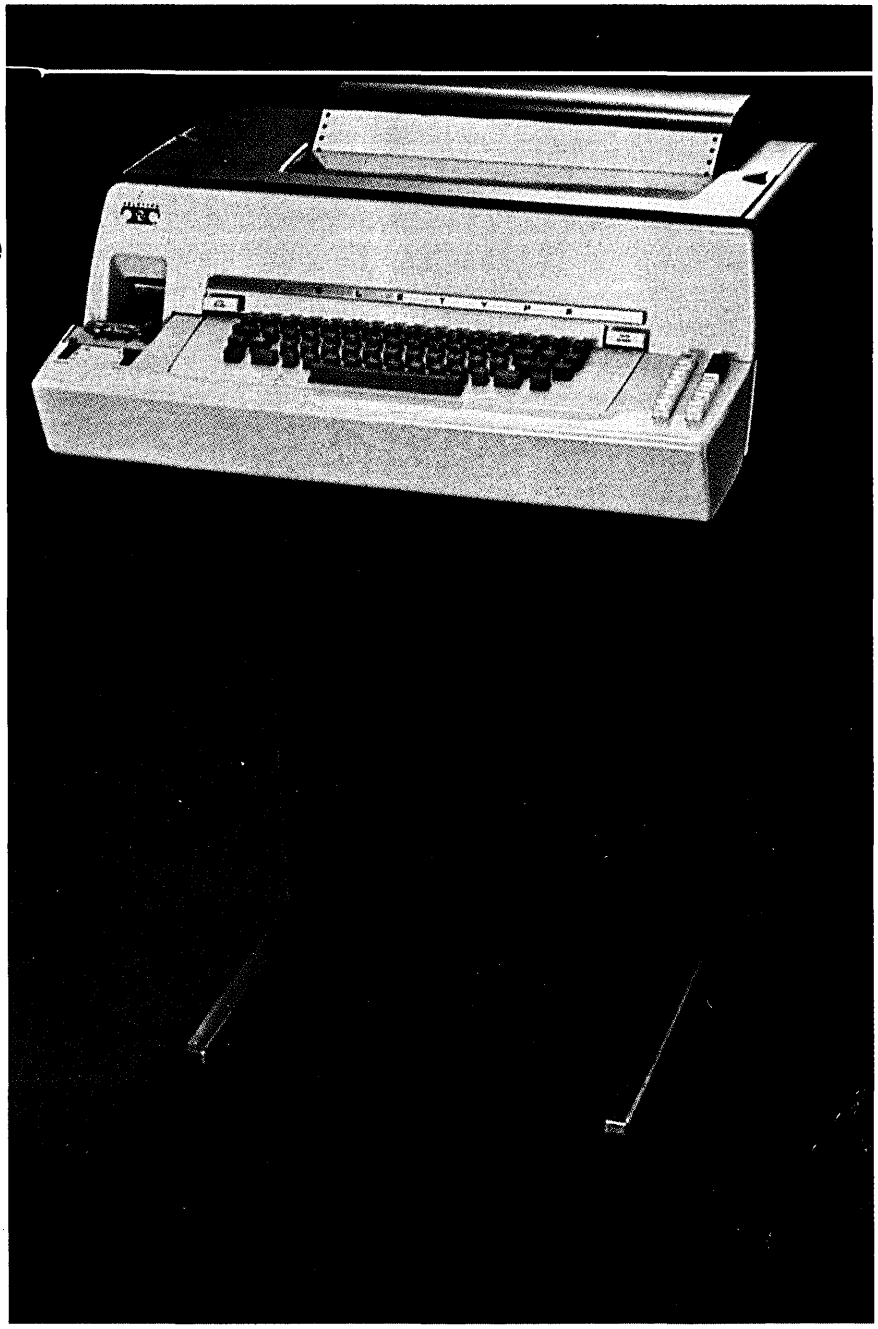
multitran

tran computer transmission corporation

2352 Utah Avenue, El Segundo, California 90245 • (213) 973-2222

Our new model 38 series.

Even the most expensive ASR is a very inexpensive $1430.*



Teletype is a trademark registered in the United States Patent Office.

Just because you need big machine features, you don't have to pay big machine prices.

Not when you've got some new alternatives: the Teletype® model 38 series terminals. They offer a lot of features. For only a little money.

Prices for an RO model 38 start as low as $905. KSR model 38 terminals begin at $1168. Even ASR terminals go for as low as $1402. And for less than $200, you can equip any of them with a built-in, factory-tested modem.

Standard equipment on all model 38 terminals is a 132-character printing format on a 15-inch wide platen. Upper and lower case is also standard. So is two-color printing.

Speed? 100 words per minute. If you need more—up to 2400 wpm—the model 38 interfaces with the Teletype 4210 magnetic tape data terminal.

There's more, too. Like plug-to-plug compatibility with the model 33. So you can update your system without changing it.

The new Teletype model 38 series terminals. Where else can you get so much for so little?

It takes more than manufacturing facilities to build the machines Teletype Corporation offers. It also takes commitment. From people who think service is as important as sales. In terminals for computers and point-to-point communications.

That's why we invented a new name for who we are and what we make. The computercations people.

TELETYPE

For more information about any Teletype product, write or call: TERMINAL CENTRAL; Teletype Corporation, Dept. 81N, 5555 Touhy Avenue, Skokie, Illinois 60076. Phone 312/982-2500

*Prices subject to change without prior notice.

CIRCLE 3 ON READER CARD