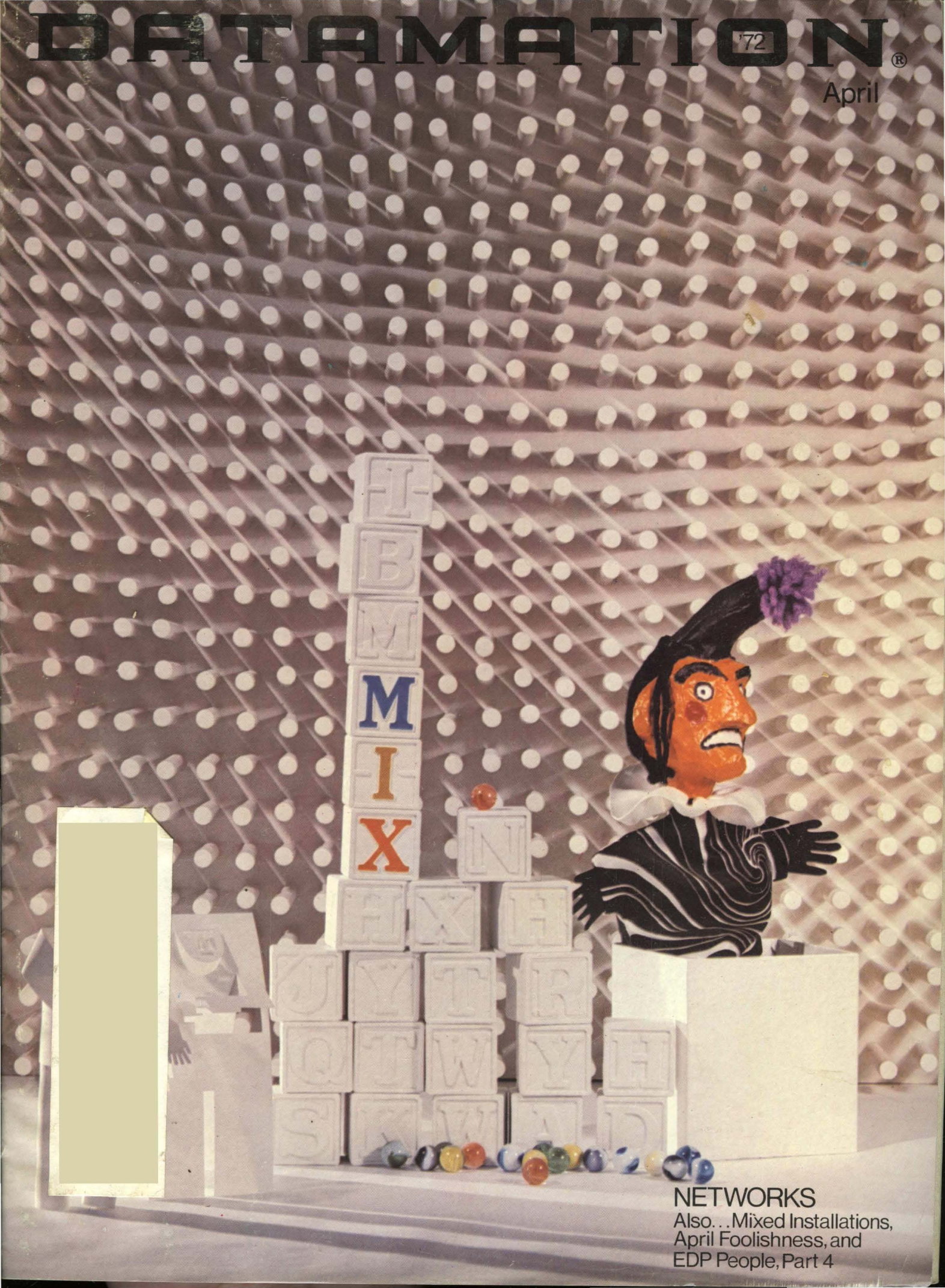
DATAMATION®

'72

April



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It's modular. We can supply it ready to talk to your system's computer in the interface, hand shaking and code format you need. It's adaptable to practically any information system for production monitoring, medical data, machine loading, time and attendance reporting.

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- 12 or 16 character slide switch or keyboard entry.
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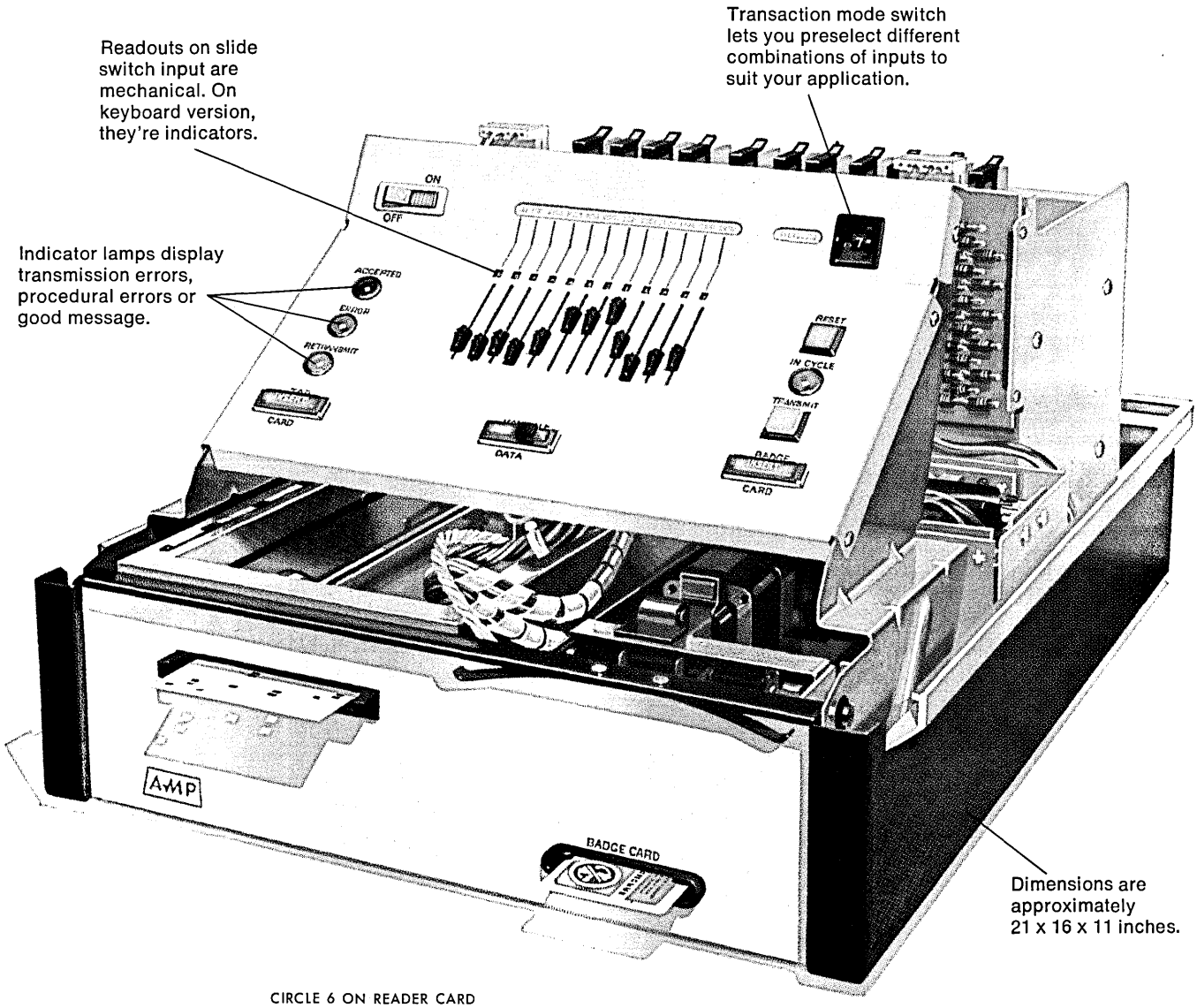

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MODELS 22+, 30+, 40+, 50+, 65+

Who has Fabri-Tek produced core memories for over the past 15 years?

Hundreds of companies, including:

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Now you can capitalize on this expertise, as this growing list of 360 customers and users are doing:

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FABRI-TEK INC.
MEMORY PRODUCTS DIVISION

CIRCLE 15 ON READER CARD

APRIL, 1972
volume 18 number 4
This issue 133,200 copies

About the Cover

Against the network background, our art director has mounted an assemblage of traditional April foolishness, a mix for installations to consider, and edp people casting their shadows before them. Photography is by Georg Schacht.

departments

DATAMATION

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CHECK OUT OUR COMPETITION

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Automatic Source-Level Customization	Yes	
Application Test Facilities Including TRACE	Yes	
Response Time Simulator	Yes	
Off-Line Application Testing	Yes	
TP Access Method Independence	Yes	
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FACILITIES		
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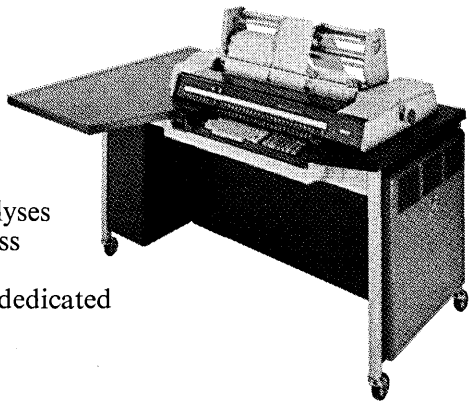

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CIRCLE 9 ON READER CARD

Look Ahead

CDC WILL TRY TO EXTEND 360 LIFE

Undaunted by those angry growls from Armonk over independently supplied 360 memory expansion boxes, Control Data Corp. has decided to plunge into the fray. It's doing this by buying up the production of ailing Minneapolis neighbor, Fabri-Tek, Inc. That long-time oem memory supplier entered the end-user market three years ago with a large auxiliary storage core memory but dropped the product early this year to concentrate on the main-memory add-on business. This spring it was understood to have 110 installations.

The extent of CDC's plunge and whether it would provide its own maintenance or continue to use Sorbus was not clear at this writing in late March. But it was known that its first order is for $1 million of Fabri-Tek's production. CDC brings a strong marketing force to this subindustry--the strongest to enter so far--and it's getting considerable support: the marketing training budget at the Golden Palace in Bloomington (local nickname for CDC's $15-million WHQ) has tripled within the last year.

Elsewhere, IBM, when pushed into court by Itel Corp., quickly retreated from the stand that it might not maintain cpu's expanded beyond IBM limits by the independents (see March, p. 7). However, some independents say the effects of the implied threat are still being felt as users cancel memory expansion orders to avoid a wrangle with the IBM maintenance people.

QUESTIONS IBM TACTIC IN EUROPE

Last September, Computer Leasing Co. asked IBM to modify a 360/30 so that it could operate on Europe's 50-cycle current. Apparently the mails were slow, because Computer Leasing says it wasn't until last month that the Grey Giant wrote back, declining to make the modification. Lee Meadows, CLC's executive vp, says IBM is trying to keep competitors out of Europe illegally. Asked whether he plans to complain to the Justice department, he said, "It's a possibility."

NCR CAN NOW THINK SMALL

Relieved of the problems of developing big machines by partner Control Data, The National Cash Register Co. concentrates on smaller systems. Early last month it introduced the 399 accounting terminal with 8K mini, and within a month will come out with two new members of the Century family. The new machines, to be ready for delivery early in '73, are expected to be higher performance versions of the Century 100 and 200 series, but we're told NCR may have found a way to insure that the new machines do not impact the installed Century base of some 3,000 cpu's the way that RCA's new series impacted its Spectra base. One of the new Centuries will have an MOS main memory, and the other will use core.

TAX ME, TAX ME NOT...

Software users and suppliers in California are sorely taxed on the subject of taxes. A bill currently before the state legislature, which has the support of vendors, users, and professional societies, would restrict assessment of software as personal property to the value of the raw material, the cards or tapes. But the Board of Equalization hasn't given up on a tax rule which would define all software as tangible and taxable.

A hearing on the rule is scheduled for June 9, and it could be

adopted after that if the bill isn't passed first. And 7,800 companies in Los Angeles County and 4,000 in Orange County had to include software when they filed business personal property statements this month. Bills based on these statements will go out June 1 for payment on or before Aug. 1 if the bill isn't passed before that. Should the bill pass after Aug. 1, "well, we'll just have to issue refunds," says a spokesman for the L.A. County assessor's office. If the bill fails, the firms can pay under protest and file a complaint with the assessor's appeal board; should appeal be denied, they can take the case to court as did California Computer Products, which is seeking return of $749,530 in taxes paid on software to Orange County in 1969-1971.

GOVERNMENT WANTS HAPPY USERS

Although Computer Sciences Corp. won a big contract last month to supply on-line machine time to federal agencies across the country, present suppliers won't necessarily be squeezed out, at least not right away. "We want happy users," says a spokesman for the General Services Administration, "so if an agency wants to stay with its existing supplier, even after its present contract expires, we won't beat them over the head." The contract, signed last month, runs a minimum of 15 and a maximum of 51 months. It obligates the feds to buy up to $42 million worth of dp services from CSC.

THE VISIBLE MAN SPEAKS

The visible Dr. Herbert R.J. Grosch ("I'm at the opposite end of the visibility spectrum from the other H.R.--Hughes") challenged the computing profession to share the benefits of its technology "with the victims who pay the bills." Keynoting a UCLA-Informatics symposium on "Effective vs. Efficient Computing," Grosch, typically blunt, said the industry's successes to date "have been of dubious social value." He listed them by generation: first, tin airplanes and missiles; second, submarines; third, confusion and OS 360, "a traveling catastrophe of unimagined magnitude."

The fourth generation he called "the harbinger of still more atrocity--invasion of privacy, domination of law processes by FBI-type agencies."

He accused the industry of tending to use its technologies "for our own benefit...to have fun." He urged his audience to put the goals of the work they do ahead of the work itself, to "state the goal, judge it, establish a metric, and think about passing benefits along to others." Apparently he didn't expect his advice to be widely taken, for he offered Grosch's Third Law: "Things will continue to get worse without limit."

RCA MEETING MOVES TO AVOID BUSSING

Former RCA employees, angered at the company's sudden retreat from the computer business last year, had been planning to charter busses from points in Massachusetts and New Jersey and descend upon RCA's annual meeting. They'll have a long way to go. The meeting is on May 2--in Beautiful Downtown Burbank, Calif. Many think there may have been a connection between the demise of the computer operation, based in Marlboro, Mass., and Cherry Hill, N.J., and the decision to hold the annual meeting on the West Coast. RCA's annual meeting traditionally is held in the East.

(Continued on page 155)

Westinghouse uses Sycor Terminals.

Because they have to be sure.

Westinghouse has a lot of products to keep track of. And a lot of customers to keep happy. The fact that they use Sycor CRT Intelligent Terminals to help keep things running smoothly says a lot about the dependability and efficiency of Sycor Data Entry and Communications Systems.

If Sycor can help Westinghouse, maybe they can do the same for you. Because Sycor Terminals and Systems are designed to produce time-saving, cost-cutting, and error-reducing differences in your day-to-day operations—especially if your business depends on branch offices and warehouses the way Westinghouse does.

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For more information, simply indicate which of the following Sycor configurations interest you (most can be ordered on a building-block basis). Mail coupon to: Sycor Inc., Department 705, 100 Phoenix Drive, Ann Arbor, Michigan 48104.

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- ☐ Please have a sales representative contact me.

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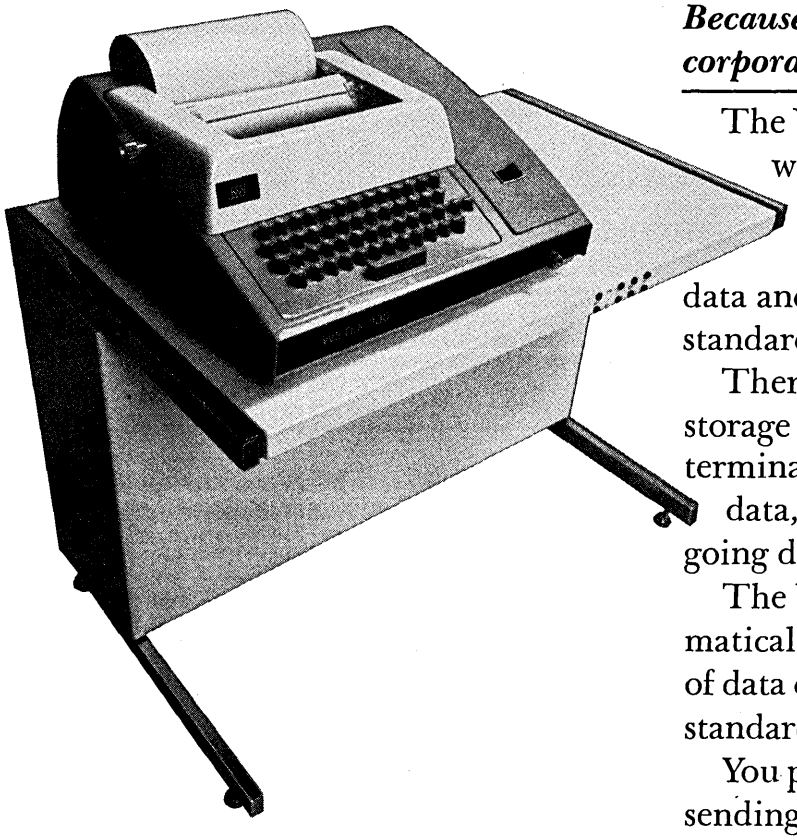

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The Wiltek terminal slashes teletypewriter network costs by combining high speed performance—up to 2400 bps—with the ability to batch data and transmit it *automatically* over standard dial-up facilities.

There are two unique first-in, first-out storage buffers built right into the Wiltek terminal. One temporarily stores incoming data, the other temporarily stores outgoing data. Each holds 50,000 characters.

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Data moves fast, so phone calls are brief. Data transmission costs go down *more than 50%*.

U.S. corporations new Wiltek terminal

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The result is fully automatic, error-free data transmission.

Because the Wiltek terminal dramatically increases operator output.

Because of the remarkable buffers built into the Wiltek terminal, the operator can enter data at low speed at the same time the terminal is sending or receiving at high speed.

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And because the buffers store and forward data automatically, the operator never has to load cassettes, handle paper tape or rewind tape reels.

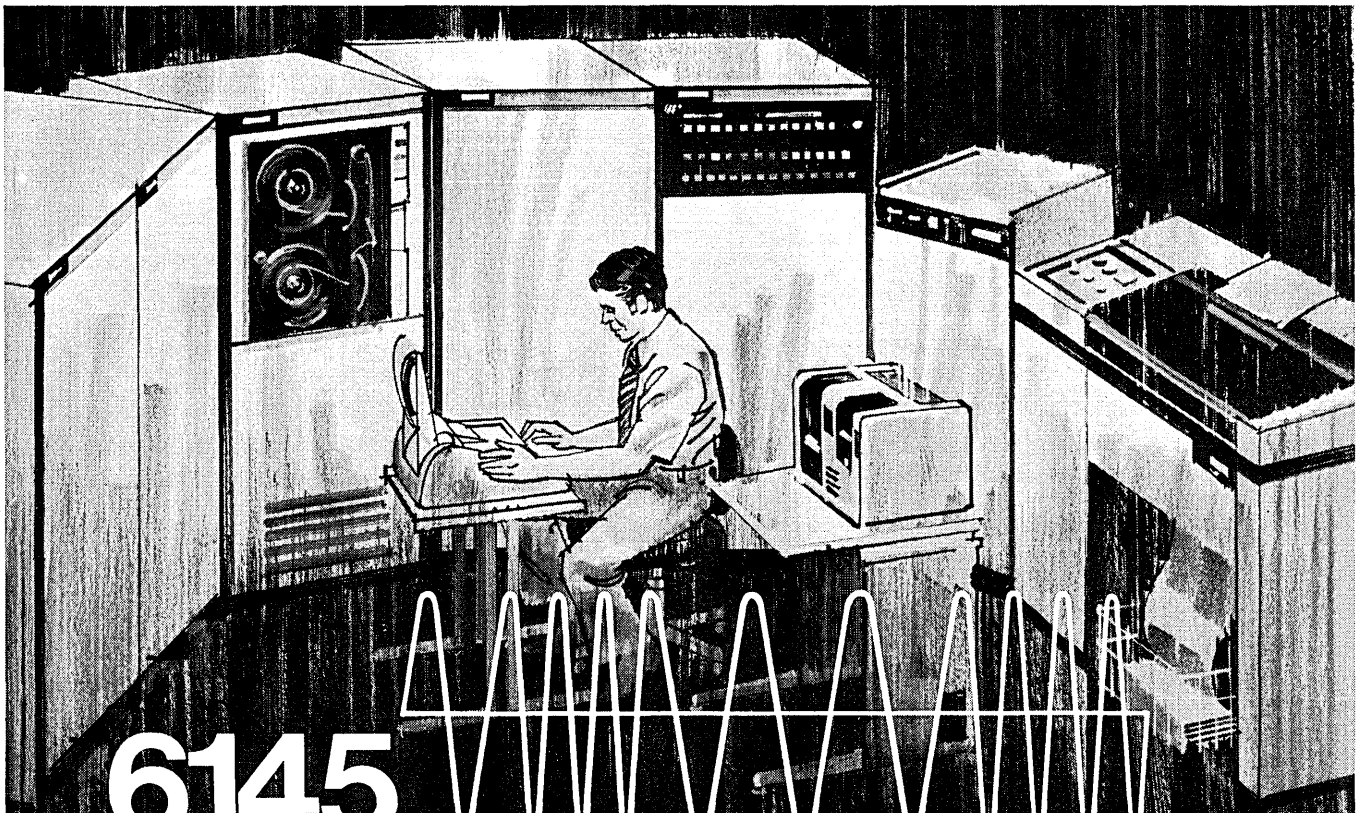
In fact, the operator never even gets involved in the communications process. Operator time can be devoted exclusively to data entry.

Because even with all its time- and labor-saving features, the Wiltek terminal leases for no more than the teletypewriter terminals most companies are using now.

This—combined with line cost savings and increased operator efficiency—reduces overall system costs dramatically.

Find out more about the Wiltek terminal. Call Robert Colella, Commercial Marketing Manager, Wiltek, Inc., Wilton, Conn. 06897. Tel. (203) 762-5521. Or write for more information.

the **WILTEK** data communications terminal



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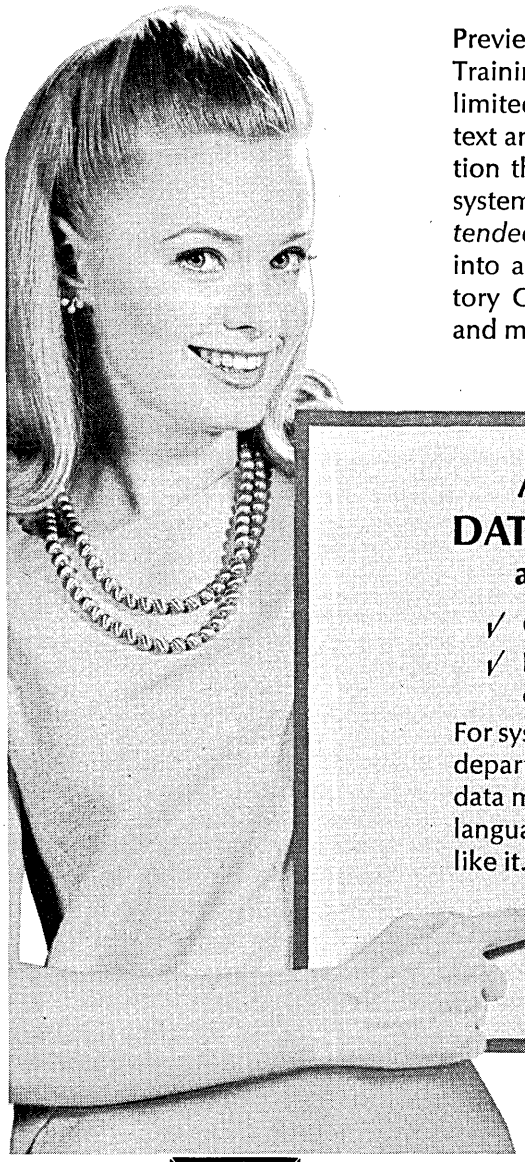

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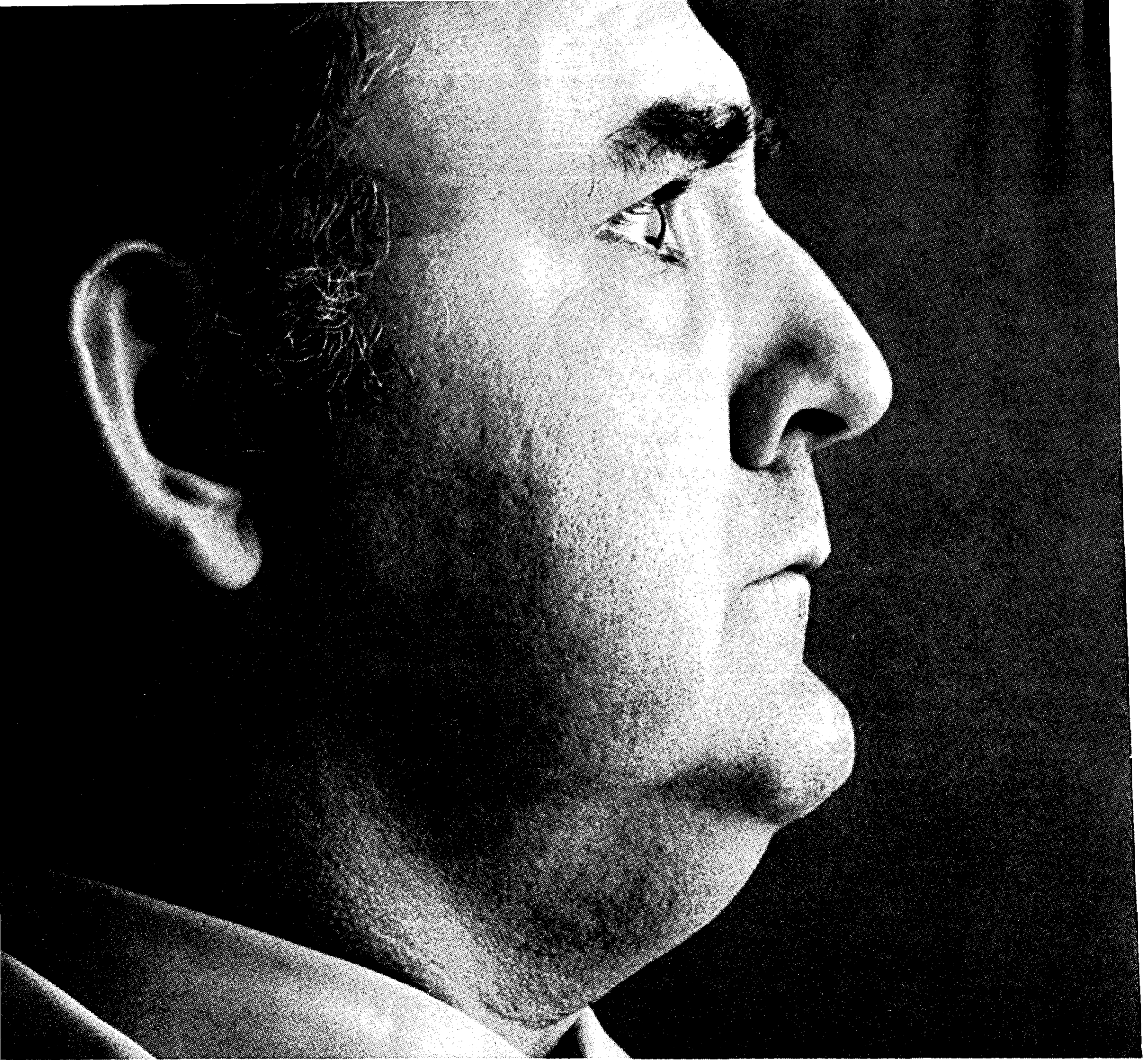
Calendar

EVENT/SPONSOR	DATE	LOCATION	CONTACT	COST
	APRIL			
American Trucking Assn. Operations Council 24th Annual Meeting and Exhibition	**23-26**	Toronto	ATA TOC 1616 P St., N.W. Washington, DC 20036	$80, members $100, others
ORSA 41st National Meeting	**26-28**	New Orleans	N. E. Miller III ORSA 428 E. Preston St. Baltimore, MD 21202	$33 $5, students
American Records Management Assn. 11th Conference	**27-28**	Minneapolis	Gene Dembouski 3M Center, 2501 Hudson St. Paul, MN 55101	$60
	MAY			
National Rural Electric Cooperative Assn. 8th Annual Data Processing Conference	**3-5**	Houston	NRECA 2000 Florida Ave., N.W. Washington, DC 20009	$175
Spring Joint Computer Conference	**16-18**	Atlantic City	AFIPS 210 Summit Ave. Montvale, NJ 07645	$20, members $40, others
	JUNE			
ICES Users Conference	**7-9**	Washington, DC	Frank E. Eby Computer Network Corp. 5185 MacArthur Blvd., N.W. Washington, DC 20016	$30
International Federation of Automatic Control 5th World Conference	**12-17**	Paris	A.F.C.E.T. Centre Univ. Dauphine Place du Marechal-de-Lattre-de-Tassigny 75—Paris-16e, France	$450 F.F.
COSATI Symposium on Legal Aspects of Computerized Information Systems	**22-23**	Washington, DC	John B. Farmakides COSATI, NSF Washington, DC 20550	$25, 1 day $40, 2 days
ACM/IEEE 9th Annual Design Automation Workshop	**26-28**	Dallas	R. B. Hitchcock, Sr. IBM Watson Ctr., Box 218 Yorktown Hts., NY 10598	$45, members $50, others
DPMA International Data Processing Conference & Business Exposition	**27-30**	New York City	Richard H. Torp DPMA 505 Busse Hwy. Park Ridge, IL 60068	$90, members $115, others
International Word Processing Assn. Conference and Exhibition	**29-30**	Washington, DC	IWPA A.M.S. Building Willow Grove, PA 19090	$95, members $125, others
	AUGUST			
ACM '72	**14-16**	Boston	Elden M. Levine 36 Parramatta Rd. Beverly, MA 01915	$40, members $65, others
	SEPT.			
ONLINE 72 Symposium and Exhibition	**4-7**	Uxbridge, England	ONLINE 72 Brunel Univ. Uxbridge, Mddx., England	£48 U.K.
Western Electronic Show and Convention	**19-22**	Los Angeles	WESCON 3600 Wilshire Blvd. Los Angeles, CA 90010	$5



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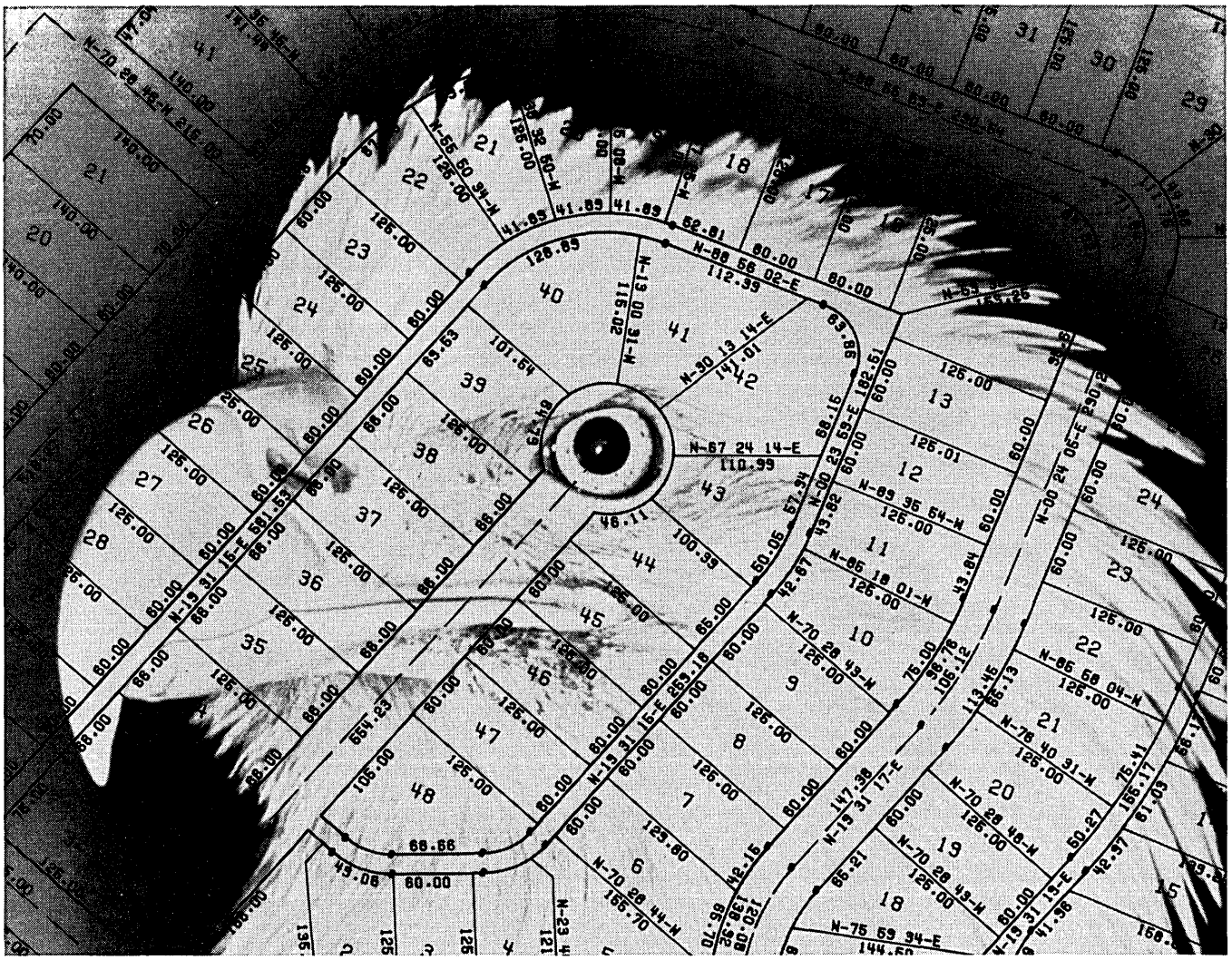

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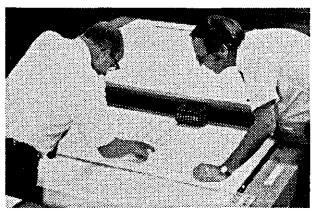

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107

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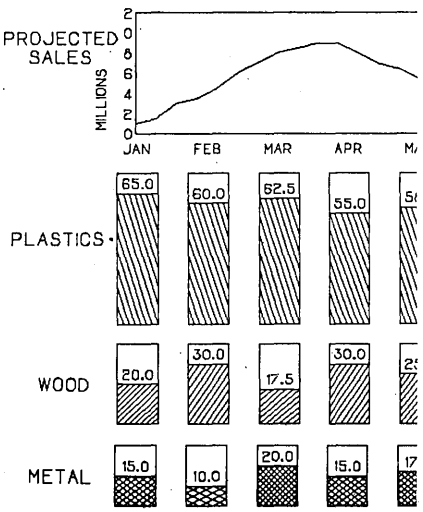

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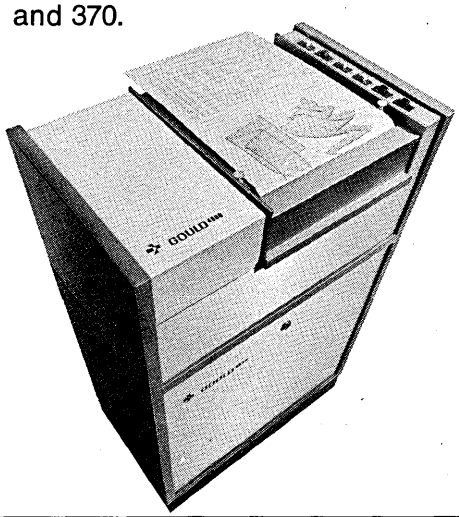

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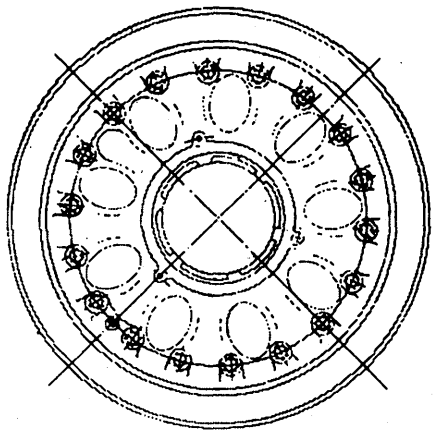

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ADVANCED DATA HANDLING SYSTEMS

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Letters

Equitable coverage

I am compelled to correct two important errors in your coverage of the birth of Equimatics Inc. in your January issue (p. 61):

1. The insurance company joint venture partner of Informatics Inc. is the Equitable Life Assurance Society of the U.S., not Equitable Life Insurance Co.

2. The quote attributed to J. Henry Smith, president of the Equitable, has a misplaced decimal point where it refers to "millions" instead of "billions."

You see, we did take a realistic look!

WERNER L. FRANK
President
Equimatics Inc.
River Edge, New Jersey

Voice mail

My Forum article titled "Picturephone —Who Needs It?" (Nov. 15, p. 152) was written to raise questions about whether AT&T is properly reviewing the priorities for our communications system and whether Picturephone is really an item of first-order priority.

I gave no alternatives because the primary point—that we in the dp industry must watchdog AT&T and question its priorities—would have been shrouded. But letters appearing in DATAMATION relating Picturephone to the deaf prompt me to comment on its efficacy and to supply an alternative.

First, I believe Picturephone's resolution and magnification to be so poor that it will be extremely difficult for a deaf person to read lips. Further, all the problems of a deaf person using a phone still seem to exist; i.e., operator communication, dial tone, etc. In fact, I wonder if service to the deaf was a design point in the original specifications—and if so, why did the product miss the target so far?

In summary, I do not think Picturephone will be very useful either to the deaf (though obviously better than what we now have) or to the dp industry. But, so that I cannot be accused of having no alternatives, I offer the following:

Recent work by a number of investigators and developers (in particular, Glen Culler) indicate that with proper support, a machine could be manufactured which would reduce human speech to a string of machine-processable phonetic equivalents, and that a similar system could be built which would reverse the process and generate essentially equivalent vocalization of the phonetic string information.

My proposal then is that this system be combined with the telephone network to provide a store-and-forward system of voice communication (which I call "Voice-Mail), and that the voice communication be followed up, where appropriate, with an edited copy of the phonetic string.

The system would work like this: I dial my local (AT&T?) computer and dial the number of the person to whom I wish to send a message. I am then switched into the system and I state my message orally. The computer reduces this to a machine-processable phonetic string which is then transmitted to the recipient's local computer during low-load periods (i.e., overnight). My recipient then could dial his "mail box" to receive the regenerated equivalent of my message. A printed copy could be provided for those subscribers who are deaf, through the local mail or via a low-cost home-based thermal printer. Admittedly, certain special training would be required for the deaf person to read the material, but this should not be anywhere near as difficult, for example, as learning braille or lip reading.

This system, while conceptual, is possible and appears to me to be of priority greater than a visual system. However, if a visual system is of high priority, I believe that it should fulfill the requirements of the computer industry if so substantial a financial commitment is being made to its development.

ROBERT J. ROBINSON
Director, Computing Center
State University of New York at Albany

Module management

Alan Cohen states quite accurately in his article on modular programming (Jan., p. 34) that "few installations manage to do modular programming successfully."

However, he attempts to answer only one of the three questions posed in the article's next paragraph (i.e., How does one go about breaking a program down into modules?). The answers to the other questions (Why are modular programs often no better than the monolithic programs they replace? Why is modularization so difficult?) are more germane to the lack of successful modular programming installations.

Although not difficult, modular design, the process to which Cohen has actually addressed himself, does require a good deal of planning, thought, and effort. As the article implies, one cannot sit down with some general specifications and a coding pad and expect to write a good modular program. Naming conventions, common data definitions and module-by-module specifications must be developed before coding is begun.

The refusal of most shops to invest this much effort in program design is the real problem. It manifests itself in schedules which gloss over design-stage milestones and concentrate on program coding and testing. Unbalanced work loads, unreliable schedules, poorly functioning programs, and critical dependence on machine time and key personnel are far too often characteristic of systems attempted in such an environment.

The concept of modular programming is not a panacea, but my experiences have thoroughly convinced me that its *managed* application can get us considerably closer to confidently delivering consistently reliable and flexible systems.

ROBERT MARSH
San Diego, California

Girls' best friend

We at CMG read your Dec. 15 edition with great interest—by the way, we think going back to monthly publication was a good idea—and your little item (p. 40) about equal opportunity for European edp women caught our eye.

We have been working on this for the six or seven years we have been in the service bureau/software business, and whilst we could not claim to have an equal number of women to men throughout the organization, we have reached a situation where two out of five systems and programming managers at our main operating company are girls. We are, of course, nowadays Europeans!

There does seem to be a very strong prejudice against women being employed in this sort of position, but we have found them very satisfactory. I think most people would find their problems simplified if they left the girls to worry about their own problems as between jobs and marriage and just concentrated on promoting the best people.

B. E. MILLS
Director
Computer Management Group Limited
Croydon, England

Those who don't

I would like to direct my comments to Mr. Milt Stone regarding his article, "The Quality of Life," in the February issue. The statement (on p. 44), "A few are not at all hesitant to use their womanhood as a weapon . . . " is very narrow minded.

Granted, there are women in this profession who do use womanhood to their own advantage. But what about those who don't? Where have you displayed the slightest consideration for

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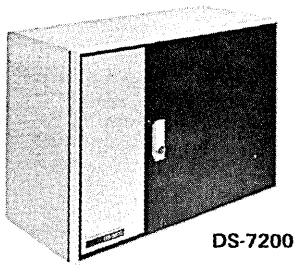

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their opinions, likes, dislikes, and objectives?

You made a mistake by categorizing women. You said "a few," but your implications and failure to credit the remainder are totally unfair to the many women who have contributed much to the progress of their own shops and to edp in general. Those who express comments such as yours in such an uncalled-for manner are exactly the reason prejudices still exist today.

Thank goodness for the manager who observes an individual as an individual.

SAUNDRA DOSS
Indianapolis, Indiana

Mr. Stone replies: It's true. I'm narrow minded, unfair, prejudiced—in favor of women in data processing. I think they do a great job—and I have a 20-year record of hiring them and promoting them to prove I put my money where my mouth is.

But you miss the point. Women are great because, in general, they have the same skills that men do and they don't have the hangups that so frequently get the males into bad trouble: (1) unwillingness to cope with detail, the make-or-break element of the dp world; (2) complete willingness to meddle in the system user's business, to tell him how to do his job.

Women are doing very well in this business. They'll do even better if they continue to be subtle about the leverage they have. That was the point.

Put off

Regarding the article "De Ludi Natura Liber Secundus" by Lücian J. Endicott, Jr., and Peter H. Huyck in the Dec. 1 publication; you must be putting us on. In particular, p. 36, col. 1, is rubbish; or it is a good antidote to those of us who take our technological jargon a bit too seriously.

ANDRIES VAN DAM
Nijmegen, The Netherlands

Adult adolescence

I read the Forum article, "The End of Adolescence?" (Feb., p. 124), and found all the questions well put. The only exception was No. 15, on which I do have some reservations. (It said) "Is the job market bad enough yet that some significant number of programmers will be willing to work for a living? ('Work' is defined here as doing something which is not among your top three favorite activities.)"

The problem in the above quote is that a large number of those referred to as programmers are not capable of being, as the title implies, programmers. I suspect that the small percentage that is really deserving of the title would in most cases put programming someplace in the first three favorite activities.

I would like to pose a couple of questions without a goal in mind to see if you can draw the argument from them.

1. When was the last time good, solid direction was given by those in charge?

2. Name the last three people under you that you gave praise to for their work.

3. When was the last time you were wrong in making a decision and let others in on it?

4. When was the last time you know of where someone received something for his extra effort, immediately following the effort?

"The End of Adolescence of the Adult."

LARRY R. RICE
Software & Communications Programmer
Newport Beach, California

Nightmare

I have this terrible premonition that the ABM program will be funded fully by the government and that some of these well-meaning correspondents who have been thwarted by division by zero will become lead programmers and analysts on the project.

KENNETH P. SEIDEL
Cohasset, Massachusetts

Source statement

DATAMATION carried a conference report entitled "JCCS . . . Whither or Wither" in the January issue, pp. 39-42. On page 42, the report quotes that "a useful, programmable, sequential logic module can be implemented on a single LSI chip." This quote is apparently attributed to IBM.

It seems that this quote was inadvertently taken from the paper given at that session by Ken Thurber and Robert Berg of Honeywell Systems and Research Div., St. Paul. The concept described should have been attributed to Honeywell.

JAMES M. LUFKIN
Honeywell Inc.
Minneapolis, Minnesota

In the article we didn't attribute the Thurber/Berg statement to anyone, even IBM. But credit should have gone to the Honeywell authors.

Poles apart

It is always a pleasure to find one's writings quoted in print, especially accurately, as in Milt Stone's "The Quality of Life" (Feb., pp. 40-44). I would only wish to add this: In the second phase of my research (reported in "Proceedings of the Ninth Annual Computer Personnel Research Conference," June 1971), I was able to compare characteristics of programmers with a much wider variety of occupational groups than were available when the first phase was reported (June 1970).

One characteristic of computer programmers stands far above the others and seems to set programmers far apart from many, many other occupations. This is their singularly low desire to take the leadership role. In this they are poles apart from the occupations which demand a penchant for leadership, as the military, or even the governmental bureaucracy.

I cannot help but dwell upon Stone, quoting Marion Bell: "I have managed two multiple-man projects and learned that I am not tough enough to want to do that again. I enjoy managing and being responsible to myself."

I tend to think this expresses very well the characteristic I have observed in programmers, and, in turn, the likely cause of the apparent malaise among data processing managers noted elsewhere in Mr. Stone's article.

EDWARD M. CROSS
Norfolk, Virginia

Initiation

In your January Letters column (p. 19), the two letters on initializing undefined variables point out problems in debugging programs containing errors where core storage is not automatically initialized to zero during the loading of FORTRAN programs. The same problem exists, of course, in all languages. Those languages such as COBOL which allow a variety of internal data formats are sometimes worse in this respect because each type of field would have a different desired null value.

I am not sure that the overhead associated with automatic initialization is desirable as a required language default. In most cases, an undefined variable, a variable misspelled on a COMMON statement, or any similar error probably gives an invalid result in any case. The fact that results are different each time the program is run under present compilers actually provides a useful clue as to the nature of the error.

The DATA and BLOCKDATA statements in FORTRAN (and VALUE in COBOL, INITIAL in PL/I, etc.) provide easy methods for the user to specify initial values when fields should be initialized at program loading rather than by dynamic assignment of values.

In any event, the proper way to get changes to a standard language such as FORTRAN is via ANSI. Implementation of such a major feature of a language as automatic variable initialization, whether done by a compiler or by an operating system or loader program, should have a machine-independent definition to maximize program portability.

A better solution, but only if the hardware would permit it to be done efficiently, would be to provide a fetch protection interrupt at all data loca-

(Continued on page 152)

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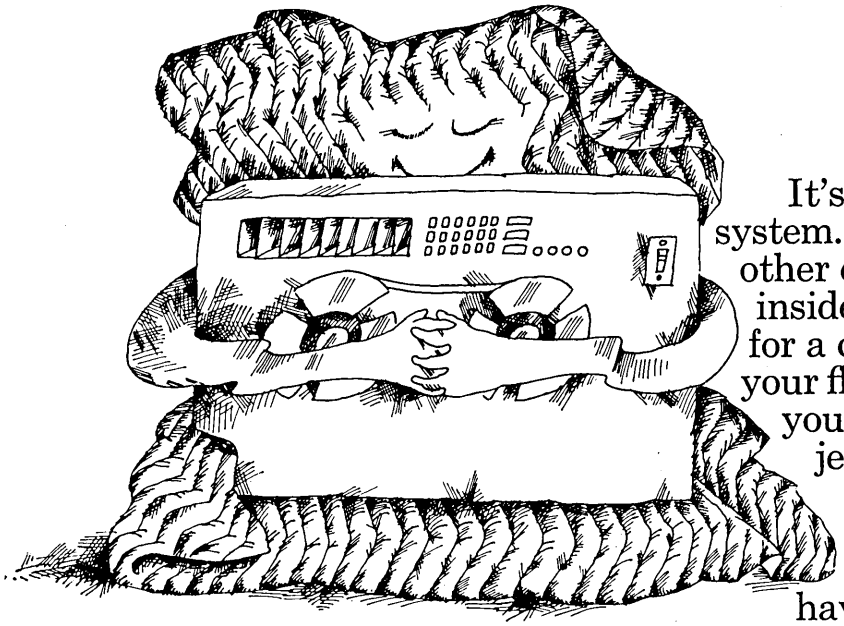

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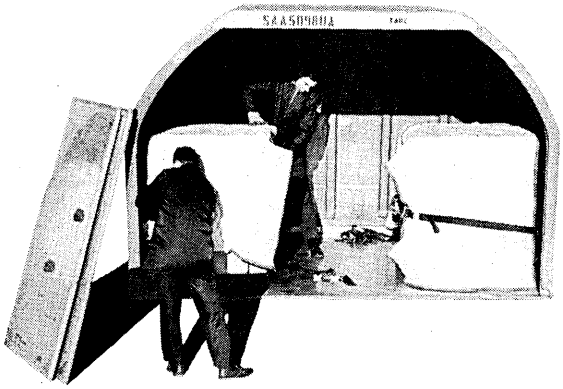

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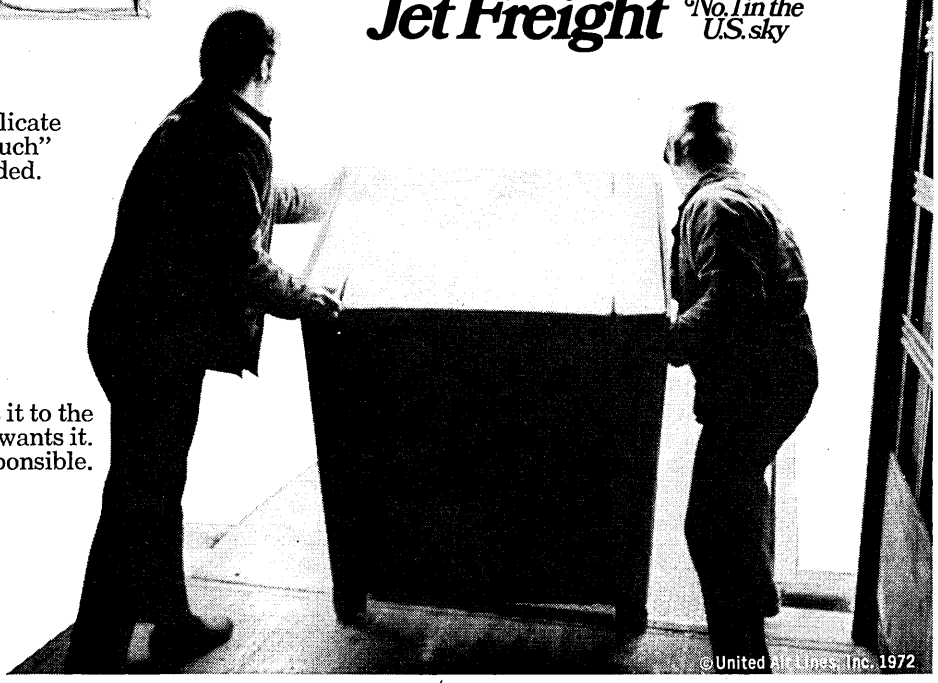

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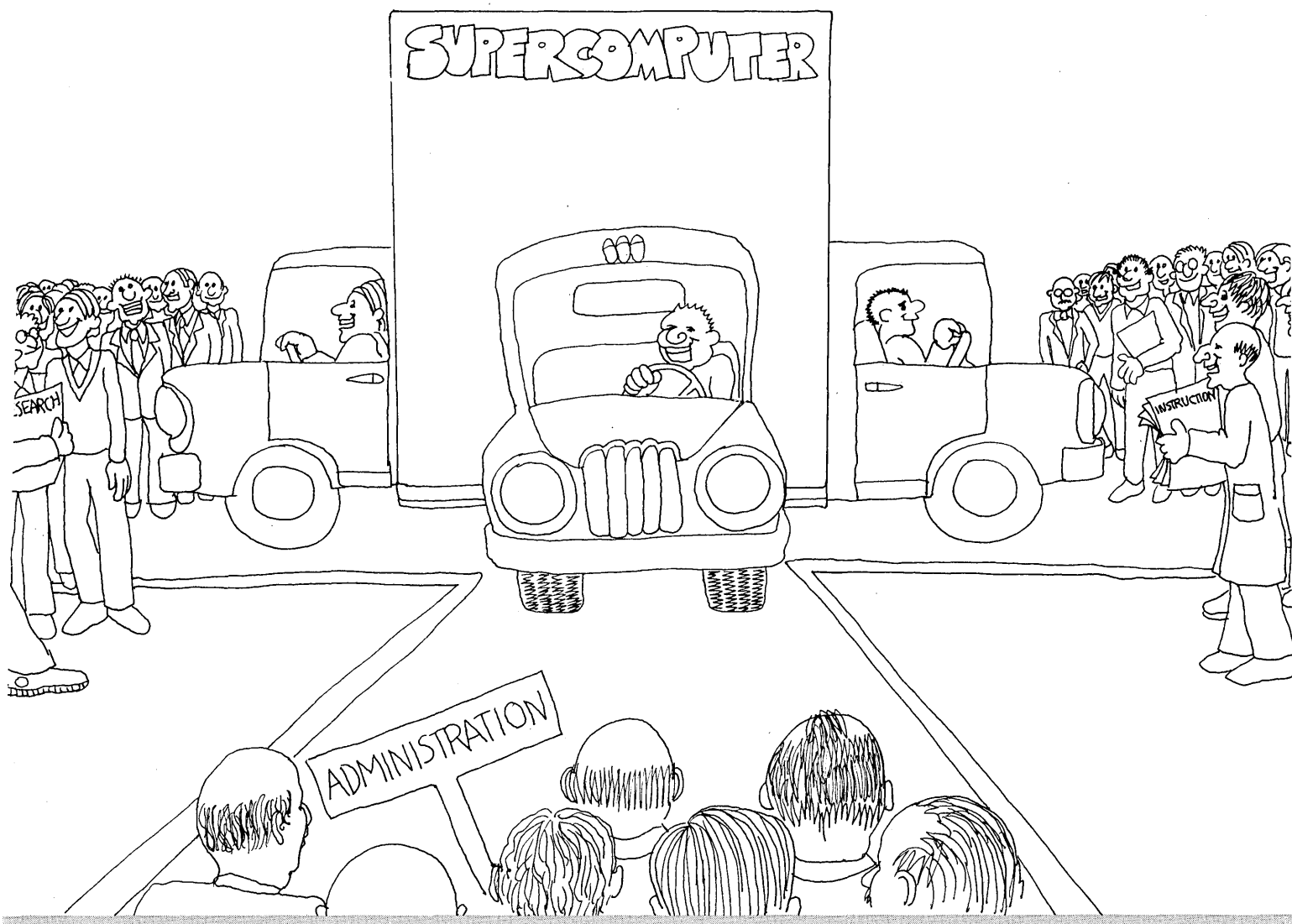

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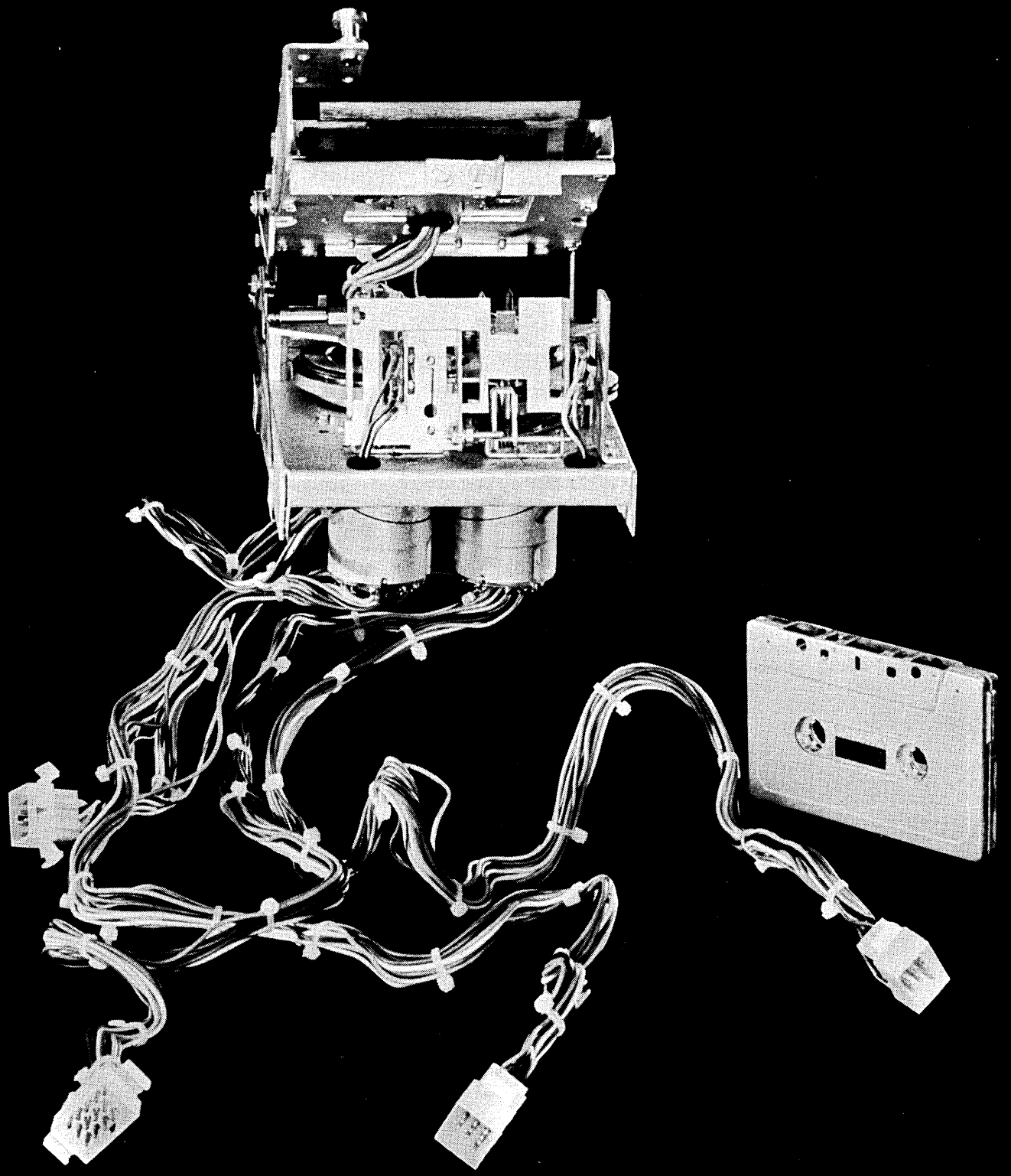

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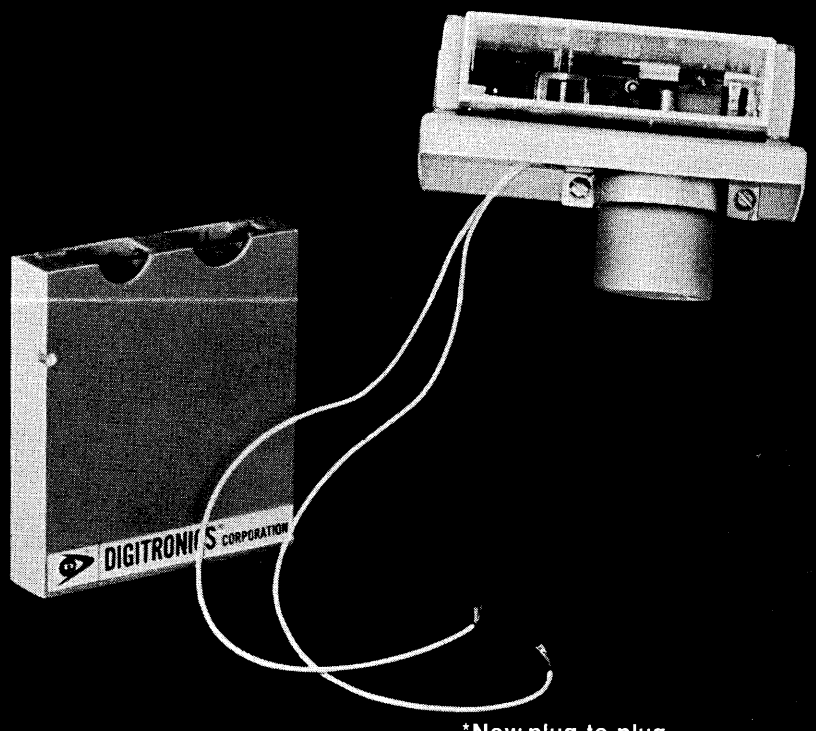

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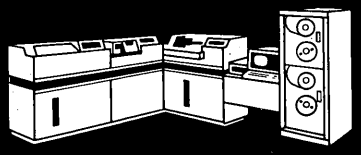

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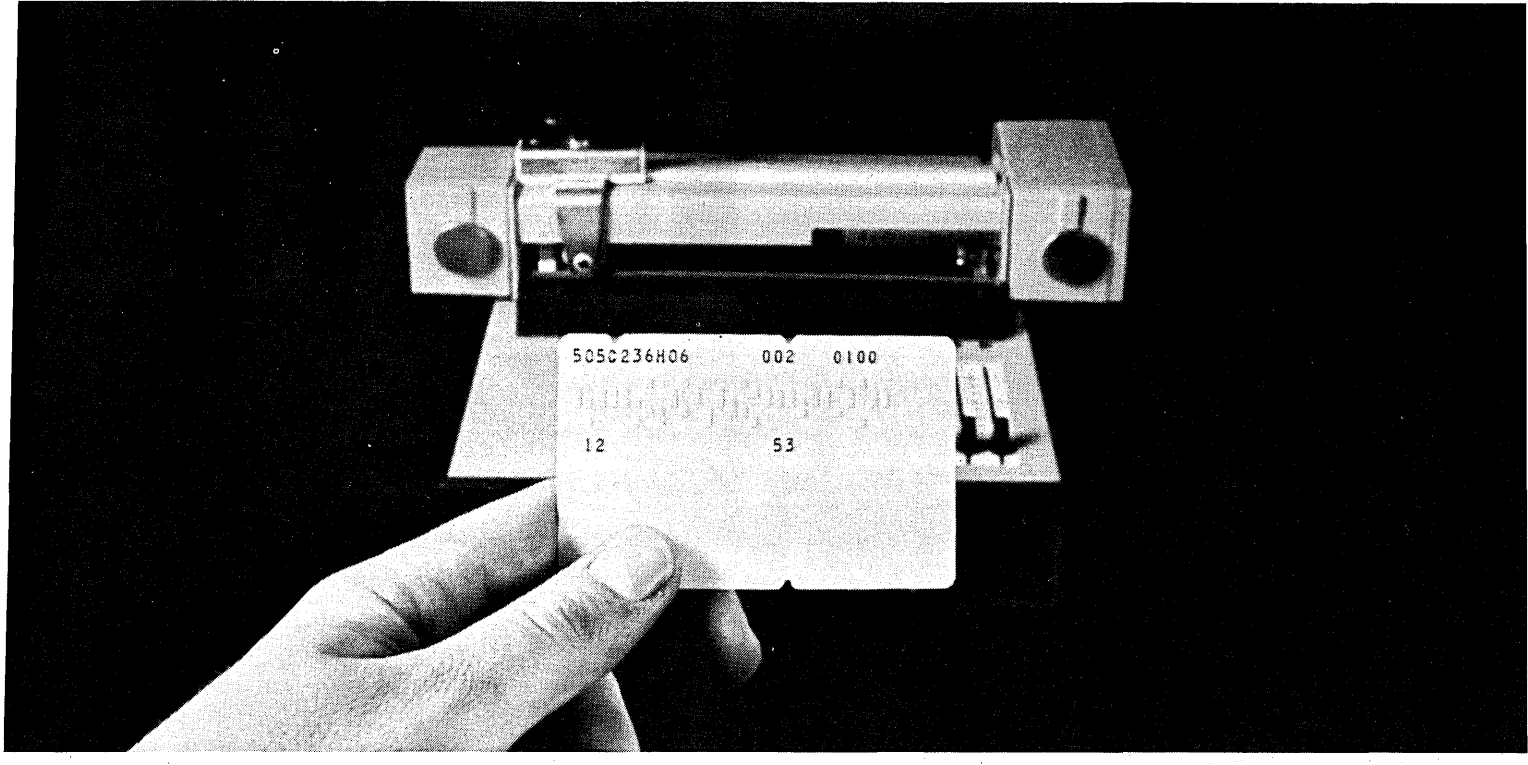

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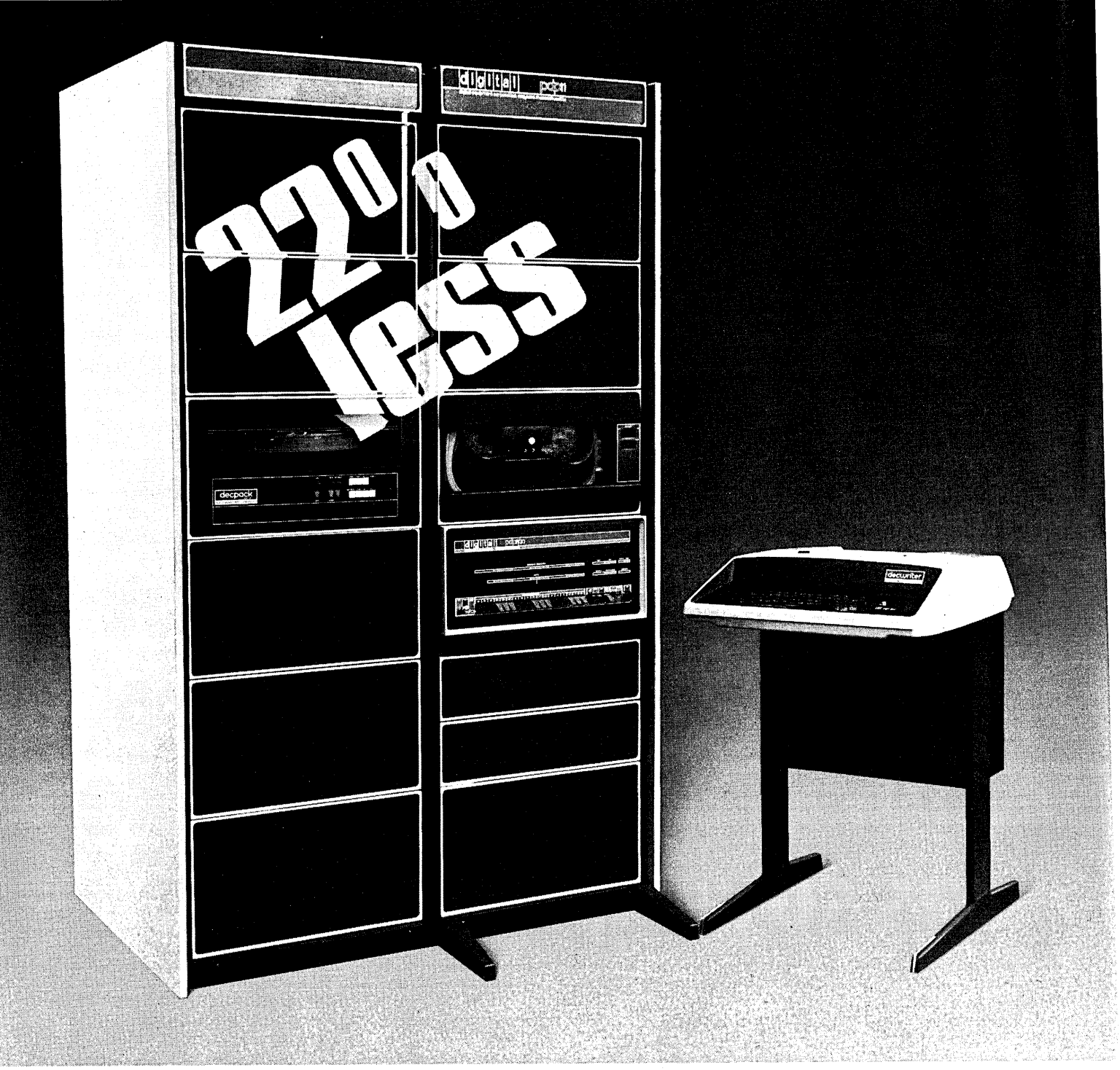

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A snapshot of seven typical networks, showing the variety of work under way and the problems that all have in common

Networks: An Introduction

by David J. Farber

A computer network is an interconnected set of dependent or independent computer systems which communicate with each other in order to share certain resources such as programs or data—and/or for load sharing and reliability reasons. This survey is based on information gathered from the IEEE Computer Society Workshop on Computer Networks (at Lake Arrowhead, September, 1971), the Mitre Corp. report on Computer Networks, the technical literature, and the experience of the author.

This article is intended to give an overview of this expanding field by the examination of seven typical networks. These seven were chosen to show various aspects of the subject, not because they are necessarily the best, or the most advanced, efforts. The key points of comparison among these networks are summarized in Table 1.

After we have described the seven networks we will examine some of the common problems that occur in all networks, such as data conversion, rigidity imposed by the protocols, etc.

The ARPA network

The ARPA (Advanced Research Projects Agency) network (Fig. 1) is a nationwide system designed both to explore network technology and to interconnect and service ARPA-sponsored research centers. The key aim of the system is to allow the accessing of programs, services, and data from any place on the network.

The ARPA network is a distributed network; sites (nodes) on the network are connected to each other either directly or indirectly through intermediate sites. This is to be distinguished from a centralized network where all sites are connected together via one central site. The computers and associated software systems that make up the ARPA network are heterogeneous, not all from the same source.

The network can be broken into two parts. One part consists of the computers which will provide the computational services of the network—the hosts; the other part deals with the function of servicing the communication needs of the network.

The communication section of the ARPA network consists of modified Honeywell DDP-516 computers connected via 9- and 50-kilobit leased telephone lines. The DDP-516 machines are called IMPS (Interface Message Processors). The communication system operates in a message-oriented store-and-forward fashion: a message is stored at intermediate points as it makes its way toward the destination. Each time the message is handed forward correctly, the handing node is freed from any further responsibility for the message. Since it is often necessary to send messages of substantial size, the network breaks long messages into smaller submessages called packets. These packets of about 1,000 bits are independently forwarded through the communications network. A duty assumed by the network, through the IMPS, is to insure that the packets are reassembled into the original message for transmission to the destination host. In addition the IMPS govern routing of messages through the network in order to minimize the transit time of the message and to increase the utilization of the transmission facilities.

Each host computer is equipped with a program called the NCP (Network Control Program). The NCP arranges for connections to be established and terminated between programs on one host and programs on another host and performs other monitoring functions for user programs.

There are currently 23 host machines on the existing ARPA network. These range from a PDP-11 through the ILLIAC IV. The network is managed by the ARPA agency and is technically directed by a steering committee of the Network Working Group, an organization of host representatives who are charged with the technical evolution of the system. In addition, Bolt, Beranek, and Newman (BBN) is charged with maintaining the communications sec-

tion of the network.

The ARPA network is today the main candidate for becoming a nationwide data network. There is considerable pressure for universities, government agencies, and other organizations to be allowed to join the network. Some of these groups would like to form closed subnets communicating only among themselves, while others desire to join the larger group in hopes of utilizing the services of the existing sites—in particular, the ILLIAC. It is clear that there is a movement toward removing the network from the status of a DOD-sponsored research activity and evolving it into a "commercially" run computer network.

The CYBERNET network

This network is included here as representative of a currently operational commercial network. While its technology is not as sophisticated as that of the ARPA network, it does face up to the practicalities of the real world. It was formed, basically, to connect Control Data Corp.'s existing data centers. The expectations were that by interconnecting the centers they could gain: better reliability by making available an alternate machine in case of local failure; greater throughput by load balancing across machines situated in different time zones; greater manpower utilization by using corporation manpower facilities more effectively, allowing access to others' programs and data bases; and, finally, the convenience of enabling a customer to choose a configuration that is best suited to his problem rather than the one which is best located geographically.

CYBERNET is a distributed network consisting of CDC machines such as 6600s and 3300s linked by wide-band and voice-band lines.

CDC speaks of the 6600s and other similar CDC machines as the primary computing capability of the network and calls them "centroids." It considers the 3300s as the front-end machines and concentrators for the centroids and calls these the nodes of the system. Terminals and satellite computers are supported for interactive and remote job submission operations.

The communications system of CYBERNET utilizes a broad spectrum of switched, leased and satellite communications facilities. It counts heavily on essentially hand-established connections for terminal-to-computer and computer-to-computer links. Thus the network by itself cannot reconfigure itself. Alternative paths do exist in some cases between nodes and centroids but in general a link failure will necessitate human intervention.

CYBERNET is operating as a commercial entity and is offering general computation services to its users.

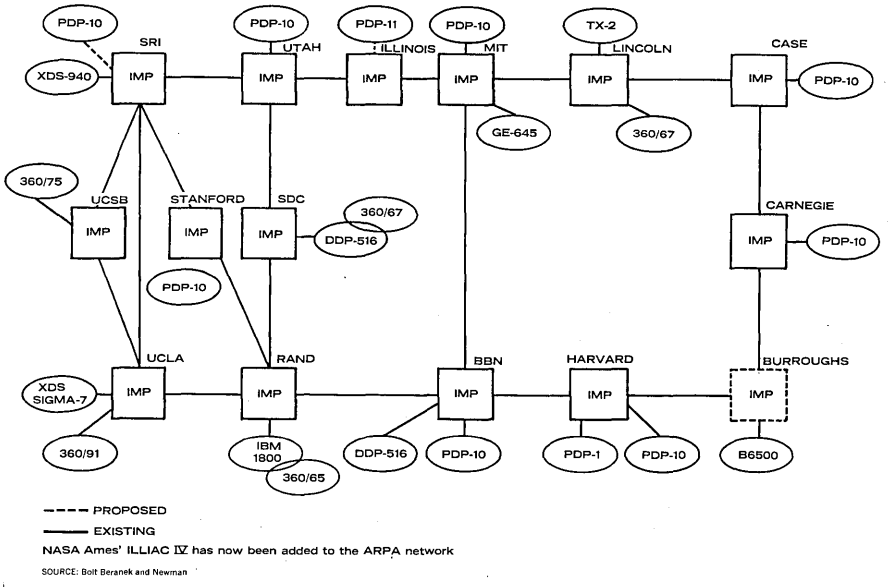


Fig. 1. ARPA Network Topology, February 1971.

The DCS

The Distributed Computer System (DCS) shown in Fig. 2, is an experimental computer network being developed and constructed at the Univ. of California at Irvine. Its stated aims are: low cost, reliability, easy addition of new services, a modest startup cost, and low incremental expansion costs. It is primarily intended to service mini and midi scale computers. Its communication architecture is based on a digital communication ring topology utilizing essentially the Bell System T1 technology and fixed-length messages. The computers are interfaced to this circular transmission medium using a fairly sophisticated piece of hardware called a ring interface, not a computer. The main novel feature of the communications protocol is that messages are ad-

	ARPA	CYBERNET	DCS	MERIT	OCTOPUS	TSS	TUCC
Organization	Distributed	Distributed	Distributed	Distributed	Mixed	Distributed	Central
Composition	Heterogeneous	Heterogeneous	Heterogeneous	Heterogeneous	Heterogeneous	Homogeneous	Homogeneous
Number of nodes	23	36	9	3	10	9	4
Geography of nodes	USA	USA	UC, Irvine	Michigan	LBL	USA	North Carolina
Machine size	Mixed	Large	Mini	Large	Large	360/67	360
Communication interface machines	Honeywell DDP 516	CDC 3300 PPU	Ring interface	PDP 11	CDC PPU	IBM 2701	IBM 2701
Communication protocol	Message switched	Message switched	Mixed	Message switched	Point to point	Point to point	Point to point
Transmission medium	Leased lines	Leased lines	Twisted pair—coaxial	Telpak	Coaxial	DDD	Telpak
Data rates bps	50,000	100-40,800	2-5 million	2,000	1.5-12 million	2,000, 40,800	100-2,400, 40,800
Transmission mode	Analog	Analog	Digital	Analog	Digital	Analog	Analog
Message format	Variable length	Fixed length	Variable length	Variable length	Variable length	Variable length	Variable length
Message size	8,095 bits	1,024 characters	900 bits	240 characters	1,208 or 3,780,000 bits	8,192 bits	1,000 bytes

Table 1

dressed to the receiver by means of the name of the receiver, not by a location at which that receiver lives. Thus the receiver can be allowed to migrate to other computers without having to inform the transmitter of that fact.

There are three types of ring interface—one to support a computer, which could be a front end machine; one to allow the direct attachment of a terminal to the ring; and one designed to allow the construction of a network of rings. This "ring of rings" operates essentially the same as the basic ring.

The DCS effort plans a distributed data base capability and a set of services for the users. It is not intended to provide a commercially viable system but rather to explore the issues involved in distributed architecture. However, it is intended that an operational system be built both to test the ideas and to explore the utilization of the large number of minicomputers that have appeared on the university campuses and at health care centers.

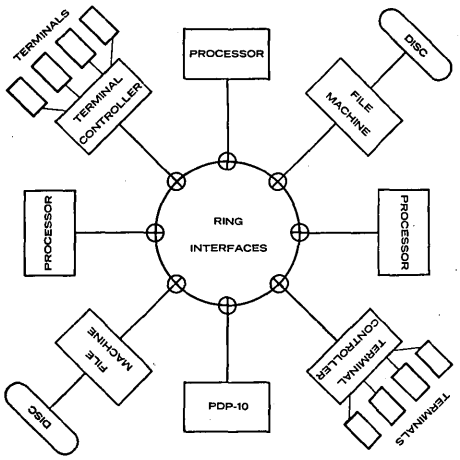


Fig. 2. The Distributed Computer System.

The MERIT network

The MERIT Network, the Michigan Educational Research Information Triad, Inc. (Fig. 3), is a joint cooperative effort between Michigan State Univ., Wayne State Univ., and the Univ. of Michigan. Its stated aim is to create an educational computing network to allow the computing at the member schools to be shared.

The MERIT Network is a distributed network consisting of three nodes. Its computers are heterogeneous. Each host computer is connected to the communications network by means of a modified DEC PDP-11/20. The communication lines interconnecting each site are a group of 2000 bps voice-grade lines.

The communications computer, the PDP-11/20, is capable of providing, through the facilities of a host interface hardware module, a variable-length message transfer from PDP-11/20 main storage to the host core and the communications system. In addition, it allows the host computer to treat its communication computer as several peripheral devices. This simplifies the host software system considerably since it allows the dedication of a pseudo-peripheral device to each user.

The communications computer (CC) is capable of acting as a store-and-forward system. Thus, if a path is destroyed, an alternative path exists via another of the CCs. The MERIT Network employs voice grade dial-up lines allowing the economic savings associated with the Telpak lines of the existing tri-university voice network.

The MERIT personnel feel strongly that networking will have a synergistic effect on the total computing environment. They are seriously facing the management difficulties inherent in the interconnection of educational computers.

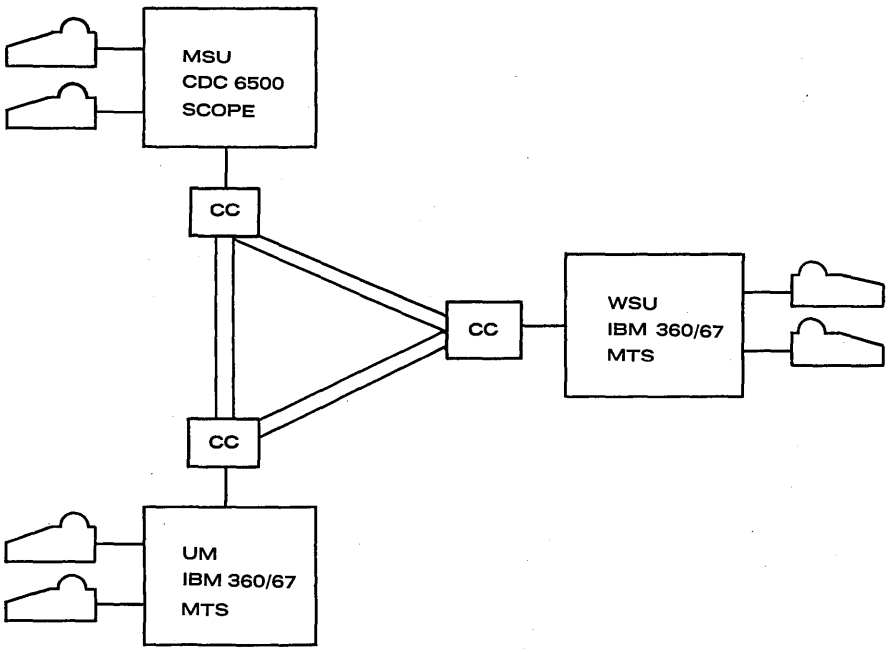


Fig. 3. CC: Communications Computer—DEC PDP-11.

The Octopus system

The Octopus system is a heterogeneous network developed at the Lawrence Berkeley Laboratory (formerly the Lawrence Radiation Laboratory) of the Univ. of California. It connects a complement of devices including two CDC 6600s, two CDC 7600s, and eventually will include a CDC STAR. All of these machines, called workers, are operated as time-shared facilities. The laboratory plans to provide for a centralized hierarchical data base and for a wide variety of input-output devices which can view the network as a single resource.

The communications system utilizes a store-and-forward protocol. The workers in the Octopus are interconnected via 12-megabit-capacity hardwired cables. The system can be considered as two superimposed subnetworks. The first is a File Transport subnet consisting of the workers, a transport control computer, a dual DEC SYSTEM 10 and the file storage. The second network is a Teletype subnet consisting of PDP 8s (each supporting 128 terminals), the workers, and the transport control computer. Notice that the Teletype subnet is a distributed network while the File Transport subnet is a centralized subnet. The dual DEC SYSTEM 10 insures reliability in this centralized subnet. In addition, while the subnets are logically independent, there are cross couples providing redundant paths in the event of failure.

The Octopus network is one of the more elaborate networks currently in operation. It is also one of the few networks which has been designed to handle security materials. One should note, however, that Octopus lies entirely on Lawrence Berkeley Laboratory premises.

The TSS network

The TSS Network (a cooperative venture between IBM and some of its 360/67 customers) was developed as a network of homogeneous computers operating in a distributed fashion. Each of the hosts operating on the TSS Network consists of a 360/67 using the IBM TSS/360 operating system. Some of the nodes have local networks consisting of 360s appearing as de-

vices, not hosts, to the network.

The communications facilities between the 360/67s utilize voice-grade switched lines. These lines are interfaced to the 360/67s by means of IBM 2701s or 2703s. Thus, while this network utilizes off-the-shelf hardware, this hardware, insofar as the communication protocols are concerned, is not programmable. Thus all the programs such as store and forward, error, etc., are resident on the host machines. Indeed, the communications software operates as a user program via an access method. There are plans to attach an IBM 370/145 to act as a communications computer and data base manager in the future. There are also plans and capabilities for utilizing 50,000 bps lines when the demand exists.

The TSS Network is experimental. Since all machines on the network are similar, program and data interchange is available. Both dynamic file access and remote batch are available over this network.

A notable feature of this network is that the host machines are IBM 360s utilizing standard hardware. One could, in theory at least, buy a copy of this network from any IBM salesman.

The TUCC network

The Triangle Universities Computation Center (TUCC) Network is a joint undertaking of the Duke, North Carolina State, and North Carolina Universities. It is an example of a relatively simple, straightforward undertaking in networking. It has been operational since 1966. It is a centralized network of homogeneous machines. At each of the three nodes of the net there are IBM 360/40s or 50s. These 360s do local batch jobs in addition to handling the telecommunications necessitated by the net.

The nodes of the net are connected to the central facility by means of a leased 40,800 bps half duplex line. This line is interfaced to the 360s by means of IBM 2701 Data Adapters.

In addition to the three TUCC nodes, local schools and colleges are serviced by the central computer via a variety of medium and low speed input/output devices.

This network is simple. It uses off-the-shelf hardware with minimal extensions to the basic IBM 360 Operating System software.

Discussion and comparisons

We have briefly scanned the architecture of a number of major attempts at computer networks. There are many others that we have not discussed. Some of these are highly specialized, such as the California Law Enforcement Telecommunications System; some are of very limited applicability. In addition to those being developed in the U.S., there are a number of efforts under way in Canada, Great Britain, France, and other countries. In particular, the network developed at the National Physics Laboratory (NPL), Great Britain, is an early example of experimentation in this field. In general, however, most of the foreign networks are planned to be basically patterned after the ARPA system. There is also an interest in loop networks such as the DCS.

All the networks we have discussed have some common objectives and some common problems. There are a number of services that can be considered as standard offerings in a large number of networks. We will define and discuss these at this point.

Load sharing, the ability to take a given workload and to distribute it among the computers of a network in order to make equal use of the resources of the network, is one of these services. It is offered by the CYBERNET, DCS and TSS networks but is not a basic feature of the ARPA, MERIT, Octopus or TUCC systems. In the case of all these systems, load sharing could be added as a user-supplied feature subject to certain restrictions. All the networks surveyed provide a form of program sharing. That is, they all allow data to be sent to a node at which a desired program is resident. A common problem encountered in heterogeneous networks first appears here. While we don't expect programs written for one brand of computer to run without human change on another brand, we do, perhaps naively, expect data generated by one brand to be transmitted and understood by a program running on another brand of computer. In general this is a difficult problem requiring careful design of message formats and protocols. In addition, in the case of data sharing of files, data conversion services must be available for converting between notations and conventions of the different computers.

There is also a form of sharing sometimes referred to as data sharing. If I have a large data set that I need processed and that data set is on another node of the network, then it might be more economical to send the program to the data rather than vice versa. All systems give this capability in one form or another.

There exists a feature called dynamic file access which is in essence the ability of a program to access a remote data set as if it were local. This allows the program to operate on a distributed data base with no special planning. It is central to the DCS design and also available on the MERIT and TSS networks.

The central area which is common to all networks is the communications and operational protocols, that is, the rules and regulations which define how one is to handle an event and what to do when an error occurs. Most of the design time spent in the construction of computer networks is involved in the formulation and debugging of these protocols. These having been defined, a number of different computers can each be programmed to behave the same, at least with respect to their appearance to each other. Most networks demand that all joining nodes conform to one rigid protocol. In effect, they all decide to talk the same language to each other. In the case of the DCS an attempt is made to support different protocols with respect to establishing contact between programs, machines, etc. The rigidity and complexity of the protocols affects the cost of joining a network.

I will make no attempt to judge which of these networks is better, or more indicative of future directions. As a designer of one of them, I clearly have biases.

As mentioned earlier, the ARPA net is the biggest and best developed network. It is, however, expensive. The IBM 360 networks are less elegant but use off-the-shelf components. Networks such as DCS, Octopus, and TSS are basically research efforts and may show future directions. In all cases, issues such as network economics and management problems transcend in difficulty the technical problems. One is left with a strong feeling that technically networks are here to stay but how we use them in our existing corporation and university structures, and how we pay for their use, are unsolved problems. □

Prof. Farber is on the faculty of the Univ. of California at Irvine and is a founder of Caine, Farber & Gordon, Inc., a Pasadena, Calif., computer systems company. He is a principal investigator of the DCS project, a network research program sponsored by the National Science Foundation. He is co-author of the SNOBOL language series and his previous computer experience includes positions at Xerox Data Systems, RAND, and Bell Telephone Laboratories.

Networking presents organizational and political problems . . . the power structure shifts as computer resources migrate from local to network control

Management's Role in Networking

by Einar Stefferud

During the period since the computer industry became well established, one segment after another has occupied the center ring—time-sharing, minicomputers, shared-processor data preparation, facilities management, for example. Now it appears that the next segment under the spotlight will be general-purpose computer networks, and there are many reasons to believe that the concept is useful and viable.

Many networks already exist using large, medium, small, and mini computers in various ways; and many more general-purpose networks are being planned. This article will interpret the meaning of this new development and attempt to provide a framework for understanding the management problems of computer networks.

Special-purpose single-application computer-communication networks have been around for a long time. SABRE and SAGE are well-known early examples of these kinds of networks, which were dedicated to specific, well-defined missions. These networks incorporated general-purpose computers, but they were not used for such; the distinction is in the use of the network.

Single-application networks have many fewer management problems than general-purpose networks because of the single mindedness of their missions. Single-application networks do not result in a large number of computers being shared among a large number of users; hence they do not generate the same kind of conflict problems for management to resolve. Examples of general-purpose networks include ARPA, MERIT, TUCC, GE, and others. (See the article by David Farber in this issue for more information on existing networks.)

At this point it is important to clarify just who "management" is and where it resides. Actually, it is distributed around the network where it deals with various functional activities. There are at least four identifiable functions to be managed: network operations, service suppliers, service users, and service brokers. Where the entire network, including these four functions, is wholly owned and operated by a single organization, a fifth management area emerges that might well be called network management, since it will have the responsibility for making the whole network concept work in practice. This network management will have the task of orchestrating the other four functions.

Network operations management deals with the communications facilities, its configurations, its protocols, its stability, etc. These tend to be technically oriented activities.

Control is the key problem for the user's management.

Service supplier management deals with computing facilities, including hardware and software, plus those vital service augmentations that make the services salable in the network environment. (For more discussion of the problems of the suppliers, see the article by Joseph Hootman.)

Service user management deals with the problems of exploiting the services that become available via the network. Users might well use a local computer facility if user management wants to pay the price of managing it in return for the benefits of full control. Control is the key problem for the user's management. For example, military security will require separate facilities until networks offer sufficient control over access to data and programs. Until sufficient control is assured, the cost of separate facilities to ensure security will be considered worthwhile. Other users may have less stringent requirements, but control of resources still looms very large for user management.

Service broker management will be concerned with bringing suppliers and users together to make deals for the exchange of services over the network.

By identifying each of these functions explicitly, I do not advocate that each network should organize this way. Indeed, I would expect many variations and combinations, with hardly any two alike in detail. On the other hand, I would except to be able to find each function being performed somewhere in each network. It is not the detailed organizational boundaries between these identified functions that are most interesting. Instead, it is the general relationships between them and the overall perspective that is provided by looking at networks in this way.

Viewed as a collection of network operators, service suppliers, service users and brokers, the network is seen to be a marketplace where buyers and sellers exchange services to their mutual benefit through specialization of work efforts, aggregation of demand for services, wider distribution and more diversity of products and services, with lower prices.

As with any model or analogy, caution must be applied to the use of the conclusions. In this case the network only creates a *potential* marketplace; it does not create an orderly operational market. To realize the potential market that a network represents, someone must develop and manage this market. This is seen as the task of network management, which raises the question of just who might be responsible for this network management, given an existing network.

In one case, if all the suppliers, users, and brokers belong to a single organization which has authority over

the entire network operation, then we might call it a "closed" network wherein the owning organization has the network management responsibility.

In a second case, if a number of independent organizations, without an overall unit head are parties to a network, then a co-op management structure might well be appropriate for developing and controlling the marketplace, and we might call this an "open" network. It is important to note that this situation corresponds to the case where a unit organization relegates the network management responsibility to its subordinate units, to work it out among themselves.

In a third case, if network services are offered by an entrepreneur, then this entrepreneur has the responsibility for developing the market; but the question of just who is responsible for regulating, controlling, and promoting trade and competition opens the pandora's box of public regulatory issues. Oddly enough, the entrepreneur would probably be unable to retain the broker's role as his exclusive domain. Once a network is in operation with independent vendors and customers exchanging services, there would be no way for an owner/entrepreneur to force the vendors and customers to deal only through his offices.

In any case, network communication operations seem to be independent of the question of who manages the market. It should be quite possible for a single common carrier network to serve a number of open and closed subnets simultaneously, with the boundaries between subnets arbitrarily determined by mutual agreement under the authority of each involved organization. Conceptually, all networks may be considered to be subnets in a single communications system. But, of course, the vendor and customer nodes are not actually connected; and even if they were, there would be no way to exchange services without formal agreement among the owners, suppliers, and users. Since the common carriers will prosper in proportion to network traffic, it will be in their best interests to promote an orderly market whether or not they are directly involved in network management.

. . . network communication operations seem to be independent of the question of who manages the market.

So far I have only considered management groups that are rather closely involved with network operation and use. Backing away to the perspective of top management, boards of directors, the U.S. Congress, GAO, state legislatures, etc., networks appear to be interesting because they offer a number of valuable advantages over other alternative ways to organize computing functions. They allow a smaller total computer capacity to meet collective peak loads; afford wider access to a wider variety of capabilities; allow increments of computing capacity to be brought on stream with smaller perturbations from the lack of full workloads at installation sites; and provide backup in the event of outages. Overall, top management sees networks as offering the possibility of lower costs per unit for computing power, on the average. These advantages accrue to top managements and seem to loom large in their thinking.

Unfortunately, the problems caused by formation of networks of general-purpose computer facilities are not felt directly by the same top management. The problems impinge on the facility managers and on the users of the facilities, who now find themselves sharing resources with a large number of others, most of whom know nothing about each other. The problems of sharing, unless properly resolved by top management, can cause a general reduction of resource control among all the user and facility managers. This will, in turn, cause a general loss of accountability among all the mission managers who are dependent upon network-supplied computer services.

The result of this is analogous to a virus infection: the entire organization functions less well than it did before networks; it somehow doesn't feel well; but nothing can be specifically identified as the cause. Typically, the only evidence of the root cause of the difficulty is an increase in the number of failures blamed on "the computers." In place of the desired computer support function, top management may have created a giant buck-passing machine.

. . . top management may have created a giant buck-passing machine.

From yet another perspective, computer communications technicians find networks interesting because they present fascinating problems involved in getting a collection of computers and communication devices to work together. Much work has been done on the technical problems in order to prove the feasibility of computer networks. This work has properly not been focused in solving the related management problems for the simple reason that technical feasibility is deemed essential before bothering to solve the management problems. At this point in time, the technical problems all show promise of being solved —given a clearly stated mission and purpose for any particular network. The time has come to attack the gener-

"E. M. Dillard & Company wants to help you, Griswald, but our hands are tied until you admit to yourself first that you have a problem."

Management's Role

al management problems of deciding things like mission, purpose, organization structure, and management controls.

At this point, I want to confess to a very strong bias. I firmly believe that *there exist no technical solutions to the management problems*; no amount of new technology can substitute for management decisions about mission and purpose or organization and control. On the other hand, I just as firmly believe that *there exist management solutions to technical problems*; after management sets mission, purpose, organization, etc., and staffs the organization with competent people, then these people can pull together the needed technologies to accomplish the mission.

So, if the network management problems are not technical, what are they? Where do they come from? Where is the network management problem generator? The answer, from my experience, is that the network management problems are generated

Unless the problems of sharing are properly managed, computer networking will fail.

by the effort to share the pool of resources that is created by the network. These are the organizational and political problems of sharing a pool of resources, and the management problems of dealing with shifts in the power structure of and among organizational units as computer resources migrate from local control to network control. Resource sharing is nearly always harder than not sharing. Unless the problems of sharing are properly managed, computer networking will fail.

Some specific issues should be resolved in order to share computer network resources: user/supplier agreements for the exchange of services over the network; controls to protect and regulate competition among suppliers and users; policies for decisions to add computer capacity to the network; establishment of responsibility for allocation of network resources, with or without congestion; and ways to buffer users from each other so they can suballocate their resources within their own areas of responsibility. And, in order to convert computer functions from a non-network environment to a network environment, top management must achieve organizational adjustments to deal with the expected shifts in the power structure.

No user of computer services can afford to become dependent upon a network resource unless he has sufficient control over his access to this resource and sufficient assurance of its quality. Controllable resources are worth a whole lot more than uncontrollable resources; this is true for computing just as it is true for every kind of enterprise. What is so surprising is the number of people who believe that computing is exempt from this law of economics "because computers are different." If computers are different, it is because they are potentially capable of supporting some aspect of virtually every part of every organization. In the context of networks, this implies that top management can have its choice: it can manage its enterprise or it can manage its computers; but it cannot directly manage both at the same time.

As a general rule of thumb, users should require resource control that is roughly equivalent to the kind of control they would enjoy with their own separate, local facility. For example: if the paymaster needs the full capacity of a 360/30 for payroll functions, and he becomes dependent upon network computer services, then he should have assurances of access to the equivalent of one 360/30's worth of capacity per hour, per day, or on whatever basis he defines equivalence. If there is any degradation of control, then there should be a price advantage in return.

However, beyond some point, which is most difficult to define, control is not tradable for price advantages; sufficient loss of control renders the service worthless because the lack of control would rob the paymaster of his accountability. Competent paymasters, like all competent administrators, hold their accountability sacred, which tends to explain why administrators so often fight for their own separate machines.

For another example: consider a tenure track assistant professor of computer science who has insufficient control over the resources he needs for teaching and research. When he comes before the tenure committee after five years of marginal failure and blames his lack of resource control for his failures, and the committee knows that he was not given any choice in the matter, what do you suppose they should do about the tenure decision? After 10 years of this sort of thing, what kind of a computer science department would you expect to have? Networks cannot and will not solve these problems.

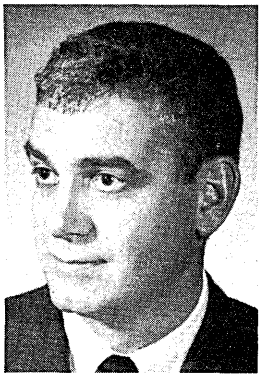
So what is changed by the coming of computer networks?

1. Large-scale pooling of computer resources into networks threatens to weaken the accountability relationships of many administrators and managers of our mission-oriented activities—unless we adjust our organizational structures to counter this effect.

2. Computer networks are creating large potential marketplaces for computer products and services, but these marketplaces need to be carefully developed and managed if they are to achieve their potential. It is not yet clear just who is going to assume responsibility for developing and managing this marketplace.

3. Network-based marketplaces for computer products and services may force a restructuring of the computer industry's traditional markets and marketing methods. Service vendors will need to find ways to package their services to make them easier to buy than the competing separate computing installation. At the current moment, user management thinks that it understands hardware better than it understands contract services, which makes it very hard for a manager of information systems to justify buying services from one of these new-fangled networks.

4. Computer networks will have a much greater impact on management, at all levels, than is generally realized. Attempts to establish computer networks will bring many difficult problems to top management attention, primarily because currently independent organizational units are going to be requested to place their computing resources under network control in the interests of total organizational benefits, and this request will sharpen the inherent managerial conflict between mission-oriented control and resource-oriented control. The goals of *program planning and budgeting systems* and *network-based sharing of computer resources* will be found to directly contradict each other, leaving management at all levels with some tough value judgments to be made. □



Mr. Stefferud is the principal in Einar Stefferud & Associates, Santa Monica consultants specializing in the computer management structures of business, government, and educational institutions. He is currently involved in planning for the management structures of networks. His BS and MBA are from UCLA.

Computer networks will have a far more profound effect than any other of the networks which have been developed to date

The Computer Network as a Marketplace

by Joseph T. Hootman

It has been less than a hundred years since the development of the United States railway system was at its peak. Numerous small, independent rail companies were formed, laid track, and offered service. Eventually interconnections were made, and the capability was then offered to move people and freight from one end of the U.S. to the other.

Subsequently, similar patterns were seen in the development of the electrical power and natural gas distribution systems, in the voice telephone communications networks, and in the commercial airline networks.

Today there is an increasing number of computer and data communication people who strongly believe that we are on the threshold of yet another major network development—the computer-based data communications network; i.e., the "computer network." It is not difficult for those involved in planning and studying these networks—linking in their planning so many segments of our business, government, and personal endeavors—to conclude that computer networks will have a far more profound effect on our society and on our economy than any other of the networks which have been developed to date.

Certainly the effect on the computer industry will be extensive. There have already been considerable effects: the development (and now apparent stabilization) of the computer utility segment of the industry, the significant interest of the various government agencies, the development and use of data banks, the efforts of the mainframe manufacturers in adding communications capability to their gear, the increasing use of minicomputers in communications-related areas, the tremendous number of terminals available, the increasing interest in intelligent terminals, the very significant effort and investment being made by companies planning to offer data communications services, the interest in two-way cable television, and the proven technical success of several existing computer networks.

The effects on the user will be quite varied and will depend to a large degree upon his use or application of the computer network. This use will range all the way from buying or selling straight cpu cycles, very sophisticated preprogrammed application programs, and data inquiry to high-speed data transfer. The networks will offer the technical base in terms of facility and capacity to accomplish an endless variety of tasks. The questions and the challenges to be faced are the ones of innovation and economics for those possible tasks.

Factors to consider

To accept the overall concept of the computer network as a major social and economic force, one must first accept three specific points regarding their existence: 1) that they are technically feasible and that the computer and communication systems necessary to permit their existence can be designed, installed, and operated; 2) that "products" can be developed for use, sale, or exchange which can be distributed through the computer network and which the user needs—in short, that a "marketplace" can be developed; 3) that the economic aspects of obtaining capital, establishing prices, and achieving a reasonable rate of return on investment can be satisfactorily worked out.

I doubt that today there is too much concern over whether we have the ability to build computer networks. We may still be so primitive that we have real problems in semantics; we may argue over technical approach; we may have bitter clashes over standards; we don't know how to cope with political and regulatory problems—but we *can* build computer networks. The tables in David Farber's article elsewhere in this issue bear out this point.

The real question is whether we can turn the computer networks into viable economic entities, where computer-based or computer-related products and services may be bought or sold. If this can be accomplished, there should be little difficulty in attracting capital; and there will be many and varied opportunities for large and small companies within and outside the computer/communications industries — as buyers, sellers, or both.

So, the key is whether the computer network can be made into a viable

Network as Marketplace

economic entity—can be made to function as a "marketplace"—attracting products and customers. One of the most important factors in making a successful marketplace is the availability of knowledge of products for sale, or desired to be bought, and prices. A second factor is the ability of the customers, both buyers and sellers, to gain timely access to the marketplace. The computer network clearly facilitates both of these two points. The NASDAQ OTC security exchange is the best example to show how a computer-automated exchange can serve the marketplace requirements. There is no requirement for a physical, centralized marketplace where buyers and sellers must meet to exchange information—so long as access through some communications medium is available to obtain timely data and to execute orders.

It is required that there be some definition of the products or services which may be traded, that there be some means of establishing credit or membership and settling, and that there be some means of physically distributing the products or services traded—even if that is only to send out a piece of paper confirming the transaction. It is clear that the computer network can very well serve itself and its customers in each of these three functions, though not without some planning, care, programming, and allocation of resources to do the work on the part of the network owners or managers.

If the computer network owners or managers do their jobs in a reasonable fashion, then the networks will be used by both buyers and sellers simply because the network represents a resource to which the customer has ready access, in a timely fashion, with adequate information regarding products and quotations, on which he can execute reliable orders at a reasonable profit or cost.

Types of networks

We must point out that there are a number of different types of networks, not all of which have the same facility for providing a marketplace—and some cannot and/or will not.

The "pure carrier" network. As differentiated from the computer-based network, this net will be for data communications only. There is no reason why an enterprising organization cannot connect to and through this form of network and use it to make markets. The key point is that the network owner/management will not itself participate in the market-making function. The Bell System and MCI operate in this fashion now, and it is expected that the other regulated common carriers will also.

The "homogeneous" computer network. All computers on the network are of the same type, or there is just one central computer operating on a "mecca" philosophy. The purpose of the network is probably to provide sharing of common programs and data. If there is more than one computer, load-leveling may be offered. Many of the time-sharing networks, especially data base systems, are of this type.

The "limited-access" network. Like the "closed" network, this type of network will have some technical, economic, or organizational limitation imposed upon the user. This may be due to the type of terminals it supports (Ticketron, savings and loans, airline reservations, etc.); the level of security involved (military and law enforcement nets); the special nature of the programs or data available (specialized computer services and data base systems—NASDAQ, off-track betting, and reservations systems); organizational or membership limitations (ARPA contractor, campus computing network, or co-op networks). These networks will make a market and may connect to an "open" network, but access is restricted.

The "high-speed" network. Using very high-speed transmission and communications gear, this network is designed for massive volumes of data traffic. It is also likely to be a "pure carrier" network. The use in batch processing and high-speed data transfer differentiates this network from the "low-speed" (time-sharing) and "mixed-speed" networks, which will be more commonly used in computer networks which have active, functioning markets. The high-speed network will be broad-based, relying heavily on microwave and satellite equipment; but it will, of course, be possible to mutiplex channels. The Datran, MCI, and Bell System networks fit here, as do some of the established railroad nets.

Selling to networks

There are a number of products or services which may be sold *to* the computer networks—no matter how they plan to operate:

Mainframe hardware and related peripherals;

Communications capacity — long lines, local distribution;

Communications equipment—modems, terminals, multiplexors, front-ends, switches, transmission hardware;

Consulting and other services—network planning and analysis installation, maintenance and repair, management systems, facilities management;

Software—communication handlers, front-end systems, planning systems, accounting and billing systems, proprietary application systems and packages.

Selling through networks

There are a number of products and services which can be sold *through* the computer networks. None of these requires that the seller be in the computer/communications industries:

Raw computer capacity—cpu cycles, storage space (either accessed by time-sharing or remote batch—even by walk-in);

Information access and information exchange (permitting access to a data base, or to permit exchange of data between user/government, user/subcontractor, user/vendor, user/customer);

Proprietary application programs (irrespective of who runs the job), including:

Commercial systems—basic applications such as payroll; management services, including modeling and simulation; management systems, including MIS and financial auditing;

Scientific programs and applications;

Production, including automated design, production control, testing;

Graphics, with both computer graphics and graphic output;

Program development (and program auditing).

Network economics

We made reference earlier to network economics as being one of the three key points that we must assume could be worked out if we are to believe that computer networks will be successfully developed. It is quite clear that the computer networks themselves will not operate as a "free market." The cost of entry to the industry and the ever-present questions of attendant governmental regulation preclude this. The individual markets created for specific products and services which can be created through the networks, however, are not subject to the same constraints. It is possible to have a very free market, for instance, in the 360 cpu cycle market where the price of a 360 cpu cycle could operate in the classic "free" market of high elasticity, supply and demand curve economics. It is also possible to have a most valuable proprietary application on which the vendor has a virtual monopoly position and on which he can exercise appropriate monopolistic pricing practices.

In short, the entire gamut of eco-

nomic conditions and pricing schemes may be brought into play in these markets. The net effect is to place a substantial burden on the market participants, both buyers and sellers, to create and maintain an orderly, effective, efficient marketplace. It will also place pressure on the computer network owners and managers to monitor activities. Finally, the regulatory bodies will have a keen interest, and abuses of the situation could lead to the difficult, and, in my judgment, undesirable regulation of computer network products and services.

The economic objectives of those using computer networks then become:

To ensure the establishment of the computer network(s) as efficient and effective marketplaces;

To gain customer preference through market efforts—product differentiation, service, and contract terms;

To obtain maximum margins through use of the network;

To do these without government interference or regulation.

Seller's network selection

We can assume that there will be a number of computer networks through which an organization might wish to market its products or services. There is no reason why a vendor cannot deal with several networks—other than contracts, costs of participation, and common sense. Still, it may be appropriate to review some of the criteria a potential vendor might wish to consider in selecting a computer network through which he plans to market:

Does the computer network offer a potential customer base for my product or service? Do these customers have a need for the product or service? Are they qualified to use the product or service? Do they have the ability to pay?

If my organization already has users or customers, can they use my product or service more efficiently, effectively, or economically through this computer network?

If I am to serve new customers, can I serve them at a profit taking into account cost of sales—commissions, network payments, customer service, program development, documentation, and so on?

Is this network run as a business, and in a businesslike manner? Does it have adequate resources, adequate management, proper staffing, and proper accounting and controls?

What is the investment required to connect, both for me and for my customers? What are the interface problems, costs of software at my end, requirements for communications gear, and what are the network charges?

What is the competitive environment for my product or service? Why does the computer network want me as a vendor? What and who are my primary competition—network, other vendors, or both? What type of contract is offered and what are its terms? What is my advantage in using this particular network?

Can I retain my individuality? Without incurring excess costs, can I avoid any imposition on my present system, applications, or organization? Can I achieve and retain product differentiation?

Does this computer network offer what my customers and I want in terms of reliability, speeds, security, response times, recurring charges, and geographical areas served?

Is there a billing and settlements capability which will permit accurate and timely accounting, billing, and collections?

Buyer's network selection

There are also some questions which potential buyers might wish to ask. It is interesting to note that some of these are the same questions, or very close variations, of those asked by the seller.

Does this network offer the products and services which my organization requires?

Can I gain economies and efficiencies through use of this computer network over other alternatives?

Are the vendors qualified, with good products and services, adequate documentation, and adequate customer support?

Is the network run as a business, and in a businesslike manner? Does it have adequate resources, adequate management, proper staffing, and proper accounting and controls?

What is the investment required for me to connect? What about multiple connections? What are the interface problems, costs of software at my end, requirements for communications gear, and what are the network charges?

Is there sufficient competition among the products and services I wish to buy or use so that the prices and customer support efforts are at reasonable levels? Why does this network and this vendor want me as a customer? What are the terms and conditions of the contracts and agreements?

Can I avoid any imposition on my systems, applications, and organization, and yet gain the advantages I

"Only once in every generation is there a computer that can write poetry like this."

Network as Marketplace

want using the product or service through this computer network?

Does this vendor and this computer network meet my requirements for reliability, speeds, security, response times, recurring charges, and geographical areas served?

Is there an accounting system which will provide timely and accurate billing with adequate cost distribution and controls?

Brokerage

In looking at the product range and the requirements of the buyers and the sellers in such a marketplace as the computer network provides, it becomes clear that there is a place, in fact a need, for the brokerage function. The classic definition applies: "One who, for a commission or fee, brings parties together and assists in negotiating contracts between them."

The function may be a service of the computer network and may thereby be included in its pricing structure, or the service may be provided separately and operated independently (even serving more than one network). In either case there would exist a brokerage node on the network which buyers and sellers would access to indicate their needs and products and services for sale. Any number of products or services could be traded here, but those which will work best are those which can be readily automated and handled almost entirely by the computers. (It would be possible, also, to trade in "futures," such as April 360/50 cpu cycles.) The brokerage fees could be paid on the gross dollar value of the transaction, or perhaps on a price-per-trade basis.

Clearly, there are some problems to be thought about in establishing a brokerage function on a computer network:

There are those situations which require personal service and which cannot be automated, and there are those tricky and complex transactions which require human intervention.

There are a number of competing products, and it is very necessary to list a large number of alternatives, clearly and with sufficient data to permit comparisons, to attract and retain customers to the brokerage function.

The vendors must understand that they still must do a very substantial portion of their own advertising, promotion, and even to some extent, selling. This has been found to be true for software sold through time-sharing outlets, and has been known to be true for some time for listed stocks sold through brokers and exchanges (though the "selling" of listed securities by companies has been carefully controlled by the SEC).

There must be reasonable pricing plans and reasonable fees paid to the broker, coupled with adequate accounting and control systems.

Where now?

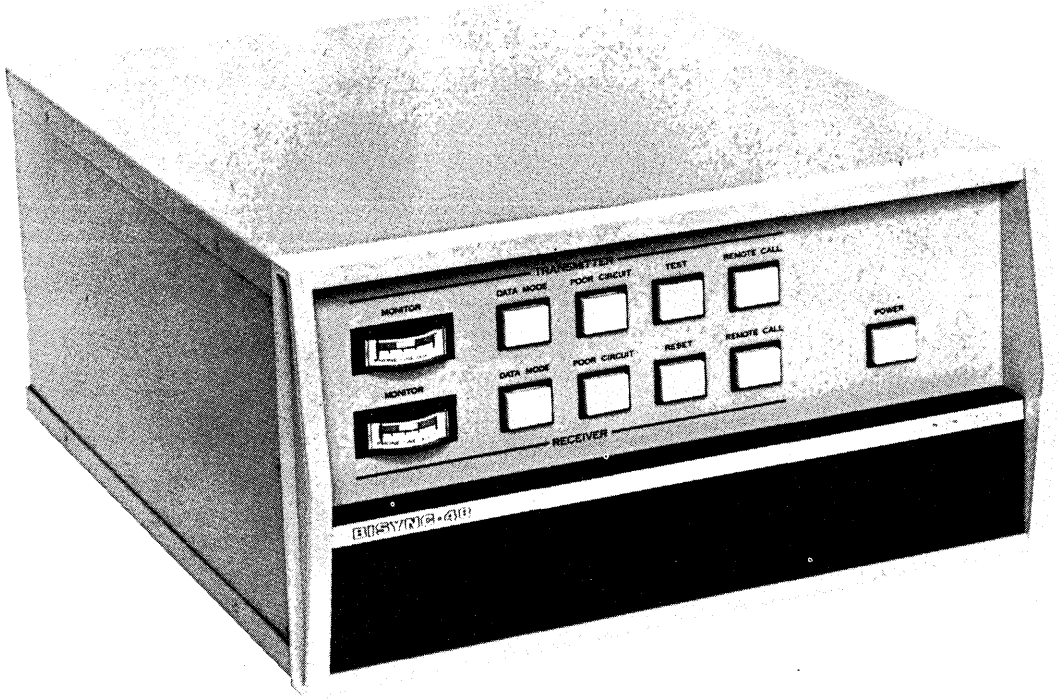
From the relatively primitive state of development which exists today, we expect to see a tremendous growth, and interconnection to provide a vast, nationwide, computer-based data communications network.

There is considerable potential for misuse and abuse, and for business failure, which creates concern over the possibilities of governmental regulation. That cloud may keep away some of the badly needed capital. A key problem will be in drawing lines between those elements which might be subjected to regulation and those which should be left to the "free market." The challenge to those involved with computer networks and their products and services will be to ensure by their actions the continued existence of the free market so as to preclude regulation.

The computer networks as a marketplace will be easy to reach, easy to use, responsive, and an excellent resource for both the buyer and the seller. They will provide the distribution vehicle for a great number of the computer-based services and applications which those in this industry have discussed for so long, but which have not yet been implemented, for use in our homes, schools, and in our businesses —large and small.

Be prepared. Think about it *now*. It isn't that far off. □

Mr. Hootman is an independent management consultant specializing in marketing and financial planning. A founder and formerly chief executive of Remote Computing Corp., a California-based time-sharing company, he has also held positions with Computer Sciences Corp. and Burroughs. His degrees in business administration are from UC Berkeley and Stanford Graduate School.



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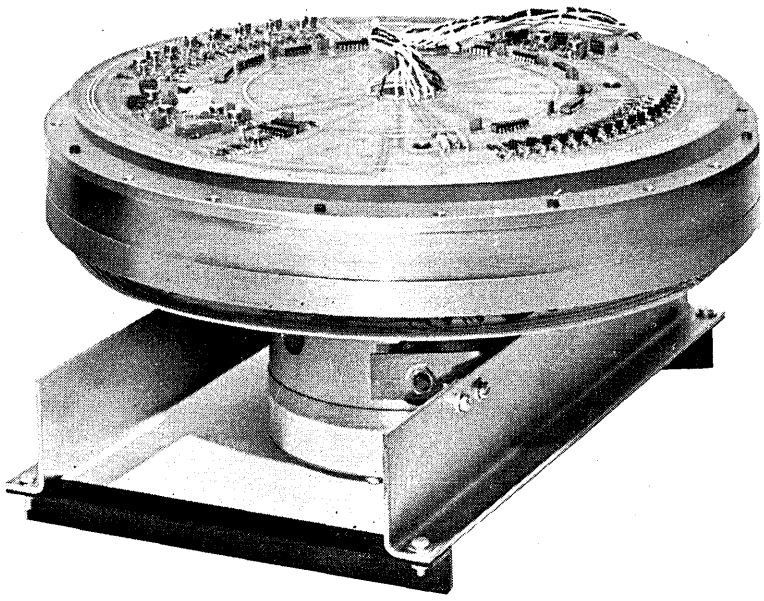

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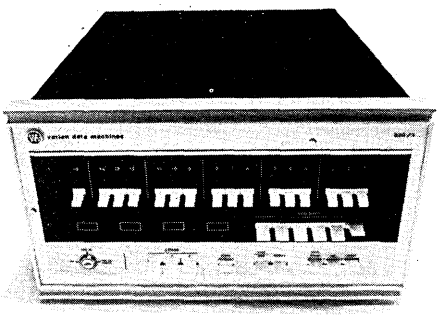

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DIARY OF A SYSTEM PHILOSOPHER

TROY, MAY 19, 1431 B. C. Arrived here this morning after a trying voyage from Alexandria. An attempted hijacking; bad food and none too plentiful at that; and, to top it all off, Pireus is being sacked by barbarians. Have been assured that I can go on to Pireus in a few months after the invaders go back to Macedonia for the winter. Will try to find employment here in the meantime.

May 23, 1431 B.C. Bad few days. Priam's court is up to its neck in philosophers. Besides, Paris, who does the hiring, is out of town on some mysterious errand. Finally got steered to an outfit called Asia Minor Information Services (AMIS). Fancy office, smashing receptionist, elegant tapestries on the walls, etc. Yet somehow they have a lean and hungry look. Said they might have an opening, but didn't seem to care for my Greek accent. Muttered something about talking to their security people. I left a resume.

May 27, 1431 B.C. Runner came from AMIS this morning. I mistrust them, but they look like the only hope for a job. The purse is getting thin, and it's a long swim from here to Athens.

May 28, 1431 B.C. I am now a Systems Philosopher. Tomorrow I'm supposed to talk to someone at International Abaci Proprietary (IAP) about a machine which will solve all of the city fathers' problems. I gather that AMIS has some ideas on how to get cut in on the action.

May 29, 1431 B.C. Talked to IAP this morning. Fancy office, smashing receptionist, elegant tapestries on the walls, etc. All wearing dark business togas. Smooth as hell. They make AMIS look like hicks. I will count the change in my purse before and after visiting them in the future.

July 17, 1431 B.C. Proposal for tax collection and city payroll accounting system is coming along. City fathers are enraptured and will fund benchmark tests. It all depends on whether IAP can deliver something which will do even half of what they claim. News from Greece is bad. The Spartans are claiming that the tide of victory has turned, but a Spartan victory promise is a lot like an IAP technical promise. I'll believe it when I see it.

Sept. 16, 1431 B.C. IAP slipped the delivery date for Rack I again. Must get it soon or we can't check out programs.

Sept. 23, 1431 B.C. Rack I delivered this morning. Demo got as far as 2 + 2 = 3.9999999, then died. City fathers not happy, but IAP passed it off as an air conditioning problem—beads sticking on reeds due to excessive humidity.

Oct. 15, 1431 B.C. Software in bad shape. Programmers claim the machine doesn't always multiply right. IAP says their diagnostics run and the problem must be in our software.

Oct. 17, 1431 B.C. Software still won't run. Went over to IAP this morning to try to get a listing of their diagnostic routine. They blandly assured me that their diagnostics are proprietary and asked if we'd like to buy them. I was half way home when it occurred to me that they built their diagnostic software with city money and it *can't* be proprietary.

"Fancy office . . . elegant tapestries on the walls . . . All wearing dark business togas."

Oct. 22, 1431 B.C. Paris is back in town, and the whole place is turned upside down. He brought his "secretary," Helen, along. Rumor has it that the Greeks are mightily annoyed. Software is still a mess and, worse yet, our best systems programmer, Cassie, has gone all mystical and depressed. Still, though, I think we can run a demo on schedule provided they don't want to see anything but the canned test case.

Oct. 28, 1431 B.C. It's official. Greek states have united, hired the Macedonians as mercenaries and declared war on us. I have become a Trojan citizen—mostly because the alternative was being executed as a Greek spy. One good thing has happened—the city fathers invoked the War and Rebellion clause and canceled our contract. Since we didn't have a snowball's chance of delivering on time, we managed to hide our sorrow.

Nov. 4, 1431 B.C. Trust IAP to find an angle. Now we're going to automate the defense system. Instead of manning the walls with masses of troops, we'll put in remote terminals at key places and allocate our defense forces from a central pool. AMIS is getting a big chunk of the programming. Judging from the way our last effort worked, my best bet seems to be to hope that I haven't acquired much of a Trojan accent. When the city falls, I will attempt to pass myself off as a Greek soldier.

Nov. 6, 1431 B.C. Big orgy last night to celebrate our new contract. Found out some interesting things. IAP is somehow managing to sell exactly the same abacus the city bought previously. Something about an ownership reversion clause in the contract. Also, both the IAP and AMIS management are taking Greek lessons.

April Foolishness

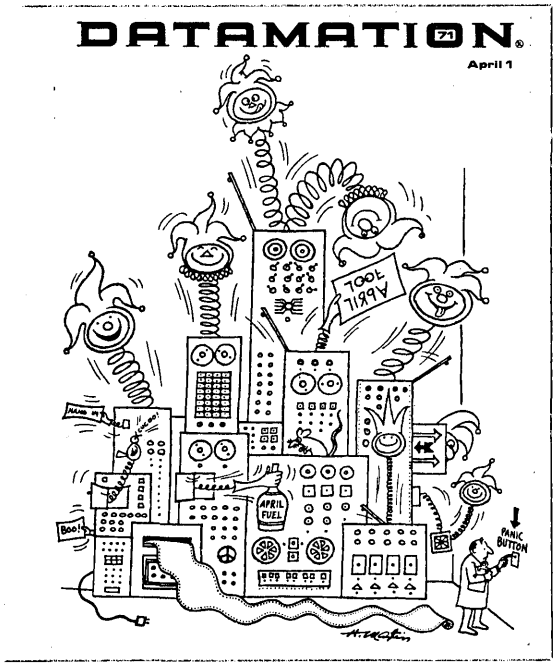
With illustrations by Barbara Benson

"Greek states have united, hired Macedonians as mercenaries and declared war on us . . ."

March 4, 1430 B.C. Bad day. IAP has slipped Rack II delivery. Specs revised again to include a threat model and kill assessment. Half the fleet is blockaded at Tyre, and the other half has vanished westward. Naval command expects them back at any moment. No way we can get the programming done in time if the specs aren't frozen soon.

March 27, 1430 B.C. Things go from bad to worse. Racks I and II are finally installed in the Palace Annex cellar, well out of catapult range of the walls. But nobody remembered the air conditioning until delivery. No program checkout time until air conditioning is in and racks have had three days to dry. Then they may work if there are no hardware bugs in the new high-speed scroll-writers.

March 31, 1430 B.C. Specs still floating. Big crisis today because maximum threat in the threat model is 250,000 Greeks. General staff wants 1,000,000. I pointed out that the entire population of the Ionian peninsula in the census of 1440 was 235,000. They



said, "What happens if the Greeks ally with the Persians and the Egyptians?" I suggested that, in that case, we would be left with no alternative but surrender. I was told that frivolity had no place in a serious discussion. Threat maximum will be 1,000,000.

April 14, 1430 B.C. Some software working. Hardware performance is erratic. Cassie in a blue funk again. At least the TROTAC staff meetings have been restful for us lately while IAP and Anatolia Bell hassle over whether the inability to communicate with remote terminals is due to IAP's interface equipment or Anatolia's lines. Greeks have arrived in force. Naval contingent at Tyre has surrendered. The other half of the navy is reported to have invaded Corsica. Naval staff considers this to be a great victory. It isn't clear why.

April 18, 1430 B.C. Disaster. The naval staff, having no more navy to run, has been put in charge of the TROTAC project. First meeting this morning. They wanted to know where the program documentation was. I tried to weasel out of it, but they as much as accused me of being a Greek spy sent to sabotage the project. We will, therefore, sit down and produce design specs in accordance with Mil Spec 392-4667C-04/16A, Volume VII, Revision 6CA. Programming staff is totally depressed except for Cassie who has, strangely, become almost cheerful. The walls have been manned with masses of troops as an interim measure until TROTAC is ready.

April 30, 1430 B.C. First sample spec rejected as being vague and ungrammatical. Programming has come to a complete halt. The abacus has been pre-empted to run the threat model software we turned over last week. IAP thinks that they can have another machine for us by August. I am not allowed into the facility because of my Greek background, but I am told that the initial threat was set at 1,000,000 Greeks on the assumption that we wouldn't have allowed for that number unless they were actually expected.

May 16, 1430 B.C. Design specs rejected—vague and ungrammatical.

July 15, 1430 B.C. Design specs rejected—vague and ungrammatical.

Aug. 12, 1430 B.C. Design specs rejected—vague and ungrammatical.

Aug. 18, 1430 B.C. Priam called the navy, AMIS, IAP and Anatolia on the carpet for the delay in TROTAC. The latter three ganged up on the navy. TROTAC has been reassigned to the army. The navy has been reassigned to carrying pots of boiling pitch to defense units on the walls.

Aug. 19, 1430 B.C. Design and program specs as well as flow charts have been accepted.

Aug. 25, 1430 B.C. It is clear that the projected system will not fit into a two-rack abacus. IAP has been asked to design a six or eight-rack unit. They have agreed, and project a delivery date of April 1429.

Sept. 5, 1430 B.C. Chaos. The kill assessment routine has concluded that all 1,000,000 attacking Greeks have been killed off, an opinion not shared by the soldiers on the walls. We are blaming the problem on godlings and various other immortals who are not dying in response to mortal wounds. A crash project is being effected to reflect an immortality factor in the kill assessment.

Nov. 30, 1430 B.C. IAP says the eight-rack machine may slip until July.

Jan. 28, 1429 B.C. Specs revised again. IAP now says that the big machine won't be ready until October.

Aug. 13, 1429 B.C. More spec revisions. IAP says maybe December.

Oct. 4, 1429 B.C. Anatolia, IAP, AMIS, and army called on carpet for delay in TROTAC. AMIS and IAP tried to gang up on Anatolia. Army suggested that the basic problem was the navy design, and recommended that the whole effort be reassessed. Everybody thought this was a great idea. Mercifully it did not occur to Priam to ask why the army had bought off on the navy's lousy design. Anatolia's contract terminated. AMIS and IAP given study contract to see what can be salvaged.

Oct. 16, 1429 B.C. First meeting of the study team today. Outcome is already obvious. One or two of the more objective participants may require as much as 48 hours to convince themselves that everything was going fine until the navy got involved and bungled the design.

July 15, 1428 B.C. After nine months of work we have produced a five-volume study (classified) which concludes that everything was going fine until the navy got involved and bungled the design. We are going to try again.

Sept. 30, 1428 B.C. I had a long talk with Cassie. She says: One, this attempt at TROTAC isn't going to work any better than its predecessor. Two, this is just as well, because Troy is good for about 18 more years so long as TROTAC *isn't* deployed. Three, this failure isn't going to be blamed on the navy—it's going to be blamed on Greek sabotage.

A lot of people think that Cassie is

crazy because she claims that she can foretell the future, but I'm not sure. The more I think about all this, the more reasonable it seems. It would take the AMIS-Anatolia-IAP team about 3,408 years to get everything they've promised for TROTAC working. Since they've only got 18 months, it is conceivable that they might not make it. Greek sabotage seems as likely a scapegoat as any, and it isn't hard to figure out who the Greek saboteur is going to be. I think it is time to think of my career and seek other employment. The Alchemy Department at Troy Tech was looking for a data processing type not too long ago. If that job's gone, maybe I can get some consulting work. If I could just get over the walls, I understand that the Greeks are snapping up anybody who can pronounce "philosopher" for their catapult aiming control system. With my experience I could surely sign on as a Staff Engineer or maybe a Group Head. I have an old resume around here somewhere. Have to update that. I wonder how big a lie I can get away with about my salary here?

—Don Kenney

Cylinder Ella

ONCE UPON A TIME, in a far-away kingdom known as Disk, there lived a forlorn Cylinder Ella. Cylinder Ella was always being accused of being off the track by her three ugly alternates.

One day, when it seemed that she had been going around in circles for hours, a message arrived at her address to say there was to be a gathering of important characters at the home of Prints Charming.

Of course, she was excited. But how could she go, defective as she was? She looked as though she lived in a dump.

At the moment of her deepest despair, her fairy god monitor appeared.

"What you need is a good surface analysis, Cylinder," said FGM. "I usually do my magic with a decimal hex, but what you need is a binary switch, and I'm not a bit too early. Just a moment, and I'll patch you right up. Now, shift left and byte down hard, while taking a deep breath . . . there, you look beautiful for going to see Prints Charming. But, you must seek home by midbyte, as that Prints moves in very fast company—he's a sector maniac, you know!"

Cylinder Ella felt as though she'd been re-initialized. She felt every bit as good as any of her alternate systems.

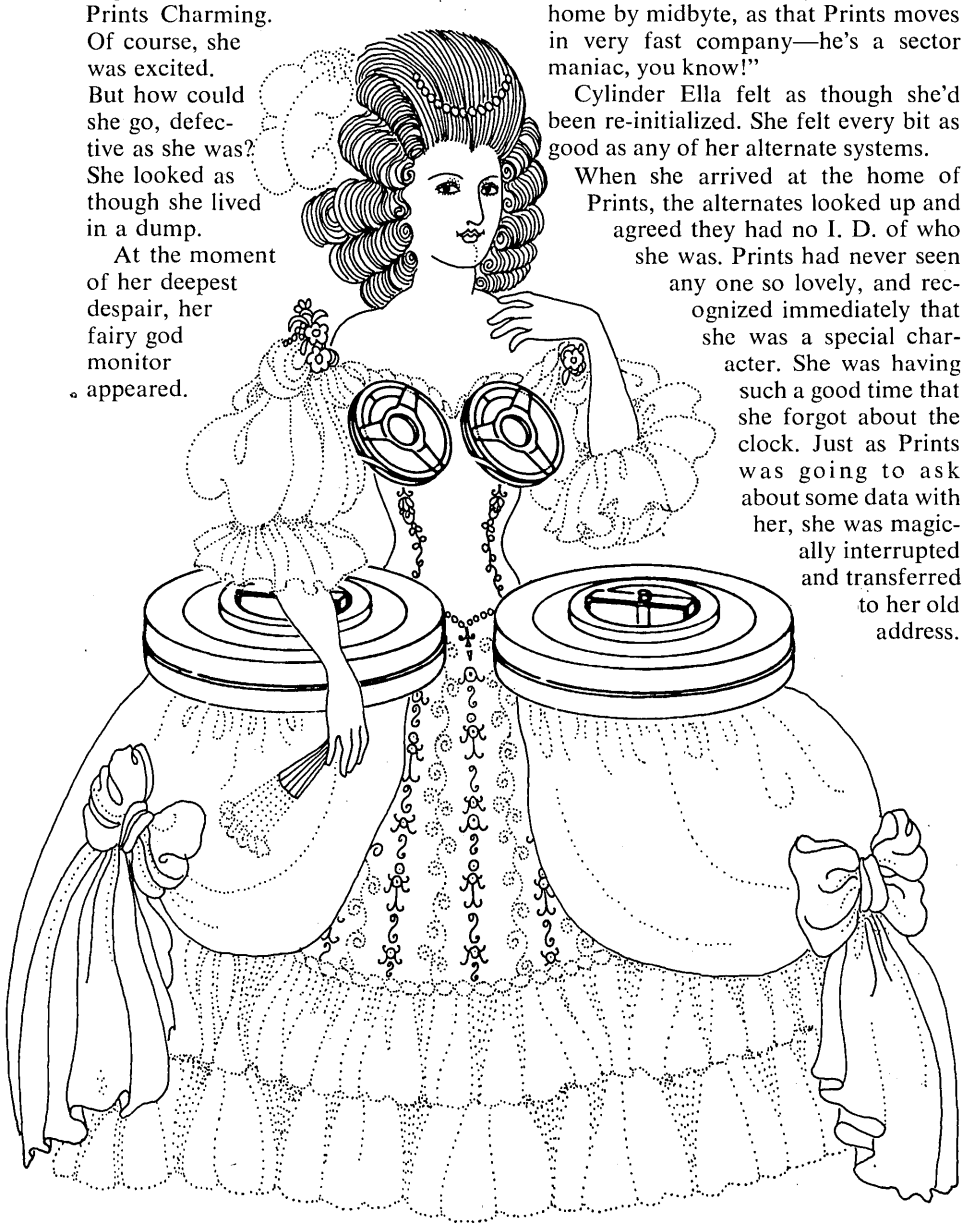
When she arrived at the home of Prints, the alternates looked up and agreed they had no I. D. of who she was. Prints had never seen any one so lovely, and recognized immediately that she was a special character. She was having such a good time that she forgot about the clock. Just as Prints was going to ask about some data with her, she was magically interrupted and transferred to her old address.

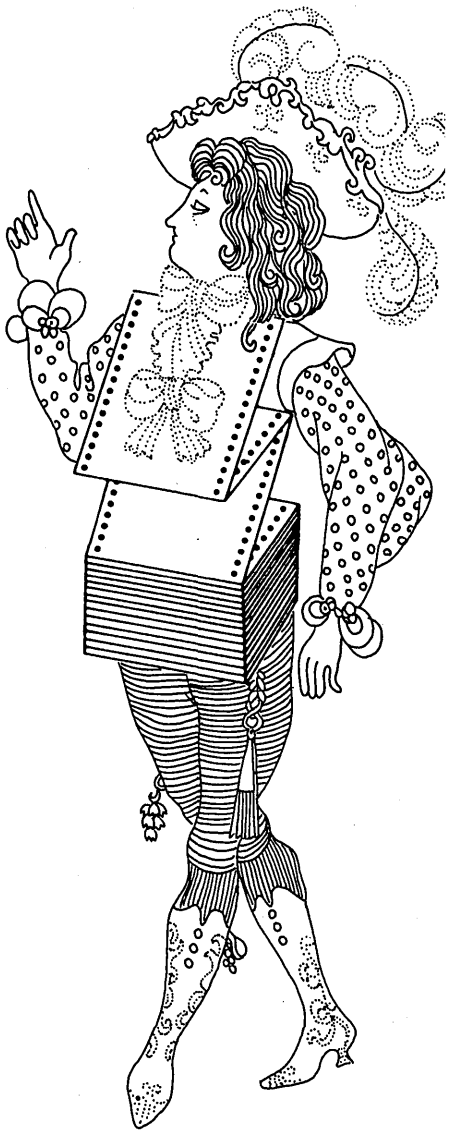
Days went by and she heard nothing from Prints. Finally, she received another message which said, "I'm in the mode for love. Tonight I will have the carriage return for you. I will carry the imprint of your image forever." Cylinder almost had power failure, as she fell back on her matrix.

"He is Asciing me to be his Prints S! My world revolves around him, too. I am touched to the very nucleus of my system. This is definitely the logical right shift for me. I will move immediately." And she did.

And they went around like that, happily ever after.

—Linda T. Muir





field application note

MEASUREMENT OF POTENTIAL DIFFERENCE

Measurement of potential differences is normally made with the use of a voltmeter, which is a suitably calibrated galvanometer (ammeter) with a built-in resistance which permits the ammeter (galvanometer) current measurement to be interpreted as a voltmeter (potential difference) voltage measurement between the two points in question. The two meter connectors are marked "+" (positive or high) and "−" (negative or low). Depending on the application, one or the other of these may, or may not, be connected to ground (GND).

The potential difference between the two points in question, A and B, is the difference between the potential at A and the potential at B, either of which may be higher (or lower) than the other, and either (or both) of which may be above (or below) ground. Not infrequently A (or B) is, in fact, at ground potential.

A potential difficulty occurs when potential difference measurements are to be made below ground potential. In this case, the positive connector will be negative, so that this negative potential, which, of course, is high, must be subtracted from the negative potential at the negative connector, which, of course, is low, to give the actual amount of voltage (potential difference) by which the negative connector's potential is lower than the potential at the positive connector.

A good operational rule of thumb is to bear in mind that, since high is lower than ground, low is more lower than ground than high.

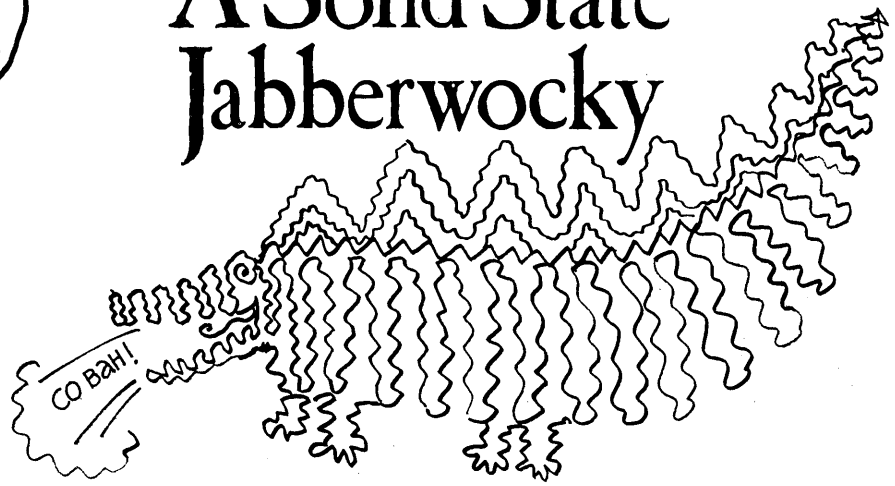
—Pete Lindley

OUT TO PUNCH

To please
The she's
That punch the keys
Distinguish these:
I's and ones; U's
    and V's;
O's and zeros; twos
    and Z's.
If these rules you'll
    apply
Your decks will come
    through
With an I for an I
And a 2 for a 2.

—Edmund Conti

A Solid State Jabberwocky



'Twas Burroughs, and the ILLIACS
  Did JOSS and SYSGEN in the stack;
All ANSI were the acronyms,
  And the Eckert-Mauchly ENIAC.

"Beware the deadly OS, son!
  The Megabyte, the JCL!
Beware the Gigabit, and shun
  The ponderous CODASYL!"

He took his KSR in hand:
  Long time the Armonk foe he sought.
So rested he by the Syntax Tree
  And APL'd in thought.

And as in on-line thought he stood,
  The CODASYL of verbose fame,
Came parsing through the Chomsky wood,
  And COBOL'ed as it came!

One, two! One, two! And through and through
  The final poll at last drew NAK!
He left it dead, and with its head
  He iterated back.

"And hast thou downed old Ma Bell?
  Come to my arms, my real-time boy!
Oh, Hollerith day! Array! Array!"
  He macroed in his joy.

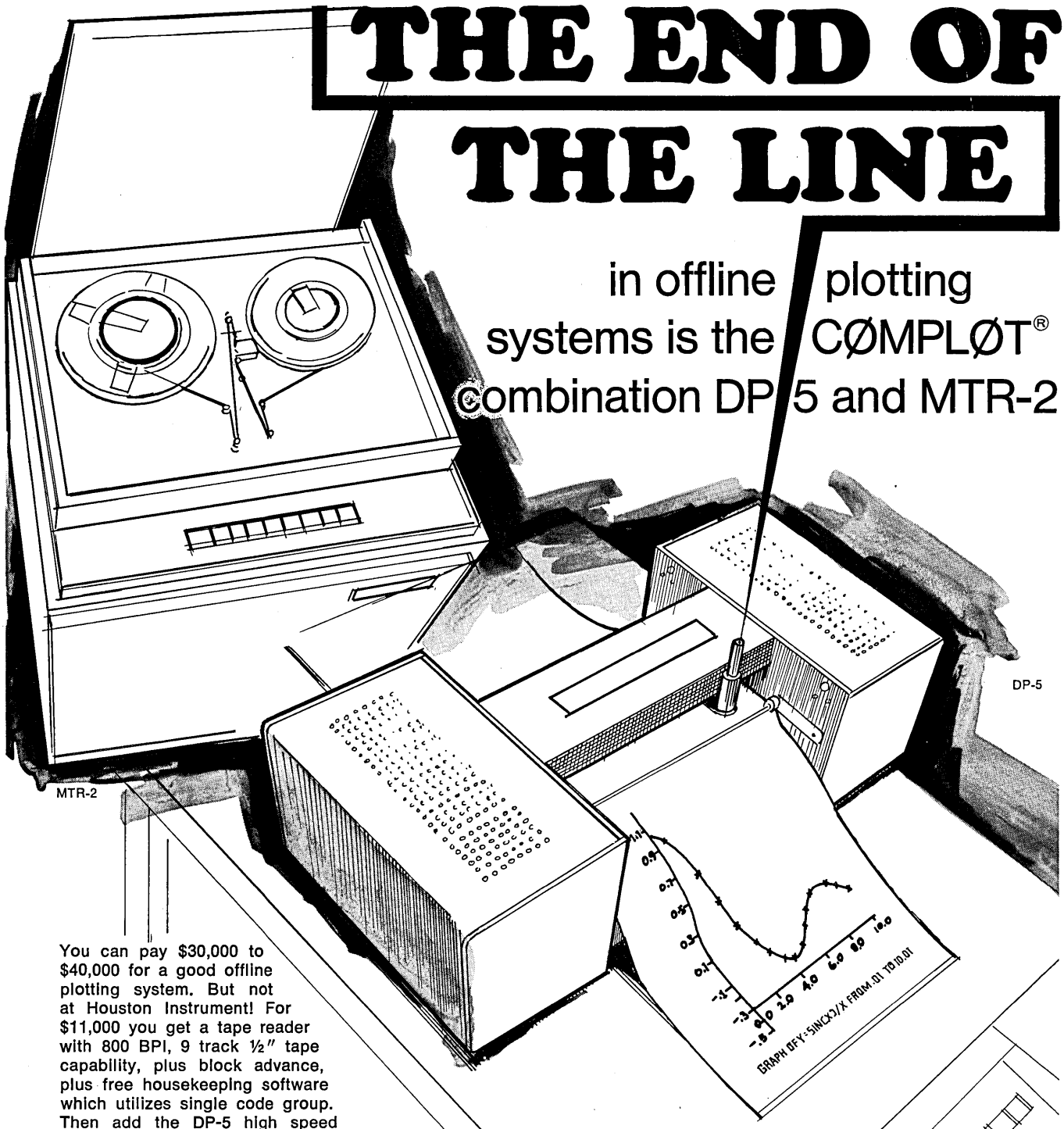
'Twas Burroughs, and the ILLIACS
  Did JOSS and SYSGEN in the stack;
All ANSI were the acronyms,
  And the Eckert-Mauchly ENIAC.

—William J. Wilson

"Johnson, if you lack confidence in our new computer-based environmental control system, I wish you'd come right out and say so."

THE END OF THE LINE

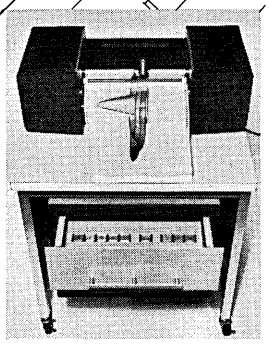
in offline plotting systems is the CØMPLØT® combination DP-5 and MTR-2



You can pay $30,000 to $40,000 for a good offline plotting system. But not at Houston Instrument! For $11,000 you get a tape reader with 800 BPI, 9 track ½" tape capability, plus block advance, plus free housekeeping software which utilizes single code group. Then add the DP-5 high speed incremental plotter for another $11,000 and you're in business. Plotting speed is 1200 increments/second. Step size is factory set at .005" or .0025".

The system makes offline plotting an economic reality. Write today for a complete brochure on offline plotting. Oh yes, the MTR-2 accepts IBM compatible tapes.

MTR-2 $11,000
(Rental $550./Mo.)



DP-5 $11,000
(Rental $550./Mo.)

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In price, features, and capability, programmable calculators now overlap the minicomputers. How do you know which to buy?

Calculators vs. Minis

by Paul Asmus

In the past decade, programmable calculators have grown from little more than programmable adding machines with a few special function keys to very powerful, flexible, interactive calculating systems that rival minicomputers. Today's programmable calculators range from simple keyboard languages to complete algebraic languages. Their keyboards can be easily custom designed for virtually any application. They have a wide range of peripherals, including just about all the peripherals available to computers. There are card readers, tape readers and punches, x-y plotters, output writers, digitizing devices, and even instrument interfaces. And today's programmable calculator is a better buy—with more computing power in less space for less money.

It seems as though there is a duplication of effort here—that programmable calculators are overlapping the lower end of the computer spectrum. One might ask, "Well, isn't that calculator really a computer?" Or, "For that much money, shouldn't I really buy a computer?"

Not necessarily. Although a programmable calculator will do many of the things a minicomputer can do, it is not a minicomputer; and similarly, even though a minicomputer can do the things a calculator can do, a minicomputer is not a calculator.

The difference is dedication. Programmable calculators are dedicated to calculating, to problem solving. They're designed to be personal, interactive computing tools. Computers, on the other hand, are very general, not dedicated to any specific application, but capable, through programming and configuration, of doing any data processing task. A computer can be programmed and configured to be a calculating system, but can also be configured to do a myriad of other jobs. The decision whether to use a calculator or a computer always depends on the nature of the application.

Being dedicated to problem solving, the programmable calculator is completely self-contained, having all the essential elements built right in. There is a keyboard for entering data or programs, or for operating without programming for "on-the-spot" calculations. There is also a display for calculated results, programs, and input data. Displays range from presentations of a few registers where calculations are done to full alphanumeric displays. Also included is an alphanumeric output printer and a means of recording and loading programs, usually magnetic cards or cassettes.

A calculator user need not become involved, then, with what it takes to generate a language or drive a printer or display. He need not concern himself with configuring the system to do his kind of problem . . . it's already configured. Specifications such as cycle time and word length are so far removed from the problems to which a calculator is dedicated that most manufacturers don't even publish them. All the user needs is a brief set of operating and programming instructions.

Programmable calculators fall into two main categories: those having "keyboard" languages and those hav-

ing "algebraic" languages.

On a "keyboard" calculator, each key defines a complete operation and when the key is depressed the operation takes place immediately. All operations—arithmetic, storage, special functions, printing—can be done from the keyboard with one or two keystrokes. One programs such a calculator by switching it to its "store program" mode and pressing keys in the same sequence one would use to make the calculation manually. Keyboard calculators are very easy to learn and people with almost no experience or background in programming find themselves operating and programming in a matter of days. Anyone who can operate one can program it, and anyone who can operate an adding machine can learn to operate a "keyboard" calculator.

In spite of its simplicity and approachability, the "keyboard" calculator can do a wide range of calculations. Most such machines have anywhere from 500 to several thousand "program steps" available, where each single key operation is a program step, and can store around 100 12-digit floating point numbers. A basic keyboard language calculator can handle the solution of 10 simultaneous linear equations easily. Almost all operate internally with 12-digit precision and display results to whatever precision the user selects. So, accuracy is usually on the order of one part in 10^{10} or better.

One drawback of "keyboard" calculators is that their assembler-style language is somewhat cumbersome for solution of very large or very complicated problems. Although the language is easy enough to learn and contains all the instructions necessary to do more complicated things like indirect addressing and subscripted variables, the process of converting a problem to the required sequence of keys is sometimes very tedious.

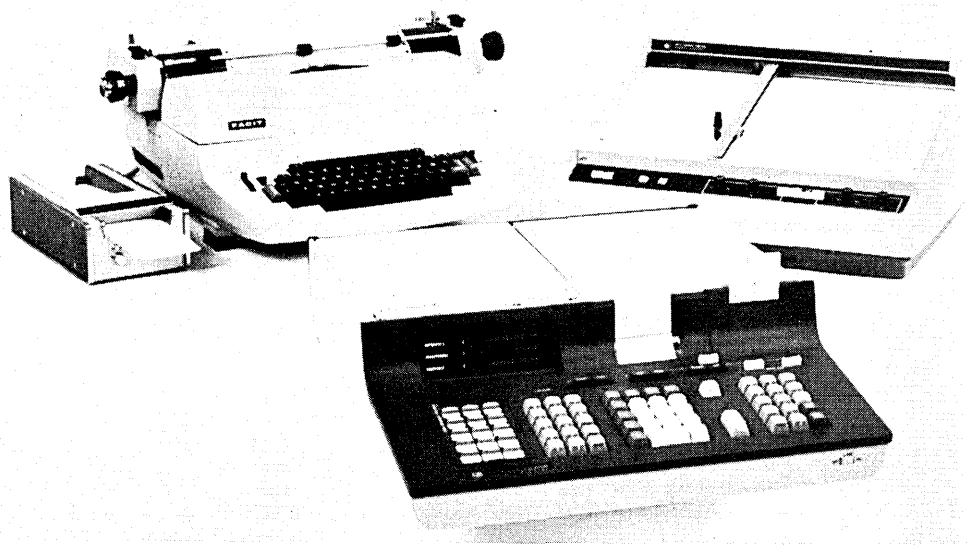
This is where the "algebraic" programmable calculator is a better choice. It has a language very similar to well-known computer languages. To operate an "algebraic" calculator, one keys the expression into the calculator using the same symbols he would use to write the expression on paper. The expression appears in the display as it is entered. At any time during the entry the expression may be "backed up" and edited; characters may be entered, deleted, or written over. If the user makes an error in entering, such as a syntax error, the calculator displays an error message right then and there, and he "backs up" and corrects it. Once the expression is properly entered he presses an Execute key and the calculator displays the calculated result. He still may recall the expression, edit it further, and execute it again.

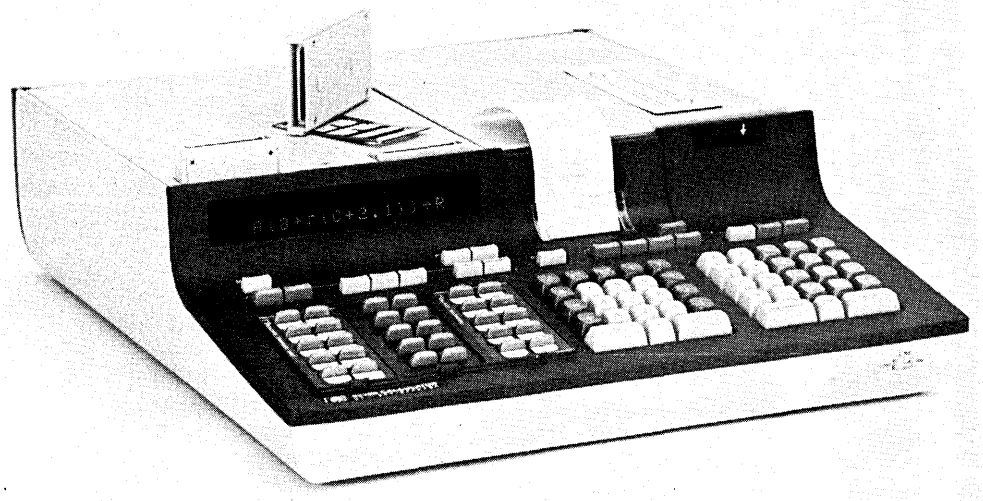
To program an algebraic calculator one "writes" a line of program in the display as if he were going to execute it and presses a Store key instead of executing the line. The calculator assigns the line a number, stores it in memory, and displays the line and its line number. If the line contains errors, such as a missing terminal right parenthesis, the calculator will display a diagnostic error code instead of storing the line. If, in running the program, an error such as dividing by zero or log of a negative number occurs, it stops and displays an error code along with an indication of the line in which the error occurred.

The algebraic calculator is the one most similar to a small computer in its appearance and performance. For less than $6,000, an algebraic calculator that can store nearly 200 numbers or about 1400 characters of program is, in many instances, a viable alternative to a computer—especially when one considers that the display, alphanumeric printer, keyboard, program storage medium, language, etc., are built in. The calculator is ready to go to work immediately, as soon as it comes out of its packing crate.

The major drawback, of course, is size. There is a definite upper limit to the magnitude of problems even an algebraic calculator can handle. There are peripherals, like tape cassettes, to expand the memory, but even with these there is a limit beyond which a calculator becomes inefficient. There are also applications in which a calculator is a poor choice.

Being dedicated also limits the programmable calculator. The price a cal-



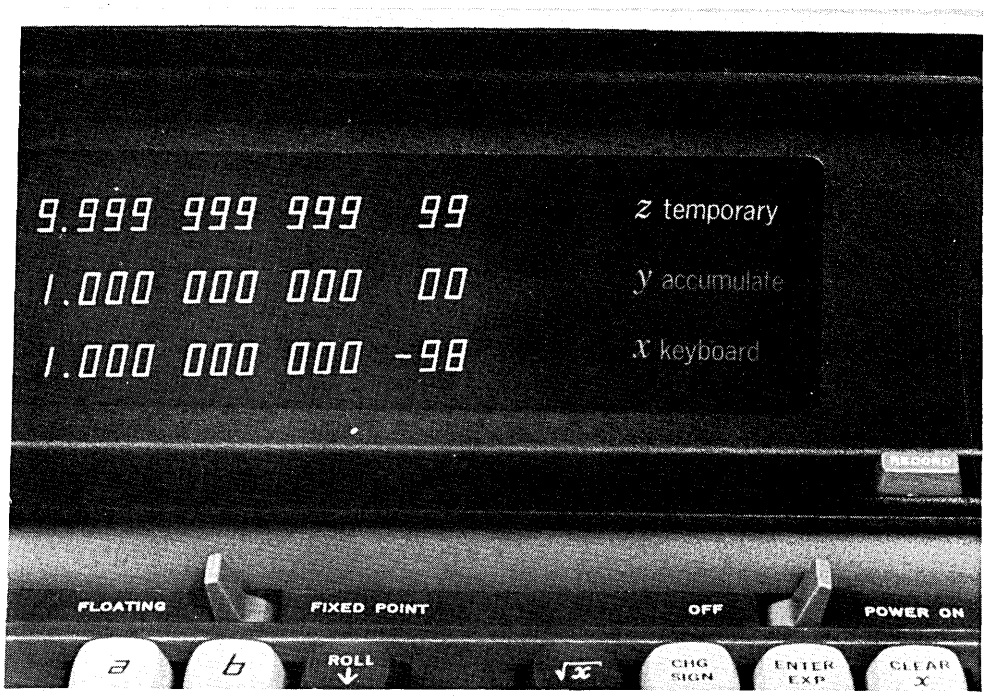


culator owner pays for not having to get involved with all the intricacies of a computer is the sacrifice of some of its alternatives. A calculator only interfaces to a specific set of dedicated peripherals, only outputs in a few codes, only reads ASCII or BCD tapes, and only accepts decimal numbers. Although it can print, draw, or type in alphanumerics it can't manipulate character strings. It could not be programmed or configured to recognize names or accept binary data from an encoder. It is dedicated strictly to calculating—so the emphasis is placed on making it easy to learn, easy to program, easy to operate, and powerful.

Making a choice

The choice of a dedicated solution or a general-purpose solution depends, of course, on the situation—on the real need for generality, the user's and specifier's knowledge of computers and hardware, the time and manpower available for the task, and, obviously, the cost. Sometimes the dedicated solution is really an application of the general-purpose machine. And sometimes a general-purpose solution can be achieved using the limited amount of generality available from a more dedicated machine. Many applications are clear-cut computer applications and some are obviously best handled with a calculator. But a growing number of them fall into a grey area where it appears that either a calculator or a small computer might do equally well. Here are some suggestions.

How much dedication? Although a programmable calculator is dedicated to calculating, it's a very general-purpose calculator. It's not tailored to any specific *kind* of calculation. It is intended for an environment in which many kinds of calculations are to be done. So, in a situation where the major task is calculating, but where the calculation is standardized, the calculator may be a poor choice. If one or two programs are to be written and used continuously with only minor modifications for a year or so, the enhanced programmability and approachability of the calculator are of questionable value. Here is a case where a dedicated mini with specialized I/O would probably be cheaper and more efficient. Where there is a moderate to light amount of programming to be done by a few people with limited computer backgrounds, a keyboard style calculator provides a quick low-cost alternative.



At the upper left, a programmable calculator system with some of the more popular peripherals, including a miniplotter. Below, an algebraic calculator showing the alphanumeric display. Above, the display of a "keyboard language" calculator showing contents of three registers in which all arithmetic operations are done.

At the most general end of the dedication spectrum is the case where a great deal of calculating and programming is done. Here the algebraic calculator can make a real contribution. It is easy to implement, inexpensive and powerful enough to meet a great many requirements. If the calculations include some very large problems, a good approach might be to augment the calculator with a computer. If the size limitation is critical in most of the work to be done, the calculator would find little use.

How much generality? The computer is the most general calculating device. It can have any language, use any number system, accept virtually any kind of input or peripheral. But is all that necessary? Is it necessary to provide FORTRAN, ALGOL, and BASIC? Must the system be frequently reconfigured? Is throughput speed that important? If those questions draw a strong "yes," there is little point in considering a programmable calculator.

But if there is some doubt about the real need for so much generality, a calculator may be an alternative. Remember, the more general a thing is the more one has to know about it to use it. If many languages are available, either each user must know enough to configure the system properly, or there must be a specialist available to help them, or the machine must be administered—certain languages on certain days. Although a calculator has only one language, the language is always available. There is no need to load compilers or check configurations; diagnostics will show if peripherals needed by a given program are improperly connected. And the language, especially with an algebraic calculator, is general enough to do a wide variety of calculations.

Another dimension of generality involves peripherals and interfacing. Programmable calculators do have generalized I/O structures available, though usually they are limited in terms of the codes they can use. ASCII seems to be the most common, and some provide BCD interfaces to measuring instruments. So calculators can do some instrument control or data acquisition and perhaps some limited process control. The limitations are slower data rate and smaller data storage space. Provided that data rate and storage space are adequate, a calculator can be a significant contribution in places like research labs where a great deal of calculating might be done on data from a simple measurement system.

Who will use it? The system chosen should also fit the experience and capability of the people who use it or program it. The programming languages used by both calculators and computers are similar in capability and ease of learning. But they are quite different in the way they are implemented. In a programmable calculator the language, the keyboard and display interface, the peripheral control software, etc., are built into the machine's read-only memory. Algebraic calculators even have syntax checking programs, diagnostic programs, and diagnostic display programs in read-only

memory. A computer language, however, must be entered into the machine by the user. If the program is to be entered via a tape reader, the tape reader driver software must be entered into the machine first. This gives the user the advantage of using whichever language he likes, or whichever program entry medium he likes—but it requires him to make machine configuration, or at least the checking of configuration, part of his calculating job.

The calculator is more transparent in this regard. The user only operates it to do calculations. Since its configuration is relatively fixed he need not concern himself with it. Once he learns the language, the calculator becomes his personal, dedicated computing tool.

So, again at the sarcrifice of generality, the calculator is easier to use. Training involves only training in the language and familiarization with the keyboard. The only specifications a user must know are the ones which tell him if his calculator is big enough to do the calculations he needs.

A comparison of yardsticks

Even though the important distinction between calculators and computers is the distinction between small, dedicated calculating systems and general-purpose systems, it is helpful to look at calculator specifications and see how they relate to computer yardsticks.

Of all the specifications given, size is the most important. It alone will tell if the calculator is "big enough" to fit a given calculating requirement. Unfortunately there is little agreement among calculator manufacturers and users as to just how to indicate size. Some use "registers," others use "program steps" or "steps"; each calculator's "step" is a different percentage of its memory; it takes a different number of steps to do a given operation, like storing a number, on one machine than it does on another. This is due to an attempt to specify calculator size in terms of the operations the machine does rather than in bits and bits per word, and so on. But it makes comparison with other kinds of machines difficult. Here are some guidelines.

Registers. In general, a register is a "place" in memory big enough to store one 12-digit floating point number with sign and a signed, two-digit exponent. This is equivalent to four 16-bit words in most computers. So a calculator that has 100 registers available for program or storage has about the equivalent of 400 16-bit words of read-write memory.

In some machines, registers can be used for program or data storage and in others there are certain registers set aside for data only and certain ones for program only. When used for program storage, a register holds from 8 to 16 "steps" in a "keyboard" machine and about 8 characters of program in an algebraic machine.

A keyboard calculator with 1500 steps and 100 data registers would be (figuring 10 steps per register) equivalent to 400 16-bit words for data and about 500 16-bit words for programming or about 1000 16-bit words total. An algebraic calculator with 400 registers is roughly equivalent to 1600 16-bit words of read-write memory.

Program steps. The number of program steps per register or the number of total program steps is only meaningful with some idea of how much calculating can be done with each step. "Keyboard" languages are very similar to assembler languages in that arithmetic is done in a specific place (the displayed registers) and that numbers are indlvidually called to the calculating registers and results sent to some storage location. Here are examples of "step usage" for typical arithmetic.

OPERATION	STEPS
Any arithmetic	1
Call number from storage	2-5
Store number	2-5
Indirect store or recall	3-6
Exchange or transfer of numbers between calculating registers	1-2
Special functions (i.e., trig., etc.)	1

A conditional or unconditional jump or branch in program takes two to five steps. Operations like STOP, END, PAUSE, CLEAR, etc., are all single-step operations.

Characters. Usually each key on an algebraic calculator represents one character of a program, even though many keys are represented in the display by two- or three-character mnemonics. A program statement like IF A > C; GTO 4 takes seven characters (IF and GTO are only one character each).

Functions. Another very important specification, especially for keyboard calculators, is a list of the special functions available with a single keystroke or program step. Functions like $\sqrt{}$, $1/x$, x^2, x^y, and π (generates π to 12-digit precision in one of the calculating registers) are built into most keyboard calculators. Functions like trigonometric operations, logs and exponentials, or special-purpose statistics calculations are usually optional. In fact, most programmable calculators have whole sections of the keyboard which can be redefined by installation of a dedicated, deck-of-card-sized block of read-only memory or by entry of a key-defining program. In addition to math functions, optional blocks to provide specialized I/O keys or advanced programming keys are available for algebraic calculators.

Speed. Usually calculating speed is given rather than processor speed or memory cycle time. Speeds range from a few microseconds for simple operations to several hundred milliseconds for transcendental operations. Obviously, computers are considerably faster. The real relevance of speed for a calculator depends on the application. In environments where a great deal of programming is done, the actual running time of a program is often the smallest part of the total time spent getting an answer. In such cases, the enhanced programmability of a calculator may actually reduce the time spent even though the calculator itself is much slower.

Price. An algebraic programmable calculator with 173 registers for program and data, with a built-in alphanumeric printer, a mag card recorder, and one special function block—complete, ready to use—costs just under $6,000. A keyboard calculator capable of doing about the same calculations would cost about $1,000 less. But a keyboard calculator with 300 steps and 50 data registers costs less than $3,000.

In summary, the programmable calculator can contribute to almost any calculating situation. It is easy to operate and program; it is compact and inexpensive, and powerful enough for a wide variety of calculations. But it isn't a computer, and shouldn't be considered as one. There are situations where a calculator may be a better choice than a computer and many where computers are obviously the best choice. But for most, the best blend of computing power, approachability, and price will be some combination of computers, large and small, and programmable calculators. □

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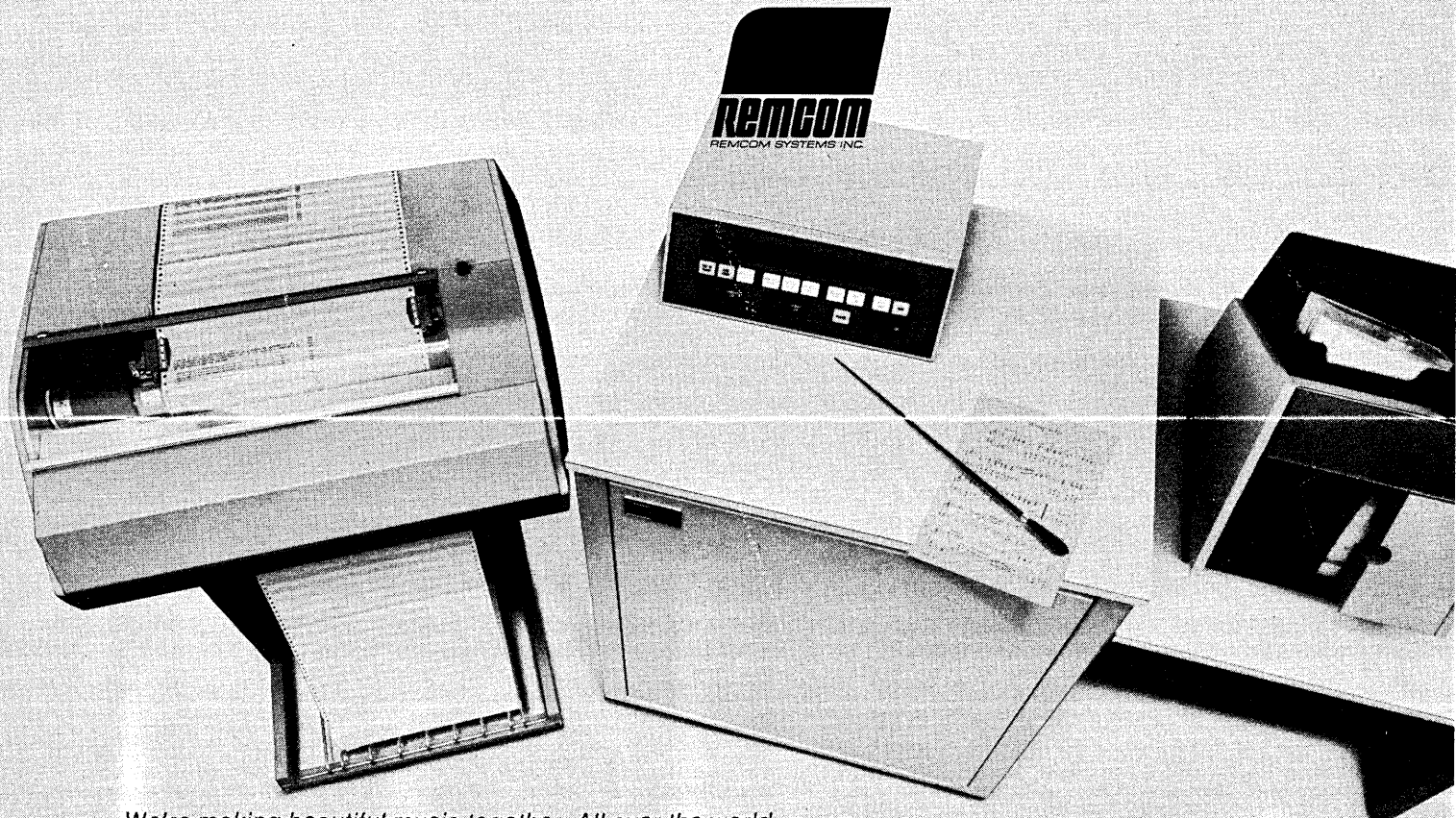

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The independents have much to offer but it's up to the installation manager to make sure he knows what he wants and what he's getting

The Mixed Blessings of Mixed Installations

by Philip H. Dorn, Contributing Editor

The last System/360 will be a set of engineering drawings and interfaces provided by IBM *while the mainframe, memory, peripherals, terminals, software and service will be pulled off the shelves of the many independent manufacturers.*

This 1980 dream might make the Computer Peripheral Manufacturers Association (CPMA) happy, but it is not going to be of much comfort to the IBM stockholders.

From a dead start of almost zero in 1968, the dream is much closer to reality than might be suspected. Suddenly and startlingly there appears to be almost nothing in a computing system that cannot be designed, engineered, sold and maintained by an independent vendor.

The key to understanding the recent events is hard to find because so many factors are involved. There is the desire of many ex-IBM employees to get a piece of the economic action; the architecture of a hardware system which requires the connection of units through standard interfaces; the sales success of System/360; the price structure IBM developed to maintain high profitability; the slowness with which IBM reacted to the growing competitive threat; the blessing of the federal authorities, notably GSA, on outside purchasing; the budget squeeze at many installations; and the cheap, off-the-shelf availability of reliable hardware components which in an earlier era had to be custom engineered.

It is not unheard of for an installation to have tape drives from one vendor, disc drives from a second, memory from a third, printers from another, transmission control units from still another and a third-party-leased mainframe. The system may be connected externally to remote terminals from many manufacturers interfaced to non-Bell system lines through modems from a wide variety of sources. The whole assemblage is maintained by an independent service contractor. Any installation which has completed this entire program is also likely to have looked into the various alternatives available for entering source data. There is no limit in sight!

While pleasant and profitable for System/360 and System/370 installations, what are the prospects for users of other IBM systems as well as non-IBM hardware? Most independent vendors do not have the sales or engineering qualifications to attack this more diverse market. With some 70% of all computers coming from IBM, the remainder of the edp community looks only marginal. Aside from a handful of comparatively minor exceptions, System/360 has been the target. The dominating fact is clearly market size. Recent attention to IBM's System/3 indicates this clearly. With well over 3,000 units in the field, independents have now drawn a bead on IBM-supplied card equipment and even on the undelivered tape drives.

Attempting to reduce the staggering sales cost for hitting these installations, the manufacturers of peripherals have resorted to OEM selling of their units to receptive mainframe manufacturers. This seems to have advantages for both sides; it permits the independents access to a broader market and allows the IBM competitors to benefit from the most up-to-date technology without incurring the heavy R&D costs of developing everything themselves.

Leaving this happy marriage of independent and IBM competitor, it now is necessary to consider the appeal of the independents from the viewpoint of the user of an IBM system, what the attractions are and what the possible disadvantages may be, both real and imaginary ones. To cover all this ground in a reasonable amount of space, the discussion will begin with the sale and then cover installation, operating efficiency and maintenance, and disengagement.

Who is a prospect for replacing primary-vendor-manufactured and rented equipment with independently manufactured boxes? The answer is not so simple as theorized in the sales training manuals. The first requirement is for the corporation under investigation to have a cost-conscious history, a demonstrable record of willingness to make a business decision that has risks to

save hard cash. In spite of regular public pronouncements about cost cutting by representatives of American industry calculated to bring a gleam to the eyes of the stockholders and Wall Street, the actions and attitudes are not very common when it comes to serious cutting in one's personal empire. Not many companies really get tough without a hard shove from the top, usually caused by a downturn in earnings.

So there is a prospect who seems sensitive to the financial details, now what? Is his management willing to take a chance on him? Is he the ultimate buying authority? How tough is the IBM sales team? Can IBM reach around you to the top management and scare them into staying with IBM? While this tactic is not spelled out in the IBM sales manual, it is naive to think that it is not done. IBM salesmen

IBM salesmen not ready to tackle the New Guinea market with used 407s will employ many strategies.

not ready to tackle the New Guinea market with used 407s will employ many strategies.

A more recent complication is the IBM Fixed Term Lease Plan (FTLP), sometimes known as Learson's Revenge. Until last year IBM equipment was almost totally on a month-to-month basis except for the purchased gear. The advent of the FTLP, 8% and 16% price reductions for one- and two-year terms respectively, may tie up even the best prospect for two years with a contract that is near unbreakable without paying severe penalties. If the target is already on the FTLP, put his name in the tickler file for next year and don't waste the time with him.

Sometimes a target of opportunity is found with a straight IBM month-to-month lease, total authority over the edp budget and hardware, and really itching to save money. That's a winner, unless he is outside a narrow radius around one of the 50-odd major population centers. If the installation is in Huntington, W. Va., or Modesto, Calif., or Pullman, Wash., or Waterville, Maine, or any of dozens of smaller cities, it is no deal at all. The economics of the independent peripheral business do not permit the installation of 12 spindles of disc or eight tape drives in such a location; the cost of maintaining an office, salesman and customer engineer with his spare parts supply simply evaporates the profit. Sometimes a third-party maintenance company can fill the gap; at other times it is simply impossible.

Thousands of large and small companies meet all qualifications. Do the salesmen concentrate on the 360/40 user with four tape drives or the 360/65 user who has 16 on the floor? The answer is obvious; it takes as much effort and sometimes more to sell the small shop as to convince the big one. Since the time required to close the deal is about the same regardless of user size, with few exceptions the smaller users do not see the independents' salesmen very often. At a maximum saving of perhaps $100/month for each tape-drive, a two- or four-drive shop is not a good prospect.

Turning these points around and sitting in the user's chair, what needs examination at this point? Essentially the reverse of the salesman's qualification set: company attitude, budget, engineering capability, personnel, maintenance force and reputation. The salesman will always say his is the best and cheapest—all salesmen say that —but this claim is not difficult to check since most installations are quite helpful on the telephone.

For a line on engineering and manufacturing capabilities, a look at a potential vendor's plant can be enlightening. Even though most edp managers have limited experience with head assembly areas, shake tests and subcontract quality assurance, common sense shows readily if the plant is well managed. Is it clean or sloppy, is it well laid out and does the material flow in an orderly manner, is there chaos on the work floor or does everybody seem to be going about his business? Answers to these questions are generally easy to find; an old hand at plant tours claims he can usually tell how good the in-plant capabilities may be in 15 minutes.

Investigating the salesman and his technical claims is easy, but finding out about his company may be harder. Independent manufacturers have had checkered financial histories in recent years and some of their earnings statements have given Wall Street and the SEC fits. The reaction in large corporate credit offices has been equally cautious. The gut questions for qualifying a vendor are: first, what is his present financial status, and second, assuming the worst will happen, are his customer and product base sufficiently attractive for acquisition by a more solid competitor? The data in most cases is not hard to get; creating meaningful information from the raw data is somewhat more difficult.

So, you like him and he likes you and it is time to deal. . .

IBM's slogan is "buying made easy." Send a letter and wait a while because the salesman will come by with all the information ever needed; models, prices and delivery dates as well as the standard-form, virtually unmodifiable contract. With an independent manufacturer, when you go to contract it is totally different. Everything is negotiable.

While the essential provisions to be discussed do not as a rule include price, just about everything else is fair game: term, test time, purchase options, maintenance coverage, spare units for back-up, installation assistance and protection against all sorts of damages —legal and to the hardware system. While price is not generally negotiable, a starting point for discussion is a discount of 20-25% from the price of the comparable IBM unit with no overtime charges. Quantity discounts are sometimes obtainable, particularly when dealing with multiple terminals; anticipated discounts are in the range of 5-10% for 10 units, 10-15% for 20 or more units.

Lease terms may run as short as six months or as long as desired, with special purchase options when required. For such overstocked units as 2311-compatible discs, almost any terms can be arranged.

Test time, a convenient tryout period, generally will vary between 30 and 90 days, based on the size of the potential order. For engineering purposes a 30-day trial is adequate but 90 days allows an installation to get in some free running time. The unit quantity usually is between two and four, although there have been installations which demanded and received as many as six tape drives for testing.

Maintenance coverage is the key technical element: time, location of spare parts, back-up maintenance coverage and the location of the primary engineer. The leverage an installation has varies by the size of the order. For 24 disc spindles or a combined tape drive and core memory order, the vendor is apt to provide full one-shift cov-

Since maintenance makes the real difference with peripherals, this is apt to be a high point in the negotiations.

erage and on-site parts. A smaller installation may have to settle for day-shift coverage for unscheduled maintenance from a location as far away as 50 miles. Since maintenance makes the real difference with peripherals, this is apt to be a high point in the negotiations.

Since most independent manufacturers have comparatively limited maintenance staffs, the possibility exists that a third-party servicing company may be required in many locations. This arrangement has proven acceptable with widely scat-

tered equipment such as remote terminals, but at least once in the recent past almost ruined a tape drive manufacturer; to this day their sales appear inhibited in that geographical area. The occasional visitor from a third-party service company may not be able to grasp the nuances of machine room relationships. Another potential danger is the requirement for service company representatives to be trained and up to date on many pieces of equipment without being able to concentrate on one.

Although not really necessary with peripherals, arrangements for spare back-up units are often consummated. A system with one malfunctioning tape drive can hardly be considered down. Back-up is an interesting question when discussing minicomputer-based terminal subsystems; in critical instances a back-up unit is often demanded and received. Parenthetically, it should be noted that such minis are among the most reliable electronic devices built and most of the back-ups sit in a customer engineering room gathering dust.

Systems engineering upon installation is unnecessary when the units are true plug-for-plug replacements. However, the advent of double density disc files requiring software system changes on the host computer alters matters. A certain amount of software assistance should be obtained as well as protection against spending excessive billable mainframe time getting the modified system to run. While changing the input/output modules of either DOS/360 or OS/360 is not that complex, a minimum assistance guarantee would probably require one man-month or until the job is completed, whichever is longer.

Finally, it is sound business to be contractually protected from damage to the primary computer owing to subsystem or peripheral failure. Since there is always the possibility of such electrical interconnect problems as reversal of various signal lines or bad pins on cables, any installation looking at independently produced boxes should, first, secure written permission from the main system's owner, and second, protect themselves legally from possible damage or unnecessary billable maintenance calls.

After these points are covered and the deal is made, it is time to undergo the delivery and installation trauma . . .

The buy is complete; it is time to install and get it running. The first step is breaking the news to the primary vendor and—since it is doubtless IBM—they won't be surprised; they have very good sales intelligence. It is a management task to pass the word politely that this is the way it is going to be and that it is expected that IBM's employees will accept the decision and continue to work for the success of the shop. They will, too. There are likely to be no problems at the customer engineering level; most of the independents' engineers were trained by IBM and have friends on both sides of the fence. Since they are all dedicated working men facing specific hardware with specific problems, they are likely to get along well, cooperate far beyond the book and live with each other peacefully. A "noise" problem may be anticipated with some of the managers and salesmen but this is minor, more political and defensive than serious, and part of the price paid for leaving the family.

The change-over pace must be carefully planned; it is asking for trouble to install independent tapes, discs and memory all at the same time. Successful installations appear to take one type of box at a time with one- to two-month separations to permit operations to settle down between jolts.

Installation of mixed equipment is rarely troublesome since the components are mostly subsystems and add-ons. For subsystems it is normal to power up, fully check out off-line and switch on at the last moment. Recent developments of microprogrammed control units permit elaborate pre-installation diagnostic testing.

To add memory to a system beyond the IBM-specified limit has been very routine until recently with just a few hours and a number of minor changes to the cpu wiring required. But IBM has recently notified users of one core extension memory that they will no longer maintain the cpu because " . . . it is not practical for an IBM customer engineer with standard training and experience on a Model 30 to maintain . . . (the) . . . substantially altered machines." There appears to be another set of IBM lawsuits in the making since the memory manufacturers are not likely to sit still. From an engineering approach, it is hard to see what IBM's complaint is about; from a sales viewpoint, the answer is obvious.

When testing, the questions are: will it do what it was supposed to do, is it hurting anything else, and will it continue to perform after the engineers have left? Aside from specially written benchmarks, the best hardware tests are the standard production jobs under normal working conditions. Periodic examinations of IBM's maintenance log should be made; severe errors are apt to show more readily in the log than in noticeable job degradation. Performance is a contract point; the document should state that the independents' equipment must run as well or better than the comparable IBM equipment. Since there are no hard and fast performance measurement rules, this "as well or better" clause is hard to come to grips with and a visit to your corporate lawyer is recommended.

With all the experience the independents have, the only thing that regularly seems to go wrong is the cables. It seems trivial but a surprising delay can occur if the cables do not stretch to the location of the new box or if IBM can not be persuaded to leave the old ones on site.

So, the units are in, running and on rent; now it's time to worry about day-to-day operations and maintenance . . .

Preventive maintenance of an independently manufactured peripheral is not the same as that done on its IBM equivalent because, with non-IBM subsystems, diagnostic packages are different. As a matter of policy, IBM no longer provides diagnostics when their units are not present; in other instances they would not work because of hardware differences.

With all the experience the independents have, the only thing that regularly seems to go wrong is the cables.

With multiple vendors attempting to diagnose a problem, a finger-pointing exercise can occur as each says "not me, him." If this happened very often the independent peripheral business would be impossible. The vendors that are trying to run an honest business bend over backward to accept responsibility whenever there is any doubt and only finger IBM as the last resort after exhaustive tests have proven their equipment clean. One vendor will pay for any billable IBM maintenance call that proves to be his fault.

Working engineers are not likely to start any serious on-site fights; more likely they will help each other even if their employers have firm policies against fraternization. Most installations with mixed equipment echo this point and note few if any cases of major disagreements, far fewer than anticipated. The most common situation is for all the engineers, including IBM's, to gang up on Ma Bell—but that is a separate subject.

Working out a convenient weekly preventive maintenance schedule is complicated; wise old hands say the best way is to get all the vendors in one room and lock the doors until the schedule is finished. While different vendors have different system availability requirements, the pressures are easing as microdiagnostics become more widely available at the control unit level.

Running a mixed vendor shop requires more formal and regularized reporting procedures, but many one-

Mixed Installations

vendor shops have found the same requirements useful: daily trouble reports, strict sign-offs on billable maintenance activities, weekly vendor meetings with the assigned account personnel, and quarterly meetings with the vendor's management personnel.

On a day-to-day basis, running a mixed shop doesn't differ much from running a "simon pure" except in two minor details. First, the weekly vendor meeting is now in a conference room, not a phone booth, and second, if successful there is a flood of requests for guided tours by the salesmen. The edp visitation phenomena can be mildly annoying but it does open splendid opportunities for a manager to swap experiences with professional colleagues. This information flow can be a useful process and should be encouraged.

Eventually IBM tops your independent and it is time to disengage and return to the fold . . .

There is no problem in disengaging; IBM is always glad to replace independent units with their new, improved models. The IBM 3330 disc is replacing many 2314-compatible units; 2400 tape drive replacements are rapidly being retired for the IBM 3420.

If the contract is written properly with normal termination provisions for example, all units on a month-to-month basis after one year with a 30-day removal notice required, getting out should be routine. If written with an absolute end date and IBM delivery slips, a gap may arise. The solution when the contract is wrong is to look at the stockpile of equipment the friendly neighborhood leasing company has on hand. Even if they do not have exactly what is needed or won't lease it on a short-term basis, a hint of a third party getting into the picture usually succeeds in either advancing the IBM date or slowing down the independent's departure.

> Eventually IBM tops your independent and it is time to disengage and return to the fold.

The cycle has been: IBM develops, the independents knock off, IBM moves back out in front again. This suggests that the next round to occur, probably beginning in late 1972, will be back to the independents. Provided current interfacing technology remains unchanged, there seems no reason why the process should not continue to be iterative.

Despite the occasional irritation of IBM management, IBM created the independents and left room for them to prosper because of an excessively high profit/price structure. This might make some points with the Antitrust Division. There are rumors that it is not entirely accidental, but IBM is not going to comment on this point. Many an IBM employee wanted to be what Mr. Watson called a "wild duck" and the independents offer the opportunity to run a business with interference from Armonk. An interesting study for a sociologist would be the number of independents created by IBM wives when faced with a transfer from the beauties of California or Colorado to the rather vigorous climes of upstate New York. As long as these forces are active, independent equipment will be available.

But, from the user's viewpoint, what are the basic advantages and disadvantages of running a mixed shop?

The key advantages are price, contractual flexibility and slight performance improvements. Any time units that are as good or better than the originals can be obtained for 30% less money, their success in the marketplace will be real. Borderline improvements, 10% more power for 10% less money, are less likely to be attractive since they fall right in the range of IBM's FTLP.

> . . . IBM created the independents and left room for them to prosper because of an excessively high profit/price structure.

Performance improvements have been largely illusory; a faster disc seek time is marginal in a multiprogramming shop with sequential files—although for purely random applications it does have some payoff. Additional reliability, a positive step with the hardware of two or three years ago, is not much of a selling point with the performance and reliability of the 3330 or 3420.

Flexibility, particularly when using a mini to replace a transmission control unit, can be a major advantage since it obviates the need for extensive hardware rework every time an installation wants to change the terminal or line network. Programmatic changes are faster, cheaper and easier to undo than hard-wired adapters.

If the advantages are obvious, what are the disadvantages? First and perhaps foremost, the game cannot be played if the location is wrong; geography counts.

Second, an installation manager has to be prepared to manage resources in a careful, planned manner. While this is in the job description, many managers are willing to take the easy route and leave the management of their hardware to IBM because this is less demanding than dealing with multiple vendors.

There is a prevalent but false notion that IBM will no longer love an installation or give good service if non-IBM equipment is installed. It may actually be quite the reverse; IBM is more likely to respond aggressively when competitive pressure is applied. It is well to remember that this is a business relationship, not a love-in. IBM is the selling party, the user is the buyer and there is no requirement for friendship, flowers and romance—merely performance, service and reliability at a fair price.

What is the long-range future? Will IBM squeeze the independents out and do the independents have the resources to stay in the game for the long pull?

The picture is not clear since much of the response hinges on the results of the many anti-IBM lawsuits still in litigation. Certainly an unleashed IBM could easily destroy the independents; IBM's R&D expenditures alone probably exceed the combined assets of the top 10 peripheral manufacturers. The federal government can also continue to help, with an active program of replacing IBM peripheral units. The federal government is, after all, the largest single purchaser of data processing equipment. Regrettably, merely listing items on a GSA schedule isn't quite enough; the program has to be active —a demand, not a suggestion.

From the user viewpoint, the best thing that could happen is a series of mergers until a handful of well-financed organizations emerge as solid competitors with full hardware lines, nationwide sales and service forces and strong engineering capability. With IBM having over a billion dollars in cash assets, the present alignment of small companies is a vulnerable target against which IBM can apparently move almost at will by a little sleight of hand in the price structure.

While predictions of political developments are unreliable, it would appear that one hope for the independents is to create sufficient pressure in Washington through their trade association, CPMA, that they will be safe through the next few critical years. If permitted to die, to be squeezed out, the ultimate sufferers will be the users who will once again be subject to the tender mercies of whatever prices the IBM Corporation arbitrarily places on system components.

The users need the independents; they have brought flexibility and price competition, viable alternatives which were missing in the second generation. The demise of the independents would be a disaster of far greater magnitude for the user than for the deceased. □

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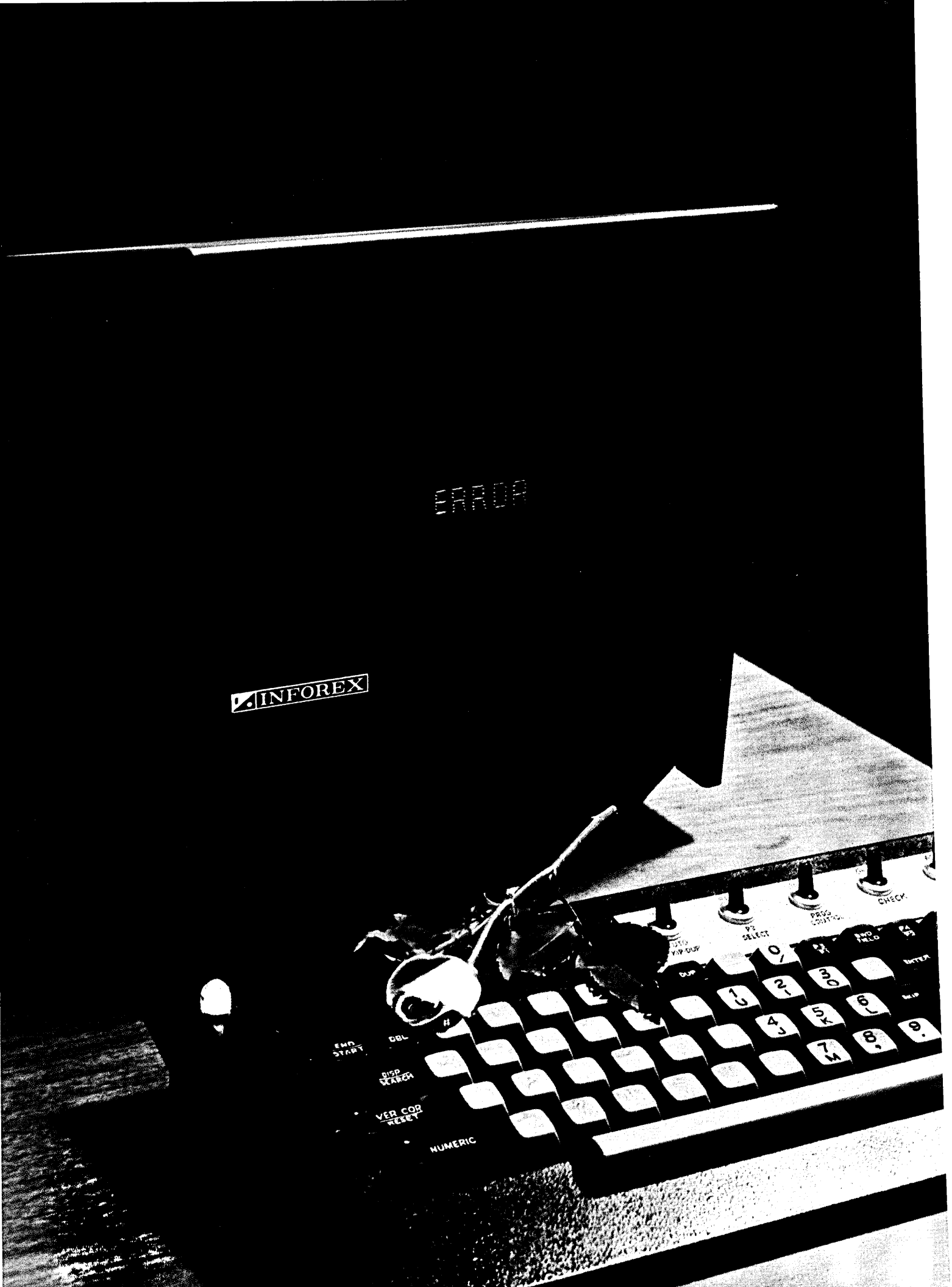
CIRCLE 40 ON READER CARD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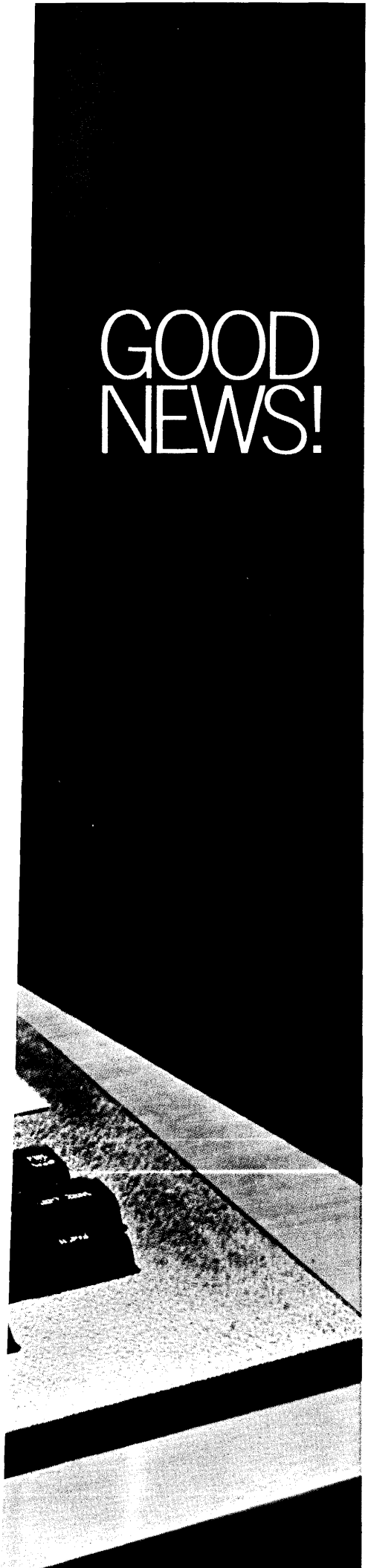

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CIRCLE 44 ON READER CARD

Technician, manager, hard work, psychology, politics . . . pick your style and pick your spot

The Insiders... Onward and Upward

by Milt Stone, Contributing Editor

Computerman has often been faulted for the binary quality of his thinking. "To that guy," say his detractors, "everything is either zero or one—and nothing is ever one-fourth or two." Which is bad, because everyone else has long since learned that in life there are few absolutes and many shades of gray.

In one instance, however, binary thinking is the only way to go. Computerman believes that to succeed he must either go up the ladder in the world of computers—or he must get out completely. And he's right. Once you step off the ladder, undue interest in computing or information systems is backsliding. As one man puts it:

"As soon as a manager gets involved in the development of a management information system, he's not regarded by his peers as still being part of management. He's become a technician."

The speaker is manager, computer sciences, for a large engineering and construction firm. He was "selected by management to manage computer activities and operations research because of my broad knowledge of the business and my management experience." Presumably, he'll get out of Computer City a split second after he's finished his tour of duty.

Be a realist

What tactical tips, what practical advice can be offered to guide the inside success-seekers? Before you set up your career ladder, realize that a little bit of preplanning goes a long way in this field. Start by getting your expectations in line with reality. A number of factors not under your control can set an upper limit for you. For one thing, in most instances computing or data processing is a service, just like the tool design department, for example. Irv Whiteman, a computer pro turned consultant/problem-solver, puts it well:

"Companies exist to make money. Within the company, the man with the greatest potential is the man with money knowledge. To make money, the company needs a product. People who know the product are next in line. To make the product and run the company, there must be tools. People who know about tools can now get into line."

Consider, too, that not everyone can be a chief. Source EDP, headhunters who specialize in the computer field, estimate that less than 5% of the professionals in the field will ever be the honcho of information systems in a medium or large corporation. The competition is tough—and getting tougher.

Finally, take into account the fact that opportunities for advancement are very much a function of growth. When companies are expanding rapidly, information systems development dollars are spent. It's much tougher to rise above a systems maintenance level when budgets are stable or shrinking.

Realistic expectations can span a range of ambitions. For example, a

Instant Behavioral Science ...we

In many ways Computerman may be special, but in one way he is not. What pushes his button is very apt to be the same thing that motivates his neighbor —his strongest need at the moment.

Maslow's need theory

Abraham Maslow[2] said that man is a "perpetually wanting animal" and that as soon as one of his needs is satisfied, another appears in its place. Maslow developed a hierarchy of needs that looks like this . . .

First, *physiological* needs are urgent. These are basic needs to sustain life—food, clothing, shelter. When these needs are satisfied . . .

Then, *safety* needs become urgent. These are needs for protection against danger, threat, deprivation. When these needs are satisfied . . .

Then, *social* needs are urgent. These are needs for belonging, association, acceptance, friendship, love . . .

Then, *ego* needs are urgent. These are needs for self-esteem (self-confidence, independence, achievement, competence) and for respect (status, recognition) . . .

Then, *self-fulfillment* needs are urgent. These are needs for realizing one's own potential for self-development, for being creative in the broadest sense.

Computerman would like to feel that his first three needs have been satisfied and that his motivation is at a higher level. In truth, his safety needs and his social needs are often uppermost in his mind.

McGregor's theory y

Mention has been made in a previous article of Computerman's aversion to Theory X management. To Douglas McGregor,[3] it seemed that "people today are accustomed to being directed, manipulated, controlled in industrial organizations (Theory X) and to finding satisfaction for their social, egoistic, and self-fulfillment needs away from the job."

In proposing Theory Y, he argued that people will drive themselves more effectively than they can be driven. Theory Y relies on self-control and self-direction. The trick is to get people to commit themselves to objectives by showing them ways of satisfying their own social, ego, and self-fulfillment needs. It is, said McGregor, "the difference between treating people as children and treating them

2. *Motivation and Personality*, Harper and Brothers, New York, N.Y. (1954).

3. *The Human Side of Enterprise*, McGraw-Hill Book Co., Inc., New York, N.Y. (1960).

"lead systems analyst" talks: "I've already succeeded more than I thought I would—mainly because of a lot of experience and because my company promotes from within." He's 32, a high school graduate, has 11 years in dp, and makes about $14K (in the Midwest). Success is supervising five programmers and "freedom in running my area—most of the decisions are mine."

But for another man who is the same age and had the same start, the expectation of a much higher perch on the totem pole is not unrealistic. The difference? Partly geography (he lives in a bigger metropolitan area) and partly education. He put himself through college (BA in psychology) by working in dp. He's had seven jobs in 15 years, rising from a $3K operator to a $20K manager of systems and data processing for the finance department of a large city. He sees himself advancing from data processing manager to vice president in charge of systems development—and sees himself hindered only by the difficulty of keeping pace with the rapidly changing technology and his lack of "good, broad, business experience."

Career styles in Computer City have two dimensions. With respect to goals, you'll look one way if your ultimate ambition is to be a manager of some sort. If you want to be known as a master craftsman, you'll look in a different direction.

With respect to methodology, you can think maverick and act conformist, or you can think conformist and act conformist. Acting maverick doesn't sell any more. Most everybody

work for more than bread

as mature adults."

In these times when the urge to do your own thing is a force that must be reckoned with, most managements use, or say they use, the Theory Y approach. This is both a benefit and a potential booby-trap to Computerman. His job, in spite of its demanding requirement for creativity, is a service job. When Computerman commits himself to the common objectives and, at the same time, seeks to satisfy his own higher level needs, he may be turning off his customer. The clever solutions to systems problems that help him to think that he is contributing may be threatening or (at a minimum) annoying to the user of the system.

From a different vantage point

A professor of economics by occupation, Eli Ginzberg[4] for many years led a Columbia Univ. interdisciplinary team in a study of man's relation to his work. Some of his (and their) conclusions are less cheery than the message of Theory Y—but of pointed interest to upward-striving Computerman . . .

1. Success is different from satisfaction. Success is viewed in relationship to the rest of the world; satisfaction has to do with the way you feel about your work.

2. In Iran the very young children who weave rugs lose their nimbleness by the time they are adolescents. They *must* look for a second career. In the United States, for a number of reasons, the necessity to shift from one career path to another will probably become much more prevalent.

3. In a rapidly advancing technological society, men get close to the top when they are already obsolete. Their knowledge is out of date.

4. Most work is performed by groups, not by individuals; hence it is very hard to assess individuals. Moreover, supervisors assess the supervised, and those who do the rating are the potential or actual competitors of those whom they rate. The more able the subordinate, the more likely that the evaluation will be faulty.

5. If an individual is interested in power, he moves very quickly away from the laboratory into the administrative hierarchy. He is not pulled away; he wants to move into the arena where the payoff is.

6. The dynamic American economy makes it possible even for people who are standing still to get ahead. All they have to do is step on the moving escalator and time alone will push them ahead.

7. Only a small proportion of any work group is really interested in working very hard. The world's work is always carried by that small minority.

8. There are important differences in career patterns—for some, career development moves along without handicap; others encounter real trouble.

The rocky career road

The behavioral scientists, noting this last conclusion, say that expectations profoundly affect attitudes. If experience falls short of expectations, unfavorable attitudes occur. When experience is better than expectations, favorable attitudes develop. Most importantly, with respect to career patterns, experimental evidence has been developed to indicate that the most satisfied members of any group are those who had the least expectations of promotion and yet were promoted—and, regardless of promotion, those with low expectations are more satisfied than those with high expectations.

A related finding is that the constant failure of expectations to materialize results in a "don't-sweat-it" attitude. The goals are lowered, and going through the motions becomes the order of the day. □

4. "Man and His Work," *California Management Review*, Winter 1962.

in dp works with somebody nowadays —and the requirement is for effective teamwork and not for brilliant orneriness.

Actually, these choices are all a matter of degree. The craftsman is expected to be somewhat attuned to management, and the embryo manager won't be able to hold his job unless he's something of a craftsman. Everyone is expected to be a communicator. The difference between thinking maverick and thinking conformist is primarily the difference between trying to initiate change and trying to be responsive to requests for changes that others have initiated. The choice of best style in this instance is most often dictated by the established tradition of the company.

Choosing a style really boils down to a choice of subject matter for concentrated study against the day when new or expanded skills can be put to work. For the embryo manager and the practicing manager it means avoiding the technician label. As one honcho puts it: "I view it (being so tagged) as an occupational hazard, and I've made some very definite efforts to avoid the stigma."

Pick your spot

You can pick your spot by the size of the installation. You'll opt for the small one if you're looking for a way to keep your finger in the technical pie as a manager, and if you want a close association with the dp team and with the rest of the company. Everything about the bigger installations is larger in scope, but the relationships are generally fuzzier and more distant, and the work is more compartmentalized. There's a strong possibility that the top honcho will be an administrator and not a leader.

You can pick your spot by the industry. The airlines, the banks, the oil companies, and the insurance companies would be hard put to do without their computer installations. Which is comforting in a security sense—as is the general personnel policy of these large and dignified organizations. The scale is grander, the pace is statelier, the palace revolutions are less frequent.

You can pick a spot because you'll be a member of the line. You'll be concerned with activities that bring in money. Typical of these situations are the facilities managers and the data base service companies. You'll work harder; you'll be gambling on the economy more than in other companies; but you'll like it if belonging to a cost center instead of a profit center bothers you.

Or you can pick your spot by the looks of the guy who'll be your boss —who'll lead you and teach you. This too, can be a gamble that turns out wonderfully well ("My boss is the real genius behind everything here, a great guy. We've had a superb relationship . . . if it hadn't been for that either of us would have left")—or horrendously badly.

But if you don't pick your spot, it's pot luck.

Disregarding for the moment the question of competence, and it frequently is disregarded, three methods of promoting your career are highlighted in this article. The tactics described are superior communication (the Hespos story), supereffort (the Ricks story), and organizational leverage (the Mancina story).

It's an in thing now to say that communications and establishing relationships are the keys to success in this business. Certainly, Hespos, Ricks, and Mancina all made noises that were well enough received to help them on their way up the career ladder. So attracting attention is a must.

Most honchos agree that they're attracted to subordinates who can make an effective presentation. It seems that even when working with a modest amount of substance, a talented matador of the flip chart can do himself no end of good.

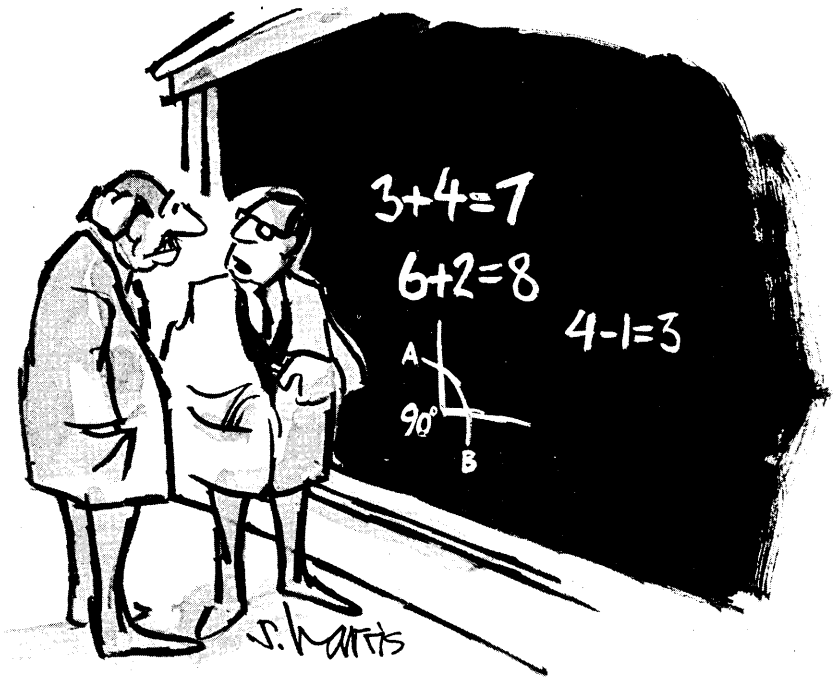
But wearing well is a must, too. To do that some homely virtues are required—competence, integrity, courtesy. And the willingness to accept the fact that computer-aided anything, design or management or whatever, is a service function and not *the* function.

One way of "reverse promoting" yourself is to annoy IBM. Better to believe this in advance than to discover later the effect of having done so.

Realism, once more

Recently, the American Management Association and DATAMATION cooperated in a study of certain attitudes held by the line executives who depend on systems and the information systems executives who design them. Significantly, one in every four on both groups indicated that prior and solid experience in line operations is a prerequisite to becoming a top information processing honcho. As a corollary, both groups agreed that tomorrow's honcho will need only a limited amount of technical knowledge. He must be a professional manager, an effective communicator, skilled in the art of relating to his peer group outside the computer activity—and he must be a businessman by inclination.

A realistic appraisal of the future would have to be that Computerman will be hard put to compete for the honcho and superhoncho positions unless he can convert himself into a modern Renaissance man, " . . . a present-day man with many broad interests who has the opportunity to indulge himself in them so as to acquire a knowledge of each that is more than superficial."[1] □



"Look—I never claimed to be an Einstein."

1. *The Random House Dictionary of the English Language*, Third Unabridged Edition.

A Member of the Engineering Team

Eric A. Weiss is Sun Oil Co.'s corporate computer sciences consultant. He's a veteran user of computers, a savvy, respected member of the fraternity. And he's an articulate spokesman for what he says is "the philosophical attitude that most of the technologically based industries have adopted.

"Computer - based systems, whether used to prepare pay checks or control plants, are processing systems in the same way that refineries are processing systems. An information system is different from a distillation tower only in the sense that the material with which it deals is information rather than gasoline.

"Once you have arrived at this concept, you have departed substantially from any thought that data processing is a research activity, or a branch of accounting, or anything so special that it requires totally new management principles or financial ojbectives. Computer technology and use is a branch of engineering."

If you can accept these ideas, Weiss believes that you'll have no trouble in accepting the idea that computer professionals—systems analysts, programmers, operations managers—are very much like their engineering counterparts. Which is not a particularly comforting thought—if you follow it through to the logical conclusions. Do the same negative factors that work to defeat an engineer also threaten Computerman?

For one thing, James Killian, President Eisenhower's science advisor, pegged the half-life of an engineer's usefulness at about seven and one-half years. In other words, an engineer would be only half as technically valuable to a firm seven and a half years after graduating as the day he leaves college.

Buttressing that idea are the recent research findings of Gene W. Dalton and Paul H. Thompson,[5] both of the Harvard Business School:

1. The average performance rankings of design engineers rise with the age of the engineers until the early thirties, drops steadily for each older group.

2. When asked to rank the complexity of the jobs assigned to engineers working for them, managers indicated that the toughest ones go to those in their late twenties—and everything is downhill from then on.

3. Predictably, annual increases in pay are at a peak for engineers in their early and mid-thirties—and everything is downhill from then on.

4. Worst of all, the years of high performance seem to be starting and ending sooner than they did even a few years ago—and this shift is occurring when large numbers of technical personnel are entering their forties and fifties.

Dalton and Thompson describe a negative spiral which they say is more psychological than physiological. When a man gets a low rating, or is left on a mop-up job for a long time, he tries harder—usually without prompt positive results. Then he develops a "don't care" attitude, then comes a lower rating, lower self-confidence, lower rating, and so on.

What should engineers do? Since everyone can't be a manager, and some truly don't want to be, the advice is to be a generalist who keeps his options open through continuing education. Thus, he's able to move into various specialties—whatever looks promising at a given time.

What should Computerman do? Presumably, the same thing, if computermanship is analogous to engineering. He can look forward to a lifetime of continuing education. But as Steve Ricks, Hibernia National's manager of systems and programming, says: "I'm wondering what the life span of a guy like me is in this field. You know, it's a pretty nerve-wracking job. They have statistics on the life span of doctors, smokers, lots of types. But they don't have any on programmers —the ones in business applications."

A final note on engineers—which may or may not fit into the Computerman/engineer analogy: In a recent study,[6] 52% of the respondents said that if they had it to do over they would still be engineers, but only 19% said they would want their children to. Said one, "I'd recommend it to my daughter to work at for a short time before getting married." □

5. "Accelerating Obsolescence of Older Engineers," *Harvard Business Review*, Sept.-Oct. 1971.

6. "Our Readers Sound Off on the Engineering Career," *Electronics*, June 21, 1971.

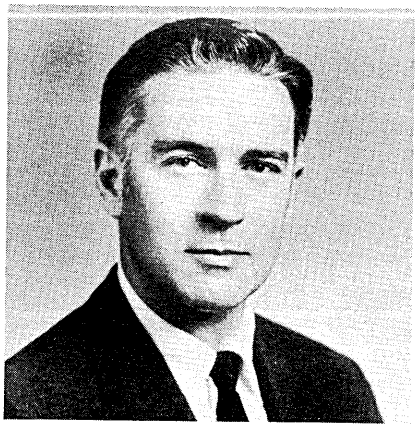
Credentials, Competence, Charisma . . .

Richard F. Hespos is director of computer applications at Dun & Bradstreet, Inc. He's *the* computer honcho in an organization that has a data processing budget of more than $13 million. His credentials are impressive.

For starters, Dick Hespos has picked up three Ivy League degrees along the way: BS in engineering from Princeton in '55, MBA from Harvard in '59, PhD in operations research from Columbia in '66. Even his military service is a credential—he programmed for the Elecom 100 at Aberdeen Proving Grounds. He has DPMA's CDP.

From the start, he was quantitatively oriented. Engineering intrigued him intellectually—it was fun—but he didn't see it as a career. "Management" is a career, and the MBA was acquired as a door opener.

At Bethlehem Steel, as a stress analyst, he was a computer customer. But, inexorably, he found himself spending more time with the computer work than with his engineering work. Moving on to Union Carbide as an operations researcher, he managed to stay clear of the computer. He was a problem solver, used programmers to get his work done, avoided "hands-on" involvement. It was at this time that he decided he'd make an honest OR man of himself by getting his doctorate from Columbia night school.



After five years as a technical problem solver, Dick Hespos planted his feet solidly in the management camp. Prestigious McKinsey & Co., the management consultants, wanted him for his experience, his personality, *his degrees* — Hespos wanted McKinsey, not for a permanent career but because consulting is "an unmatchable compressed education in business, a good way to get smarter faster." During his seven years in the big leagues of consulting, he saw himself not as a computer expert, but almost as a business generalist. He was "a guy with one foot in both camps."

And after seven years, he decided that the job he was best qualified to hold was the superhoncho job in dp. But first, he took a "conscious detour" to make a million dollars as an entrepreneur. Hespos

invested one year in two projects—an attempt to put together a package that would make John King and King Resources a significant force in the computer business, and an attempt to put together a $5 million venture capital fund. Did he make it? "Hell, no."

At D&B he reports to the executive vp and to the president. He's the management interface for computer operations in all of D&B, and he's second in command of the corporate development and planning activity. That makes sense because, as he puts it, "the computer is our manufacturing tool, producing the things we sell." He has 40 people on the corporate staff reporting to him on a solid line basis and some 500 people in data processing throughout D&B reporting to him on a dotted line.

Why did he make it? The answers are simple. (1) He has the kind of education that personnel departments look for and seldom find. But the substance is there, too. He's smart and business-savvy. (2) He's a communicator. He has the ability to talk up, down, sideways without obscuring the issue and without offending. (3) He's personable and likable. (4) He managed his career carefully and cleverly. (5) He commands the respect of the people who work for him.

Dick Hespos disagrees with the people who say that management skills are far more important than technical skills in managing a dp organization. Without downgrading the need to be a good manager and to understand the business of your company, he stoutly maintains that there is "a third leg to the stool. You have to command the respect of the people who work under you." And, as far as Hespos is concerned, that means that the honcho must have had a good enough grasp—at one time—of the nitty-gritty of computing so that he can now appreciate and understand the substance of the problems his people bring to him. □

Making Your Point . . . the hard way

Stephen G. Ricks is a 34-year-old officer of the Hibernia National Bank in New Orleans. When he was made assistant cashier in 1967, he was the youngest officer in the bank. Which was nothing new for Steve. The bank's systems and programming manager has been young for everything he's tried, and he's done everything the hard way:

He was married at the age of 17 and he and his wife had five children. By his own admission, the family need was a powerful motivator. Ricks was forced to work —hard.

He spent the first four years of married life in the Air Force, in the production control section of an installation squadron. He was discharged, still lacking a means of earning a living.

He went to work for Wesson Oil Co. in his native New Orleans and (from IBM and DPMA) learned to be a tab operator, "board wire type." But Wesson was bought by California-based Hunt Foods; dp was centralized in the West; and Ricks moved his growing family next door to Disneyland (literally). Why? Ricks felt it was his best chance to move up by learning programming. Hunt had a 1401 on

order. He learned, but it was the hard way—at Fullerton Junior College, on his own. He wrote programs on his own, too, after school. And he and his wife and, by now, four kids didn't like California or living next to Disneyland.

The Ricks family returned to New Orleans. In a year's time, Steve worked for three companies, first as an operator and then as a tab supervisor. In each case, the carrot was the promise that a 1401 was on order and that when it arrived, Ricks could become a programmer. The 1401s never arrived, but the third company—Hibernia National—did install a computer, an NCR system. Recalls Ricks: "I like to passed out at first." But he had finally made it into programming—the hard way.

From then on Steve Ricks rose quickly in dp. A bank officer in 1967, he got his CDP in '68, became DPMA chapter president in '70. At the bank he's responsible for systems development. In the Hibernia scheme of things he's a designer, a scheduler, a programmer, a debugger, an administrator. He would not be able to hold his job if he were not technically competent. And he wouldn't have his job if he hadn't been single-minded, persistent, and a very, very hard worker.

In fact, he feels that the long hours required in dp have prevented him from going to school at night. But, in his city and in his job, he may be close to the truth when he says that "ambition is most important. Without it, a degree won't do much for you." □

Scoring Points . . . the quarterback's way

Dr. Richard D. DeLauer, executive vp of TRW Inc., says: "It may not be palatable to the computer people, but we're attempting (at TRW Systems) to establish the idea that operating the machines is a way of life in itself. Like running any big plant. Now there's nothing that says that some guys that come up that ladder can't move into other activities—because they're good factory managers—but it's also true that there's an inversion (a firm limit) on where everybody in that business can go."

And after 16 years in computing, all with one employer, William P. Mancina figures he's gone about as far as he can. He's TRW Systems' superhoncho for information processing operations—the factory manager Dick DeLauer was talking about.

Bill Mancina's credentials include two masters degrees, in math from the Univ. of Minnesota, in business administration from Stanford—and a number of years of teaching experience. But the real skill that he brought when he paid his own way to Southern California in 1956 is the product of his years as a winner—a successful quarterback and football coach. When he joined Ramo-Wooldridge (later to become a substantial part of TRW), the computer center had about 30 people. Sixteen years later, a dozen regimes later, Bill Mancina is firmly entrenched—he runs the team he built.

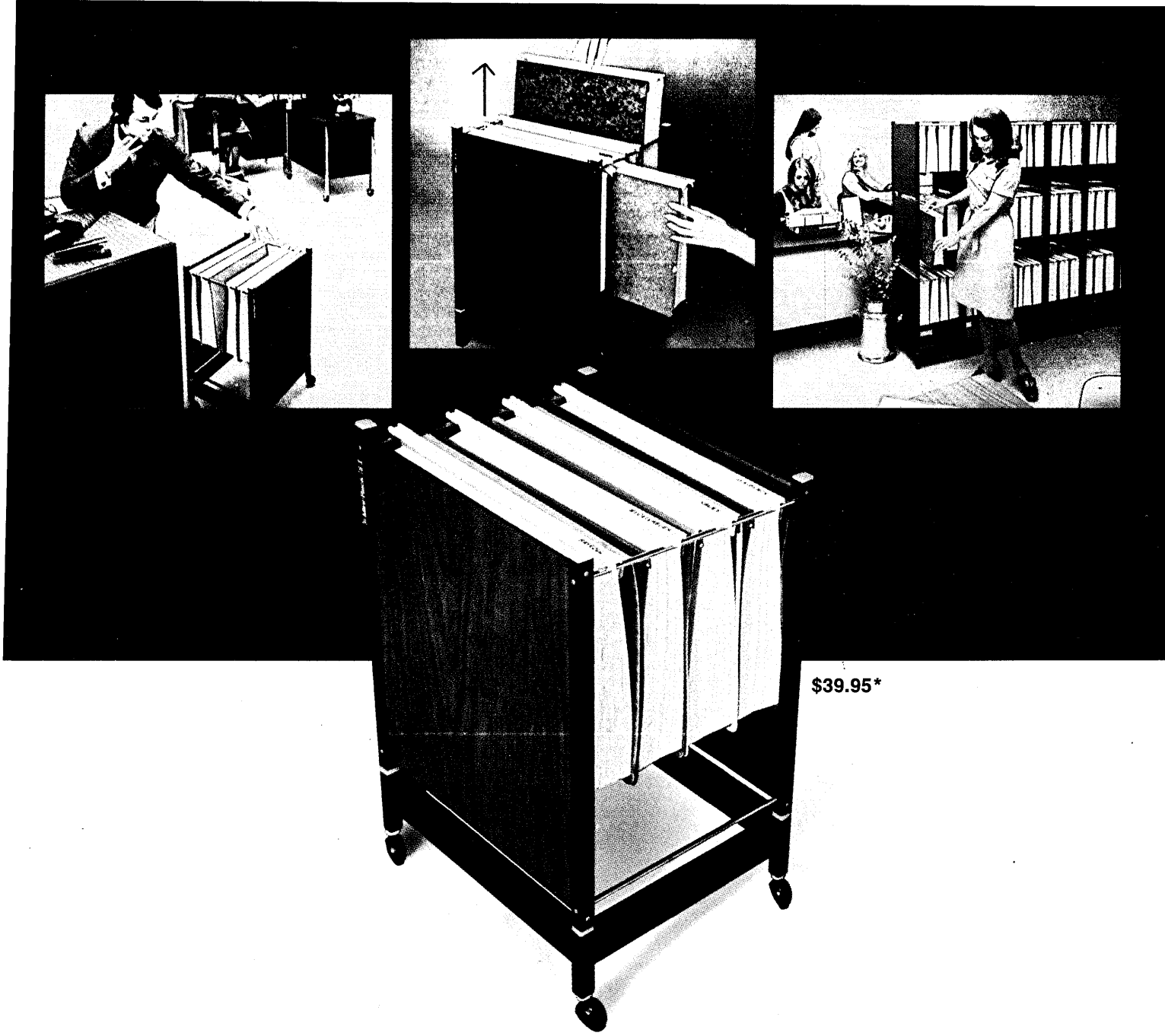
How did he get started? "The company, then as now, encouraged its employees to speak up, to talk things out," Mancina says, "and I kept talking about the need for improvements in the way things were run." Thirty months after joining the company as a trainee programmer, the outspoken critic, as he says, "got the ding dong." He was asked to run the computer room (an ERA 1103 installation). He's been running bigger and bigger ones ever since. Siberia turned into a career.

What's the secret of success? Bill's answer to this question is a model of play-it-safe tactics: "As you go up there's an increasing emphasis on managerial ability and a decreasing emphasis on technical. I don't know if that line is linear, concave, or convex," he says, standing at a chalkboard in the conference room, "but it starts up here where no managerial experience is expected and gets to the point where very little technical knowledge is needed." Could a member of his technical staff recommend unneeded hardware and get away with it? "There's no way to avoid getting snowed." One way to minimize the chance is to discuss technical recommendations openly, bring out a diversity of opinions, get enough people in on the conversations, ask questions, seek explanations.

But those who know Bill best suspect that the real recipe for his success is his statement, looking up at the ceiling, "I enjoy dealing with people." Dealing is what he means. He cements relationships with any potential ally—you help me and I'll help you—and potential allies include a diverse group of peers within his corporation as well as vendor personnel. In his own huddle, he calls a single play and demands perfect execution: Make me look good and I'll see that you get to do your own thing. Simple?

That's been the quarterback's way from the opening kickoff. □

(IN THE MAY ISSUE: The spinoffs . . . onward and outward. How to use computermanship as a lever to pry open other doors.)



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And we're not exactly novices in the computer field, either.

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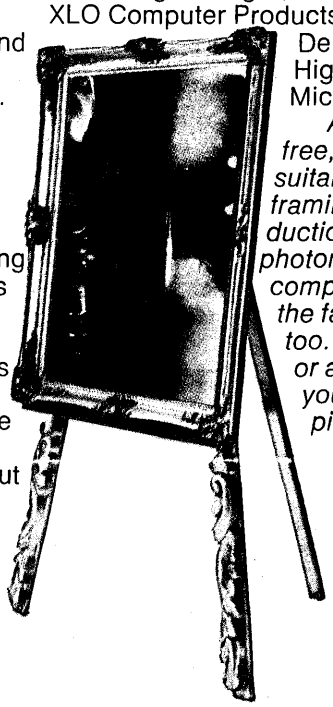
And we're rapidly moving into other areas, too.

For example, we've recently acquired Cybermation, Inc., a company that designs, develops and builds ultra-new computer data entry and communication systems. Including a mini computer and a whole family of specialized input/output terminals for remote computing.

So, when someone from XLO Computer Products comes knocking on your door, rest assured that he's not representing just a couple of guys who tinker with computers in their basements on weekends. He's backed by a corporation that got where it is by making the right move at the right time. Many times.

The products he tells you about won't necessarily be the least expensive on the market. But they'll always be the best for the money. That's part of a price/performance philosophy we've developed throughout our corporation for 52 years. And it works.

To know more about the world's newest computer company, drop a line on your letterhead to our marketing manager, Joe Molina. XLO Computer Products, Box 03056, Dept. DP-1, Highland Park, Mich. 48203.



Ask him for a free, 16 x 20" suitable-for-framing reproduction of the photomacrographic computer art on the facing page, too. One way or another, you'll get the picture.

XLO COMPUTER PRODUCTS

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News in Perspective

Why shouldn't Memorex try the mainframe business? It has a peripheral customer base of 2,500 installations, and its officers think mainframes follow naturally . . .

What's Texas Instruments up to in computers? Its new monster gets little attention in the press. But IBM's biggest supplier of circuitry intends to make waves in the computer business. Page 85 . . .

Britain's stumbling computer company, ICL, turns to a one-time IBM marketing whiz for guidance. He's Tom Hudson, introduced to us on page 90 . . .

Those silent keys are breaking up that keypunch gang of IBM's. But always there's the threat IBM could enter the key-to-disc market and silence them for good. How are the independents doing? Page 93 . . .

Profitable time-sharing companies? Yes. See page 105 for the views of three experts who say profits could rise up to 30% . . .

The Dept. of Defense is getting out of the time-sharing business. On page 106, a look at Arpanet and its future as a commercial network . . .

Norm Ream, the veteran edp consultant/executive, enters politics in California's Orange County . . . within view of the Western White House, yet! Page 109 . . .

Mainframers

Memorex: Reversing the Trend

Almost two years ago, General Electric dropped out of the general-purpose computer business. Less than a year ago, RCA did likewise. Here in 1972, just when a nifty trend was developing, a company is *entering* a field where financial angels fear to tread. Not only is it *not* another exit, but the company making its entrance is one that has been demonstrably vocal in its criticism of IBM's dominance.

Memorex Corp. of Santa Clara, Calif., which started in 1961 as a producer of magnetic tape and made a logical move to oxide-coated disc packs in '67, then got into the disc drive line — meanwhile also introducing COM and communications systems — now says it is getting into the mainframe business. The news is disconcerting, following as it does the withdrawal from the activity of two substantial corporations that after several years found it to be a less-than-profitable venture.

Add to that the more recent moves toward consolidation of effort seen around the world. On the Continent, Siemens, CII, and Philips have reached some sort of agreement. In Japan, the Big Six now has an outward appearance of three stronger mainframe-producing companies. And even in the U.S., Control Data and NCR have announced intentions to develop cooperatively marketed mainframes and peripherals.

Why?

So, one question raised is: Why should Memorex try it?

Because, says a Memorex spokesman, the independent peripherals business doesn't have a promising long-range outlook. Not that you can't have a viable business, he adds, but the profit picture over the next decade will not allow the type of growth characteristic of a dynamic business.

And because the company wants to get into the systems business, capitalizing on its customer base of some 2,500 sites. The majority of them are 360/30, 40, and 50 installations, but from 700-800 reportedly are mod 20s. And that's what one of the two new computers (see Hardware, p. 115) is intended to replace.

Specifically, there are two computers, the MRX 40 and 50, the latter being field upgradeable and having twice the speed and twice the main memory capacity of the 40. Both are designed for heavy input-output applications, featuring eight asynchronous processors that share a common arthmetic logic. The MRX 40 should be the major seller, they say, with monthly rental from $2,500 to $4,500, while the MRX 50 will be priced between $4,000 and $6,500 a month. "We see the MRX 50 as getting near the hairy edge of the 370/135 or the 125 if IBM announces such an animal," they say. "We're not trying to get into that as a main thrust to compete against that IBM line." Overall, they should sell twice as many 40s as 50s, they add.

LAURENCE L. SPITTERS: The problem is financing.

"We're not going to try to stand up and sell the system on the basis of hardware architecture," states J. Garrett Fitzgibbons, youthful marketing vice president. "Our objective is to come up with a system at the low end (starting at $2,500-5,000/month), where we have software and the functional capability of disc and communications that haven't been offered in that price range. If you look at what we're placing on the market, you'll see that we're bringing a (360) model 40 capability down into the model 20 area." He adds that the new systems will have DOS capabilities with communications, allow multiprogramming (two parti-

Any media storage cabinet you buy now may be obsolete before it is delivered...

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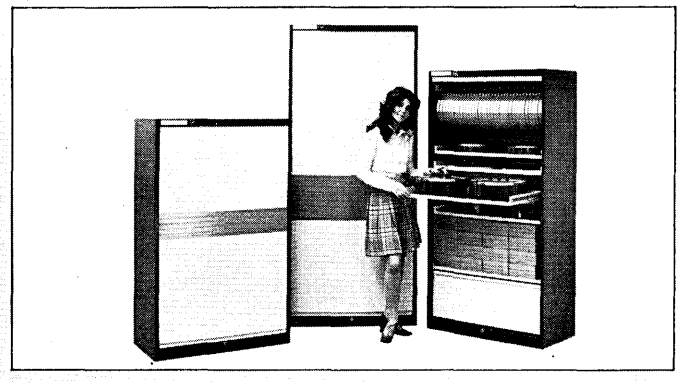

optimedia™ coordinated cabinets have other benefits such as "Action Level" storage that lets you place all media at the most convenient retrieval height, smooth operating roll up doors that open all the way leaving the entire inside fully accessible, and up to 20% extra storage capacity when compared 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.

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MEDIA MANAGEMENT SYSTEMS

CIRCLE 110 ON READER CARD

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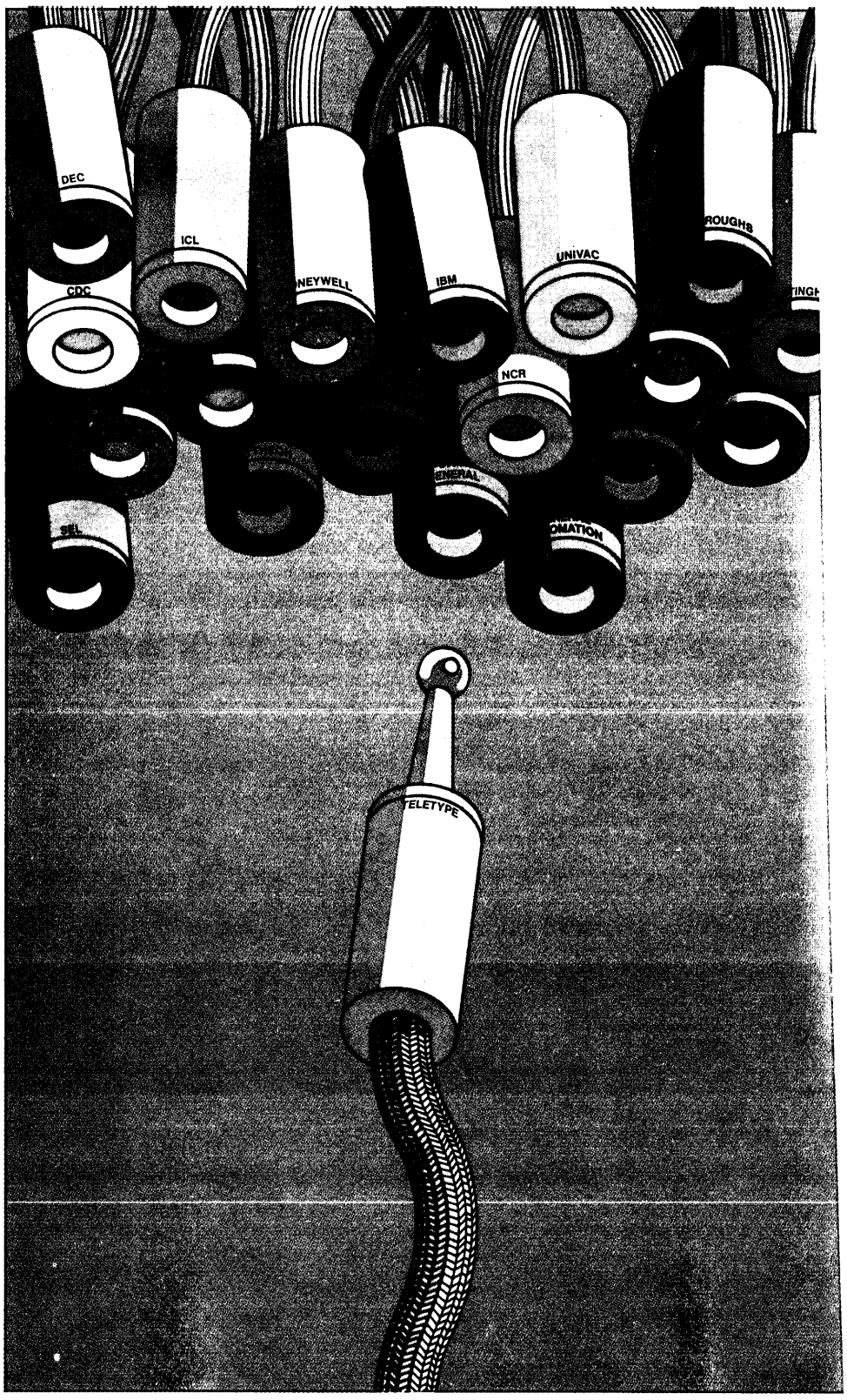

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Take a look at our model 33 series. At 100 wpm, it's the number-one standard-duty data terminal in the industry. Outstanding reliability, flexibility and economy are the reasons why.

Big system features at economy system prices? That's the forte of our new wide-platen model 38 series. Because it's the logical extension of the model 33, it's designed for plug-to-plug compatibility.

Looking for heavy-duty, year in and year out operation with minimum maintenance requirements? Take a look at our model 35 series. You'll also find a broad range of features at an economical price.

Our model 37 series handles all the requirements of complex data systems. It offers the utmost in flexibility and vocabulary at 150 wpm. In addition to the ASCII characters, you can add up to 32 special characters of your own.

For paper tape systems, we've got equipment with capabilities to send and receive up to 2400 wpm.

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

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tions), and offer as much disc capacity as the user wants.

The market

Memorex sees two major uses for the new machines: as small, standalone 360/20 replacements (for which there's 360/20 emulation), and as remote communications processors. The latter market, according to Fitzgibbons, should account for 75% of sales, and the former for 25%.

In selling the system as a standalone, the major initial applications effort reportedly will go into the availability of packages for manufacturing and distribution industries ("where IBM has had its major penetration," says Fitzgibbons, an ex-IBMer). This is because Memorex, rather than creating such packages internally, will seek those that already are running, using them on a royalty or other type of arrangement with the creator.

"Our emulation will run differently from IBM's. It will run under our operating system, so our machine will not be dedicated to look like a model 20." Fitzgibbons adds that the 20 can be emulated in one partition, allowing other programs to run in the other partition.

But what happens when IBM comes out with the 370/125? "We've anticipated that . . . We're really below the 125, and our competition is out there today; that's the System/3, which is the one IBM's really pushing. I don't know what IBM's announcement could do except maybe help us. If we're out there and performing, that would stimulate the industry."

Does this mean something below the 125 wouldn't matter? This could hurt, Fitzgibbons admits, but he adds: "IBM isn't going to focus on us." Memorex is still small potatoes, he says, and will probably remain in that position for a long time. "They (IBM) should probably be back there, saying, 'well, we got 'em now. They're getting into the computer business.'"

Which brings us back to the same question: Why? One benefit of being in the systems business, says Fitzgibbons, is the ability to avoid scrapping equipment that comes back off rental. To illustrate, he cites Memorex's hardwired disc controller, which either must be sent back out as a disc controller or scrapped; it can't be modified as a tape controller.

"In other words, we're trying to get in a position where we can cascade our products, which IBM does so successfully," he says. IBM gets 2314s back, sends them down to Boca Raton, Fla., puts the discs on the System/3, and presto — they've added five more years to that product's life. IBM did the same with 1401s, he reminds us, and with the 360/30, which is modified and remarketed as the mod 22. Thus, Memorex seeks hardware architecture that allows for this same cascading. "Seventy to eighty percent of those parts will just go back out that door again."

Fitzgibbons adds that Memorex is looking at products like a crt subsystem, which reportedly is in the works, using one of the new computers. Also, an rje subsystem. The hoped-for result: interchangeability of parts, reduction of parts inventory, and a cut in the cost of field service education. "We've always been pretty much tied to IBM," Fitzgibbons says. "Now we can provide a subsystem to Univac or Honeywell or NCR."

And it is this market — the big users engaged in remote computing with mod 20s, the Univac 9200 and 9300, and various Honeywell computers at distant sites — that the company is eyeing. According to the marketing vp, Memorex missed out on a Ford Motor contract that called for 20 or 30 systems because Ford wanted them on the air in July. Nevertheless, four or five letters of intent, representing 40-50 systems, reportedly are already in.

"I feel we have an excellent opportunity," says Fitzgibbons. "I think the limitation will be more on our ability to fund our growth into the business than to get the business."

That, of course, has to be the prime unanswered question. Can Memorex finance this venture? Neither Memorex president Laurence Spitters nor exec vp James Guzy was available for comment, so we asked this question of those in the financial community who have followed the ups and downs of the company.

One securities analyst opined that the company would be $20 million short on cash to finance what he termed "a modest" introduction of computers. Memorex, he felt, was in no condition to raise this cash through the sale of equities, nor was it in any position to go back to financial institutions for a loan. But, he added, the Bank of America, the nation's largest bank, held the majority of Memorex's short-term notes, and "if the Bank of America wants to ride with them, that's all Memorex needs." Is this probable? "I think the company's going to be around, mainly because I don't think the B of A can afford to see 'em close up . . . I think they're going to ride with them for another year."

Return to media

This analyst adds that the future of Memorex must rest on the return of the media business. Historically, the sale of mag tape and videotape has accounted for the vast majority of Memorex's profits. Should this business pick up, then, its reflection on the company's earnings would be "dramatic." The firm, of course, recently entered the high-quality audio cassette field, demonstrating in its tv commercials how music recorded on the tape could break glass.

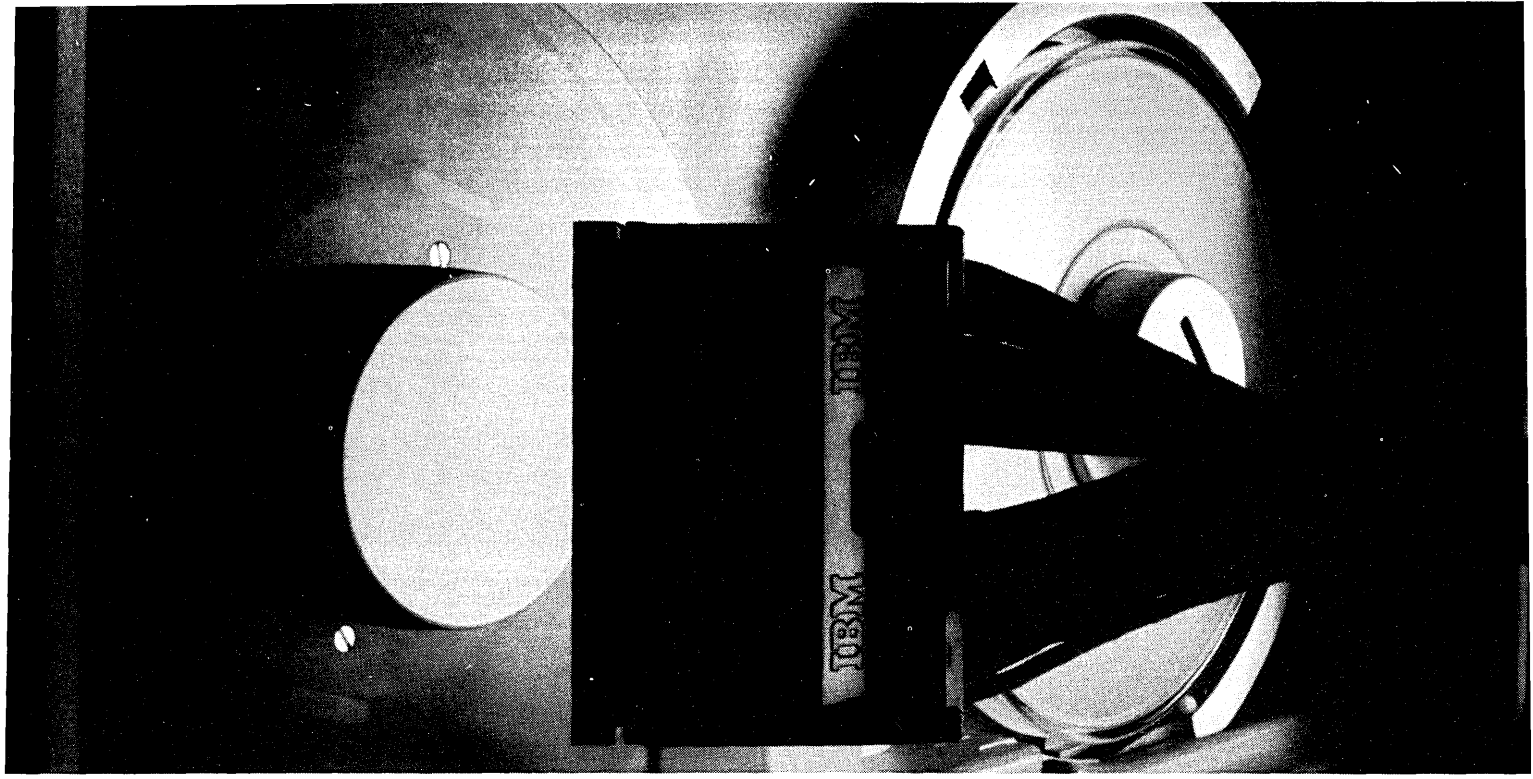
Memorex calls its nationwide introduction "successful," but some have questioned whether the quality of the tape isn't too high for the market, whether most hi-fi fans couldn't get by with a lesser quality at a lower price and get no noticeable degradation. The quality is there, they add, for possible use in home videotape systems, but this market is growing slowly. Nevertheless, Spitters, in a recent letter to shareholders, says: "We expect the cassette products to account for the majority of projected growth of our media sales business during the next few years."

If this should come to pass, it would indicate a diminished reliance by the company on the sale of computer tape, a market where Memorex is one of the top three sellers. A turnabout in this business, however, is required before mag tape sales can again contribute to the profit picture as it did at the start. One industry observer notes that some on-line banks get by with no tape drives, relying entirely on discs. But he also points out the scheduled availability later this year of tape drives for System/3 installations and says this may increase demand next year for the serial storage medium.

That still leaves the hardware business and the profit contributions of the ILC Peripherals Leasing Corp. The unprofitable aspect of this activity should make a turnabout during the late second or even third quarter of this year, an analyst says. "And when it turns, it will turn exponentially for at least a year."

The systems business

Of concern here to one observer is what he considers an excessive num-



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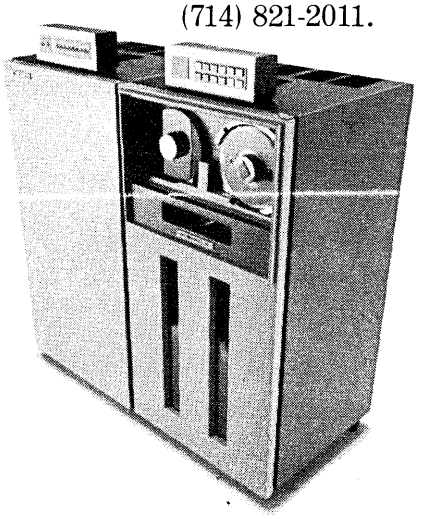

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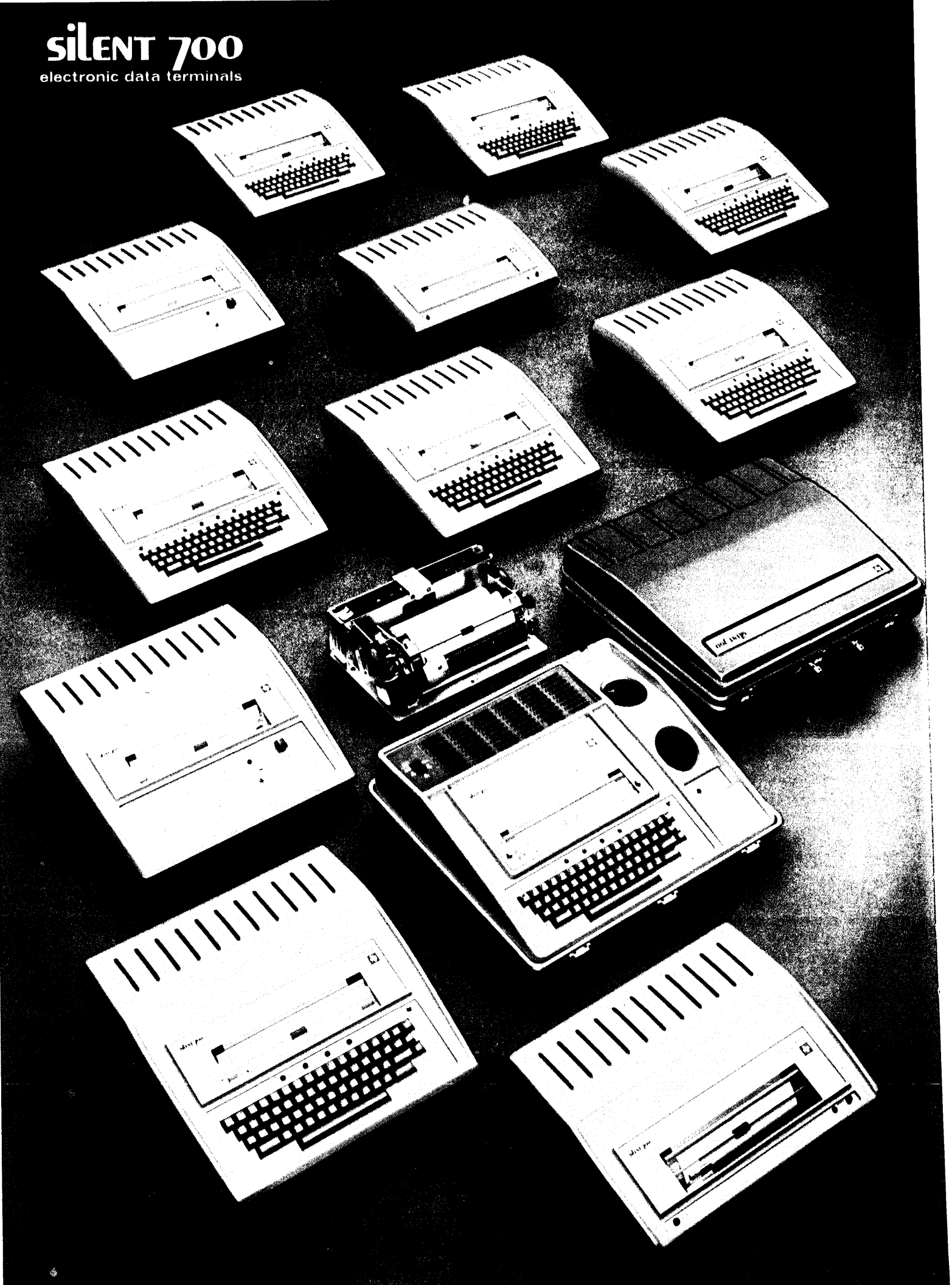

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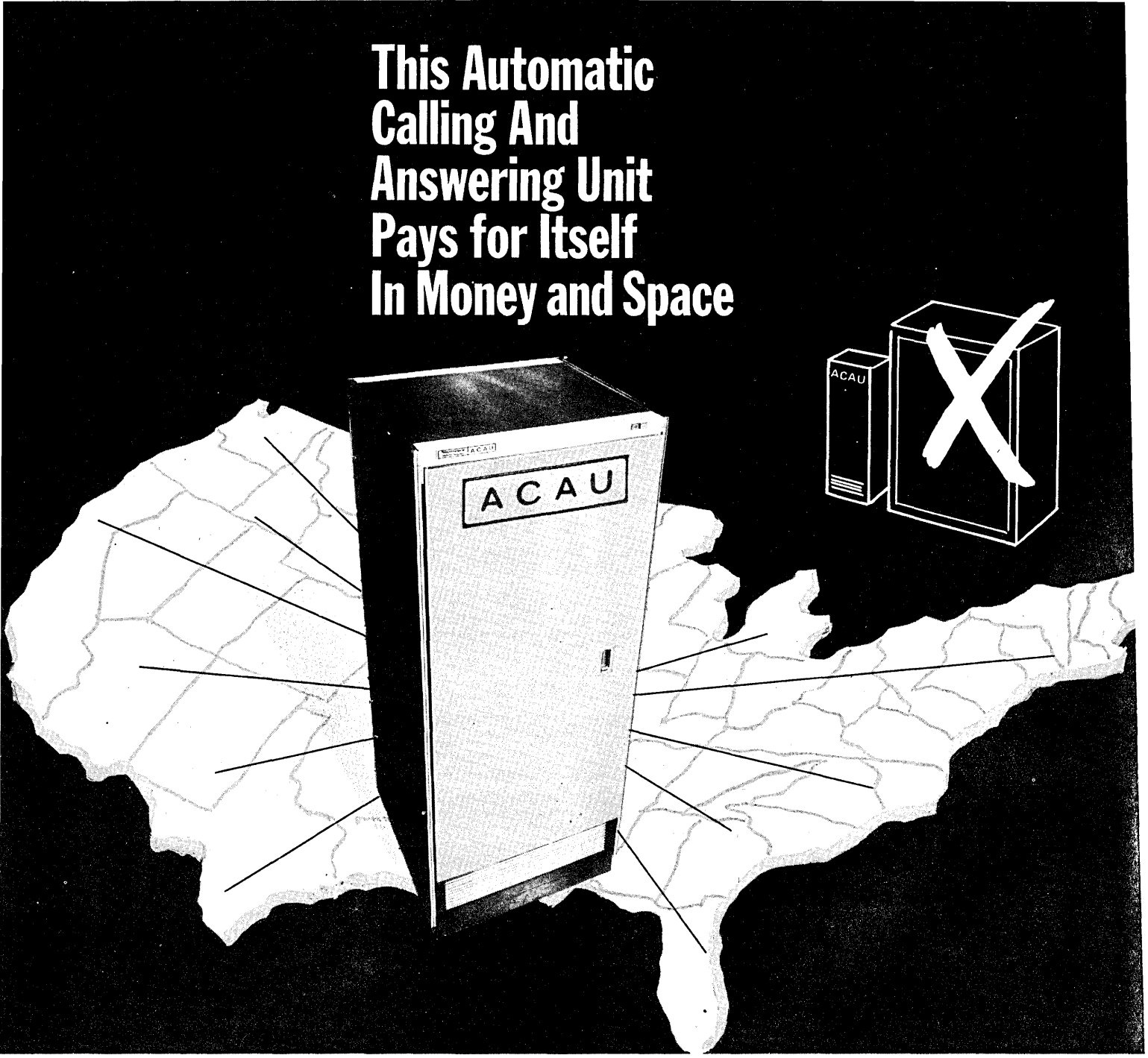

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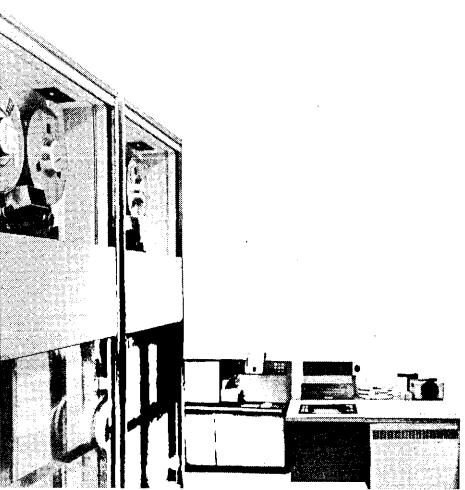

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CIRCLE 96 ON READER CARD

ber of 2311- and 2314-type disc drives installed by Memorex. Telex, he explains, cut off the marketing of new 2314s last May, while Memorex continues to ship them. "I don't think there's any chance in hell they're going to recover their costs on any 2314 shipped after August or September of last year," he adds. "They have 20 or 24 months to recover their costs," and there's not that much revenue-producing life remaining in them. "We're strong believers that in two or three years you're not going to see any 360s around . . . and if there isn't, you certainly can't believe that too many of the 2314s will be out.

"I can see three years hence," he continues, "when we'll have the same problems with 3214s that we're now having with 2311s — just warehouses of 'em. Talk to the leasing companies . . . the biggest things off rent today are 2311s . . . I think one major portion of IBM's writeoff is the 2311. There's just no market for 'em."

Memorex's statement: "About two-thirds of our total manufactured output was marketed under lease."

If there is any thread that runs through these observations and speculations by outsiders, it connects back to Garrett Fitzgibbons' remarks about the importance of being able to "cascade" products. Manufacturers who depend on leasing contracts face that inexorable day when they gear comes back off rent. And the ability to extend the market life of each unit of hardware can spell the difference between almost making a profit and bathing in the bounty.

Within Memorex, then, the rationale for this latest decision is understandable. Others have questioned the morality of the independent peripherals business. At Memorex, they question the long-range implications of restricting themselves to it. By also getting into the systems business, they reason, there are significant economies to be gained and new markets to be opened. The distributed network system, predicted to be a major trend in the '70s, is one of these new markets. And Memorex peripherals attached to Memorex computers will certainly be favorable to the company's cash flow. With the U.S. economy in a recovery phase, it could be that corporate turnabouts like this — and this is no isolated example — will be seen with greater frequency.

— Edward K. Yasaki

RCA Users Still Go for New Series

RCA's folly in introducing an RCA Series line that chiefly impacted its own Spectra equipment may well be turning into a boon for Univac. Reliable sources report that sizable numbers of users of the old Spectra computers are continuing their orders for RCA Series machines, and new orders are still coming in for the new machines.

The benefit for Univac, of course, is that the trend indicates that many former RCA users will continue with Univac. Previously, the widespread industry opinion had been that IBM would pick up the majority of former RCA customers, because RCA stressed compatibility with IBM equipment.

Most orders were said to be for the smallest scale machine, the 2. In addition, orders have been placed for the 3 and 6; but at this writing there were no orders for the 7, the largest machine. Since Univac agreed to take over the RCA equipment base, it has been calling the equipment simply the Univac Series 70.

Univac officials declined to discuss the rate of incoming orders, other than to say the firm expects to receive "a sizable amount of orders" from the former RCA customer base. Univac's agreement with RCA calls for it to place a final order with RCA by June 30 for equipment for the old RCA customers.

It is not entirely clear what will happen to the old Spectra equipment that will be returned to make way for the 2s, 3s, and 6s, although Univac executives have said in the past that they hope to keep the equipment out in the field largely by refurbishing it and getting it out to existing customers. A few weeks ago, Univac said it was getting "very few returns" of RCA equipment.

The price/performance characteristics of the RCA Series line — and particularly its large memory sizes — were so attractive to users of Spectra equipment that the new series impacted the Spectra line with devastating results for RCA, which dropped out of the computer business last September. Univac elected to go ahead with the new RCA line, and this move appears to be holding many users for Univac.

In addition to using the method of locking former RCA customers into Univac by upgrading the customers into the 2, 3, and 6, Univac has announced plans to eventually use its existing 9000 and 1100 lines to "bridge" the customers over into Univac. Many feel the bridge machines will be the 9700 and the 1106. "And we will be using all the known bridging techniques like simulation and emulation and maybe some new ones," says John C. Butler, vice president and general manager of Univac's Series 70 operation.

At a meeting of former RCA users in Atlanta, Butler said: "We want these customers 5, 10, 15 years from now, and that's the commitment we're working on now. We plan to enhance the existing RCA software. This is not a wind-down thing; it's a move-ahead operation." Univac opened the users meeting to the press, and reporters found the users favorably impressed with Univac's commitment to the former RCA users.

Siemens in virtual bind?

In another development, it was reported that West Germany's Siemens, which has been marketing RCA's equipment in Europe, has sent a programming team to the U.S. to learn Series 70 VMOS. Univac and Siemens have an agreement whereby Univac supports VMOS in exchange for Siemens' support of DOS until June 30. After that, both firms will be on their own with both programs.

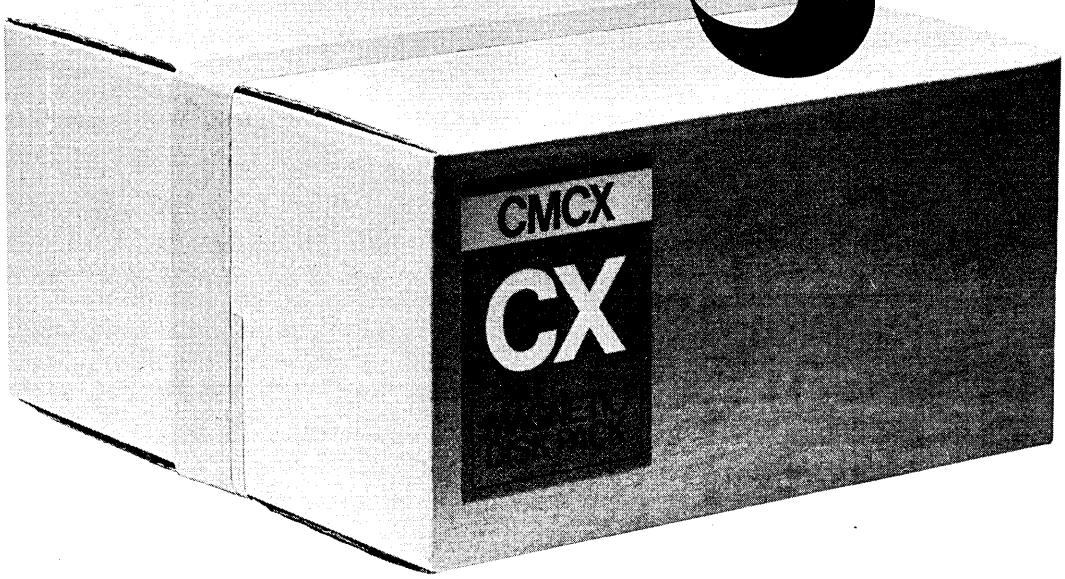
Siemens could be in something of a bind, because VMOS is a considerably more difficult program to learn than DOS, and the trend among customers is towards VMOS. Univac will continue to issue new releases for VMOS — version 8 is expected soon — but after June 30, Siemens will not be likely to get much support in VMOS from Univac. The two firms — Univac and Siemens — often sell against each other in Europe, and it is possible that they could be competing for customers in Europe in situations in which Siemens would be pitching VMOS, whose major advancements will be coming from Univac.

TI's Monster Will Make Waves

The January announcement that Texas Instruments would deliver a version of its long-rumored Advanced Scientific Computer (ASC) to a government laboratory didn't get much press.

But the simple announcement of the big semiconductor company's quiet entry into the supercomputer business has big implications.

Ready?



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First of all, TI is evidently gambling that IBM is *not* going to get back into the monster race . . . because TI is the largest outside supplier of integrated circuits to Armonk. If IBM did decide to build a Superstretch 370/XX, it would be unlikely to buy circuits from a head-on competitor. That question, though, is one TI probably won't have to face for quite some time.

What happens *now* to Control Data Corp.? That company has survived by building the most powerful scientific computers in the world, but the ASC was picked over CDC's biggest computer, the Star, when the customer considered performance, software, and reliability. How many $25-million Star contracts are there for CDC to bid on? CDC has to sell computers to stay in business — TI can always go back to building semiconductors.

But there are more important implications for the three manufacturers. The ASC computer will go to the Geophysical Fluid Dynamics Laboratory (GFDL) branch of the Commerce department's National Oceanic and Atmospheric Administration. The ASC will monitor the earth's oceans and atmosphere in faster than real-time, analyzing pollution levels and effects, searching for indications of climate change, evaluating hurricane modification efforts, and hopefully providing accurate weather forecasting up to three weeks in advance. If the ASC can just take some of the surprise out of storms such as the one that raced undetected across the Bay of Bengal to drown thousands of Pakistanis last year, it will be well worth its price.

Not powerful enough?

The ASC that goes to GFDL in July of '73 consists of a 160-nanosecond semiconductor memory with one million 32-bit words; a cpu with four identical arithmetic units for performing both scalar and vector operations; an 85-nsec peripheral processor that controls all system overhead functions with its eight logical processors; and an eight-port memory control unit that ties all the boxes together and performs memory mapping functions. If the four arithmetic units can be kept busy most of the time, the ASC would approach a 66 million instruction/second execution rate in vector processing. In the scalar (sequential) mode, multiple buffering and instruction look ahead are used, making the ASC look a lot like a cross between the CDC Star and the highly parallel Illiac IV. A complement of peripherals, an operating system, and an optimizing Fortran compiler are scheduled to accompany the ASC mainframe to its Princeton Univ. home.

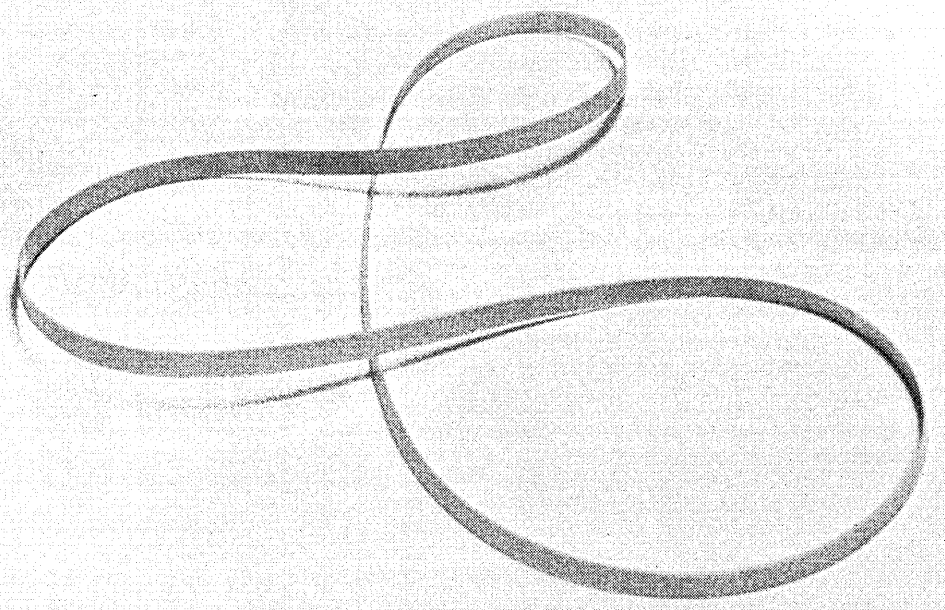
Dr. Smagorinski, head of the GFDL, rates the ASC as 16 times more powerful than his current computer, a 360/91. This will allow the laboratory to reduce the size of the ocean and atmospheric sections from the current limit of 100-mile-square sections down to around 50 miles per side — for the entire earth. If only one ocean or one part of the earth is being simulated, the resolution of the model gets correspondingly better.

Many computer designers consider the ASC second in power only to the Illiac IV computer. But as impressive as the ASC hardware is, even it may not be enough. Says Dr. Smagorinski: "To do the job I'd really like to do, I need a computer capable of running one billion instructions per second."

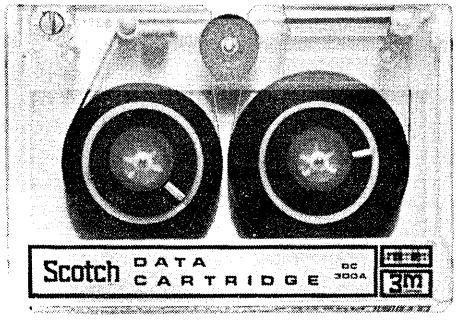
—M.W.C.

(Continued on page 90)

In the grand traditi

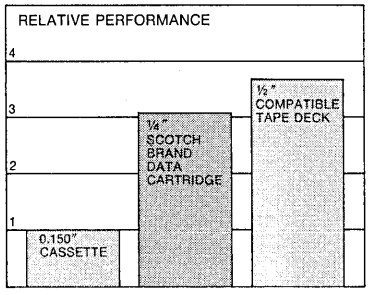


The 3M drive band. A new concept in tape handling.



Based on an entirely different, elegantly simple drive technique, the new ¼" Scotch®Brand Data Cartridge combines reel-to-reel performance with cassette convenience and price. The Data Cartridge functions as its own transport and needs to be driven at only a single point. There are no pressure pads, no pinch rollers, no capstans — tape handling is fast, accurate and precise with *no* external tape guidance.

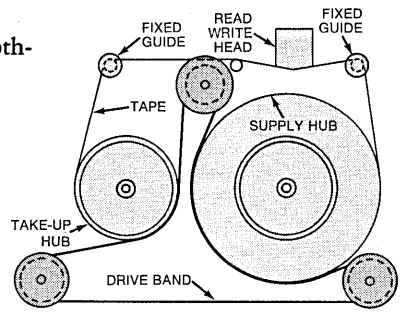
With our new technique, tape is handled — not just driven — in the Data Cartridge. The drive band travels around three tension rollers and is wrapped partially around the tape on both hubs, making



n of the paper clip:

"rolling" contact with the tape. Tape wear is extremely low since the tape oxide touches nothing else except the head. Compliance in the band provides controlled tape tension at all times. No machine operation can cinch, spill, stretch or break the tape.

A single external motor powers the drive band through contact with extended hubs on one of the tension rollers. Tape motion is easily controlled by starting, stopping or reversing this motor.



Since no external guidance is required, tape/head alignment is simplified and a variety of head and data configurations may be used with consistently high data reliability.

The end result is low cost digital data storage like nothing you've ever seen before. The Data Cartridge starts and stops within 25 ms at any operating speed, shuttles at up to 180 ips, stores up to 8 times as much data as the 0.150″ cassette and has an expected lifetime in excess of 5000 passes.

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CIRCLE 62 ON READER CARD

news in perspective

International

Meet Tom Hudson Who Now Runs ICL

The choice of former IBM marketing whiz Tom Hudson as the new chairman of the U.K.'s International Computers Ltd. is expected to be the cue for a much wider management overhaul of Europe's largest mainframe house. And it seems clear that Hudson will assume much more of the chief executive role than is customary for U.K. chairmen. However, this is one of the reasons why he was more or less given the job by the three main shareholders in International Computers — the Plessey

THOMAS CHARLES HUDSON: From Canada to IBM to ICL.

group (telecommunications and electronics), the British General Electric Co., and the U.K. government — all of whom contributed the formation of ICL in the first place from the tatters of the industry some four years ago.

With this sort of alliance, a bloody palace revolution could hardly have been expected to get the first change made. Hudson was an obvious candidate to replace Sir John Wall because he was Plessey's nominee to look after its interests. This he did from his own consultancy set up over six years ago which has specialized in European affairs rather than restricting attention to the U.K. Since Hudson is himself an emigre from Canada, an outward looking attitude is understandable.

Investors are disenchanted with ICL's management, specifically its fail-

ure to forge strong overseas links in the Continental European countries seen as so important with the Common Market development. Curiously, the way in which ICL has buttoned up a lion's share of the business available from behind the Iron Curtain seems to have earned it little respect from the investors. It is a fact which raises speculation about the commercial viability of these deals.

An old victim

The route by which Hudson has reached the top floor at ICL is almost as interesting as the tortuous decade of mergers which produced the company in the first place. Indeed Hudson is not without responsibility in causing trouble for the old International Computers and Tabulators, which formed the core of each new pattern in the kaleidoscope. Until he arrived in the U.K. in '52, the U.K. was the only industrially developed country in which IBM did not operate, and it was T. C. Hudson Esquire who in 11 years from 1955 took IBM (U.K.) from three to 6,000 people and cornered an estimated 40% of the market. Needless to say that 40% was bought in the early days entirely at the expense of the local manufacturers, who numbered 10 at the time.

In fact, Hudson's departure from IBM was caused by an excess of success on his part in the extraordinary affair of International Time Recorders, which used to be a wholly owned subsidiary of IBM (U.K.). But at the end of 1963 it was sold off to its directors and senior employees at net asset value, with the purchase being financed by a debenture loan from IBM. But that was quickly repaid.

Ultimately International Time went public. The prospectus revealed that Hudson would realize a substantial capital gain on a large block of International Time's shares issued to him at par. At the end of last year Hudson had about 235,000 shares in International Time, putting him comfortably into the million dollar category on capital assets. However, when the successful public flotation appeared in '65, Hudson's masters at IBM felt they had been taken advantage of. Other companies are believed to have sought Hudson's services, but he declined on an agreement with IBM to keep out of direct competition for five years.

In fact, he is the first senior IBM-trained executive to fill the top job in one of the major European manufacturers, and he is already on record as saying that "one way to get into trouble is

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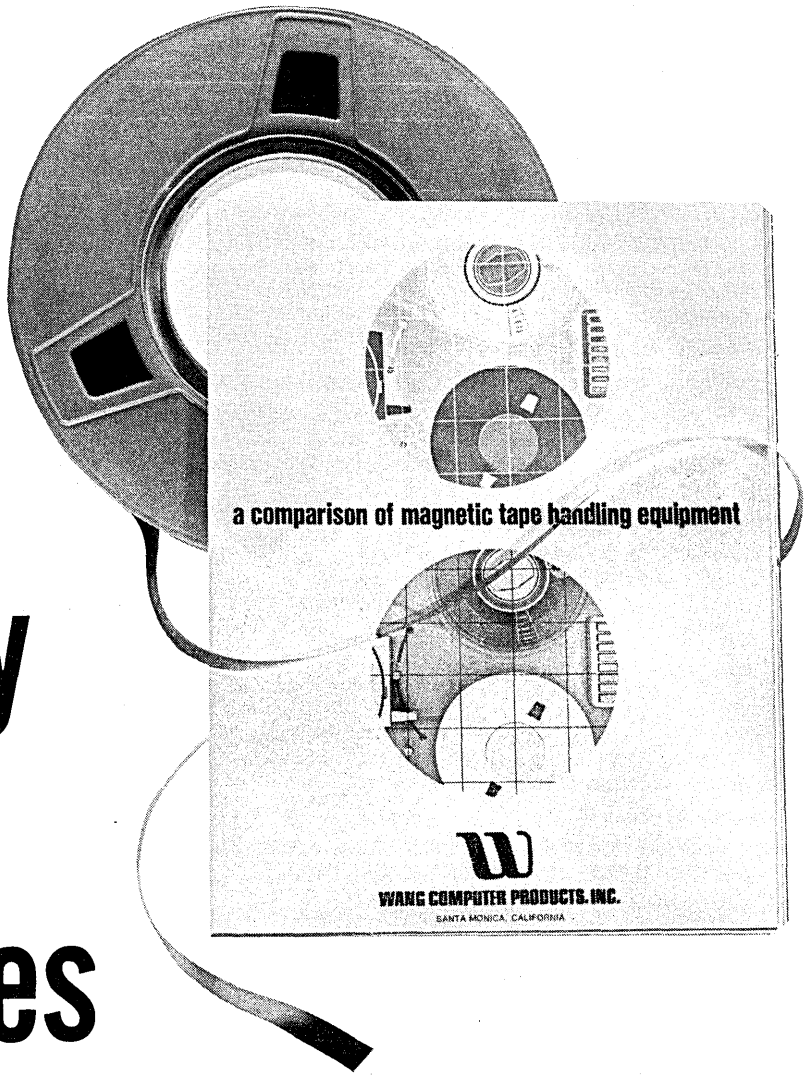

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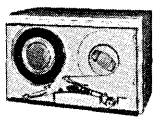
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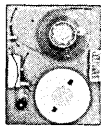
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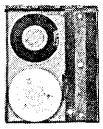
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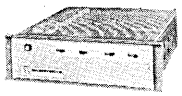
Formatter

to copy IBM." But this was almost certainly a reference to attitudes over product planning as opposed to a strategy of quotas for the market and capital-intensive manufacturing to boost productivity. Over the past year ICL has trimmed 3,500 employees but still carries some 32,000. This is on a last-year profit of about $21 million from a gross turnover of $390 million.

Computing the profitability of ICL is risky, as it has government development grants which tend to paper over possible financial cracks in the woodwork. There are also some questions raised over the discounting rate for buying back systems through an autonomous leasing company shared with one of the banks. Whatever the troubles to date, Hudson certainly steps in at the crucial moment as ICL readies its new range for later this year. And then?

— Pearce Wright

Data Entry

Where IBM Won't Tread — Yet

In some respects, we remain in the horse-and-buggy stages of the computer industry. For example, consider the keypunch: Developed more than 40 years ago for accounting machine applications, keypunches are still being delivered by the hundreds each month.

It seems only natural then that some clever computer people would think of something to replace keypunches using more modern technologies. As it turned out, a lot of them thought of one particular solution at roughly the same time — shared processor data entry systems, also called key-to-disc-to-tape systems. This discussion is limited to the key-to-disc subindustry segment.

The key-to-disc market is largely focused on an estimated 500,000-plus installed keypunches, and the independent manufacturers are swarming around that base like piranha. "I can guarantee a 30% increase in productivity over keypunches with our data entry systems," says James K. Sweeney, chairman of Computer Machinery Corp. of Santa Monica, which, with some $45 million worth of installed equipment, has the highest dollar value of equipment installed.

Of importance to the key-to-disc market is IBM's reluctance to date to introduce any modern equipment that would severely impact its keypunch base. True, IBM has offered alternatives to keypunches — like the 129 card data recorder, the model 050 key-to-tape equipment, and the 3270 information display system — but none is cutting into IBM's keypunch base significantly. The 129 will have the most impact, but that matters little to IBM since the 129 is essentially a retrofit of IBM's old standby, the 029 keypunch.

Fear retaliation

All of the independent key-to-disc suppliers, of course, fear retaliation by IBM, but they are virtually unanimous in their thinking that IBM's threshold of pain — that point in time when the independents could deeply cut into IBM's keypunch base — is far enough away to give the independents plenty of time to move successfully in the market.

Indeed, the independents already have been moving aggressively. For instance, at year's end, Inforex, of Burlington, Mass., had shipped some 800 systems with a total of 6,000 keystations and is thought to have some 7,000 this spring. Of the independents, Inforex is far and away the leader in number of systems and keystations delivered, and with some $33 million worth of equipment out, trails CMC only in value of equipment shipped. Inforex, in addition, manufactures all of its minicomputers, tape drives, disc drives, and other major system components to keep its costs down.

Inforex is on the low end of the key-to-disc market — the overwhelming majority of its systems have just eight keyboards. Thomas B. Horgan, Inforex president, describes his firm as "a computer periphery company as distinguished from a computer peripheral company." In short, Horgan is staking out a position for Inforex along the periphery of the computer industry in an effort to avoid head-on combat with IBM. Inforex has been spending some $800,000 annually on a new product which knowledgable observers expect to be announced around mid-year.

Mahawk Data Sciences Corp. and CMC are also moving into the low end — small systems and less sophisticated software — of the key-to-disc business. Mohawk has just begun initial deliveries of its 12-keystation 2405 system, while its 20-keystation 2404 system is scheduled for delivery in June. "We've got the largest sales and servicing force tuned to this market in the world," says Orrin B. Craigie, MDS vice president of marketing operations. "For the 2404 we're targeting our people directly on the keypunch replacement market."

Mohawk has been delivering the hardware components of its key-to-disc systems since September in the form of its peripheral processor, the 2400. Mohawk makes virtually all of the major components in its systems with the exception of its disc, and many observers expect the firm will eventually make that, too.

The broadest range

While CMC is moving on the low end with its CMC 5, it probably offers the broadest range of key-to-disc systems of any vendor. The firm said it has some 350 systems and 5,800 keystations installed worldwide. CMC does not manufacture its system components, although it is beginning to make some of its minicomputers on license from Digital Computer Controls. Most of CMC's minis are supplied by DEC.

Surprisingly, there has been little activity in key-to-disc from the mainframers. IBM, already noted, has no system available. Univac, which has a sizeable keypunch base, considered acquiring financially troubled Redcor Corp., of Woodland Hills, Calif., but backed away from the deal. Univac, however, is still said to be interested in the key-to-disc market. NCR and Control Data are known to be working on systems, but at this writing had made no formal decision to enter the market.

Honeywell, then, remains the only mainframe company with a commitment to key-to-disc systems, and while "the other computer company" had initial hardware and software problems with its Keyplex system, a Honeywell spokesman reports that the firm has ironed out the problems and is currently in heavy production. At last count, Honeywell had delivered more than 100 Keyplex systems worth $11 million and had a backlog of 75 systems. Honeywell manufactures virtually all of its own system components.

"Our production will be moved from San Diego to Framingham, Mass., during the second quarter," said the Honeywell spokesman. "We don't anticipate any production interruptions, because we solved our start-up difficulties."

The key-to-disc market has been fraught with danger for some companies. Some, like Realtronics Inc., Computer Access Systems, and Transitel (which marketed a system manufactured by Systems Engineering Laboratories), simply folded their tents and dropped out of the business. Those companies, however, never really got beyond the lift-off stage.

Others, like Redcor, had to cease operations primarily due to the inability to obtain lease financing. The firm had sold more than $11 million worth of equipment. Last month, Redcor filed a Chapter 11 petition and was still hoping to continue in business.

Redcor and most of the other independents have been victims of a new ruling by the Accounting Principles Board of the American Institute of Certified Public Accountants that requires that revenues from equipment shipped to customers be delayed as sales and be recorded under the "operating" method of accounting rather than the "financing" method. One result was that the companies have had to delay sales and, worse, many — like Redcor — suddenly found it impossible to get decent leasing arrangements.

Another major key-to-disc manufacturer, Consolidated Computer of Canada, was forced into receivership, largely because of financing problems, many of them related to lease financing. At this writing, however, the firm was on the verge of coming out of its difficulties and emerging in a stronger financial position than it had been before. William G. Hutchison, president of Consolidated, reported that ICL of England was buying Consolidated's subsidiaries and customer base in the U.K. and Germany with the result that Consolidated would be getting a new financial lift. In addition, ICL will purchase $7 million of Consolidated equipment over the next 12 months. "We'll be in a strong financial position when we come out of this," said Hutchison.

Consolidated's Key-Edit line covers a broad range, too. The approximately $23 million worth of Consolidated equipment installed represents nearly 200 systems and about 2,500 keyboards in North America and Europe.

While Consolidated is using the direct sales to ICL as a means around the lease financing problems, other companies are simply rewriting their agree-

(Continued on page 99)

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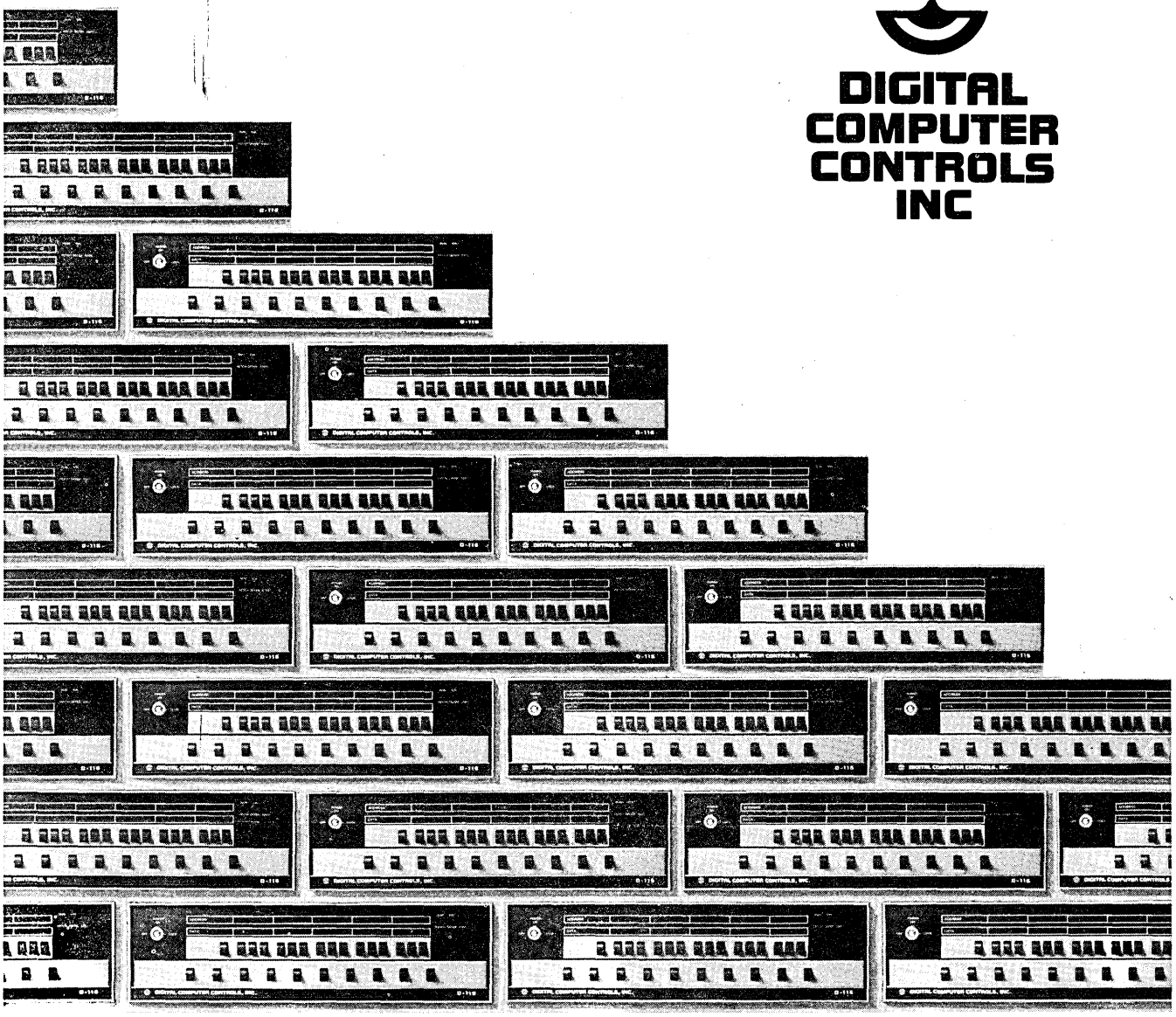

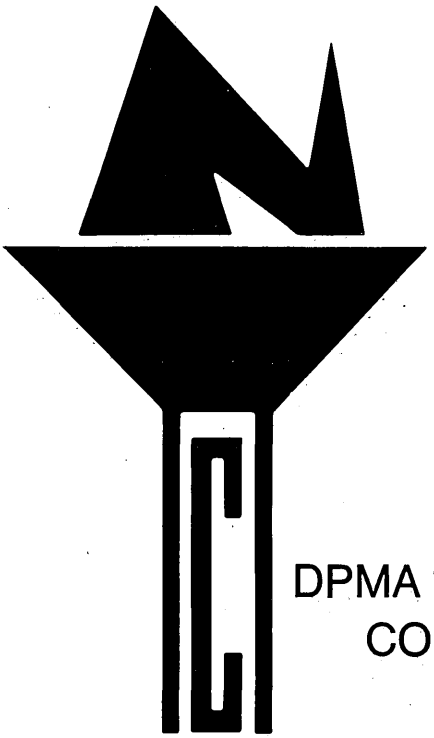

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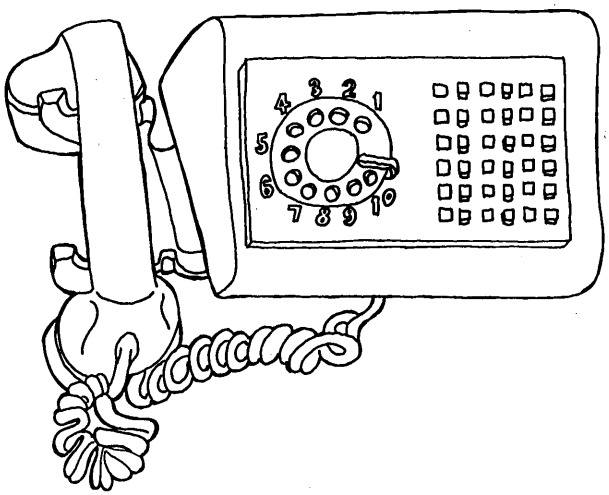
ments with lease financing companies to permit them to record more equipment as outright sales. Inforex has done this, for instance, and the other young independent companies are expected to attempt to follow suit. The older established companies in the key-to-disc business — like Honeywell and Mohawk, for instance — do not have the lease financing problems, because they have sufficient cash flow.

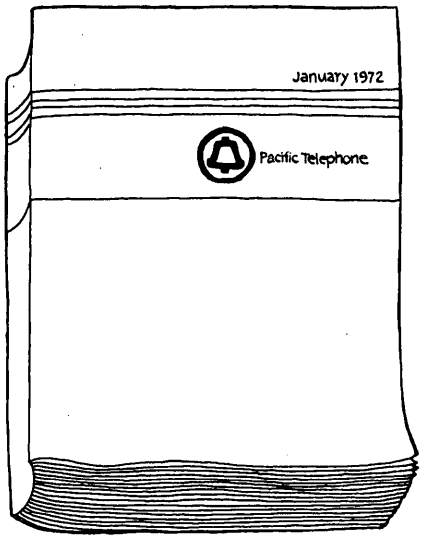
General from the brink

Another firm that has been rescued from the brink is General Computer Systems, of Dallas. The firm never really had any difficulties with its equipment and has recently taken steps to beef up its financial and marketing operations. Frederick Adler, the New York venture capitalist, and Bernard Benson, former president of Benson-Lehner Corp., have been successful in raising money for GCS, and the firm has recently hired Redcor's marketing vice president, Dallas Talley. Albert Bieser, GCS president, reports that his firm has installed 33 systems and 640 keyboards with a total value of less than $4 million. GCS's equipment is on the high end of the key-to-disc market, stressing flexible software and remote terminals.

One company that got a late start in the business — Entrex, of Burlington, Mass. — was about to close a $10 million financing deal at this writing. Although Entrex had shipped only 10 systems at year's end, president Barry M. Harder observed that the firm has just opened nine sales offices in the U.S. and that he expects to sell 100 systems this year. "Our biggest problem was the economic situation," says Harder. "The private placement market was tough sledding for awhile. Now we have our ducks in a row, and we're ready to roll."

The key-to-disc firm that makes the largest systems, Logic Corp., of Cherry Hill, N.J., is also the first profitable company in the business. Logic has been profitable since the first quarter of 1971. It has delivered 31 systems worth about $7 million — nearly all of it in the Northeast and the Midwest. Logic claims to have the largest single installation — 56 terminals configured around one minicomputer. Lewis A. Barr, Logic's vice president of marketing, said that his firm provides a great deal of custom software for its customers.





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The companies also are moving aggressively on an international basis. Mohawk and Honeywell have had extensive international marketing and servicing networks in place for years, while Consolidated (primarily through ICL), Inforex, and CMC are in the process of building European subsidiaries. GCS and Entrex have licensing agreements in Europe, and Logic has no foreign sales as yet. Inforex and CMC have recently made deals with Japanese firms for the marketing of their systems in Asia.

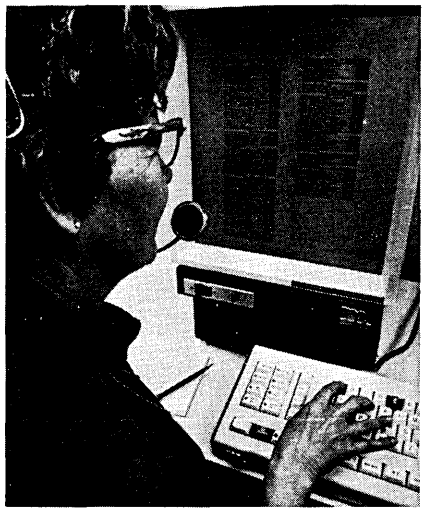
— W. David Gardner

Information Retrieval

New Help for Mr. Bumble

A small Mountain View, Calif., firm, Microform Data Systems, Inc., has staked first claim to the information market (telephone number variety) for automation.

The phone company involved is General Telephone Co., Santa Monica, where 50 operators man the directory assistance office.



NUMBER, PLEASE: Directory assistance operators at General Telephone in Santa Monica use computer-based microfiche system to find it fast in the white pages.

Microform Data is implementing a minicomputer-controlled information retrieval system for the office following a six-month test of the system using 10 operator stations. Each station is getting its own Microdata mini and a microfilm viewer. Data is on microfiche; the fiche addresses are stored in the mini. Telephone numbers can be retrieved quickly with the customer giving as little information as section of the city and the first three letters of the last name, says Dean Mack, Microform's executive vice president.

The Santa Monica General Telephone system is the first operational directory assistance automation system for a phone company, but can Ma Bell and IBM be far behind? Probably not. A 16-month pilot program by Bell Labs and AT&T's directory assistance people, using an IBM 360/50, was concluded in Oakland, Calif., Jan. 28, and currently 8 miles of tape generated in the program are being studied at Bell Labs. The study is expected to take from three to six months, and a possible outcome is nationwide implementation. This wouldn't automatically mean that IBM would get a piece of the action. The equipment used in the Oakland test, which included a Honeywell 516 used as a preprocessor, was prototype hardware and could be replaced by something else in a national operational sys-

tem.

And Microform Data is after Bell too. Mack said his company was negotiating with New York Telephone Co. (Bell) to set up a test system. His company already has systems in Bell offices in Los Angeles, San Francisco, New York City, Newark, and Pittsburgh which perform a function opposite to that of the directory assistance system. They retrieve a customer name and address when fed a phone number and are used when a customer questions a specific call on his bill. He could find out that number he was so sure he didn't recognize belongs to good old Uncle Joe, and he'll find out fast.

Companies

User and LSI: Priorities at IBM

"Cost-justified applications" and "very large and inexpensive memories" through the wonders of large-scale integration: these seem to be key words in the gospel being preached by IBM chieftains from the podium and to the press. *The Wall Street Journal* was clued in by Chairman T. V. Learson last spring, *Fortune* received some of the same this spring, and the American Management Assn.'s 18th Annual Systems Management Conference in March was kicked off by similar words from president Frank Cary.

Certainly cynics can claim that the pronouncements have hidden meaning: shorten 360 life (since the new programs and new technology are for 370). IBM had already used everything but the podium to accomplish that. But what IBM executives are saying is certainly reasonable and comforting to the beleagured user. Cary told the AMA crowd that in the business recession of the last two years, the user became cost conscious, cancelling orders and discontinuing installed systems. "Information processing is still cumbersome, and installed applications are costly to maintain." But the "conspicuous hesitation in growth" has not been the result of industry saturation, he said. "Increasing labor costs," Cary asserted, are an "economic incentive to apply technology," and in fact, echoing President Nixon's State of the Union message, "the U.S. will remain competitive by increasing technology and productivity, not by building a wall."

In a survey of users, IBM found that only 12% of the edp budget is spent on new applications development. The bulk of the computing goes to record-keeping functions. "Customers are looking for guidance on how to plan, control, and implement new applications" and for ways to improve communications between dp and end-user management. Among IBM's solutions: "more function has been built into the control programs," program packages "of almost immediate use" have been readied, big and cheap memories are on the way, and customer education courses are being expanded. Too, IBM, in much-precedented moves, is working with key users to "develop leading-edge applications — in banking, in municipal government, in communications, and in the retail industry, to name a few."

The industry is quite interested in the public appearances of Learson and Cary — especially since IBM's top executives have stood aloof from computer conferences in the last few years — and looks forward next to the keynote

speech by T. V. Learson at the Spring Joint Computer Conference, whose overall theme has to do with changing technologies.

All That Shows Is the X

Xerox Corp. tucked its ailing computer business into three newly formed organizations and then jumped into the typewriter business. All of this happened in early March — just two months before the third anniversary of its entry into the computer business through the acquisition of Scientific Data Systems for $908 million.

Xerox enters the typewriter business by acquiring Diablo Systems, Inc., a tiny Hayward, Calif., firm which recently introduced an automatic printer that is twice as fast as the IBM Selectric, but much quieter (March, p. 116). The HyType I, as it's called, uses a plastic disc instead of IBM's spinning ball, and many of the mechanical parts in other typewriters are electronic in this one. Although Diablo has been offering it as a receive-only printer, a keyboard is all that is needed to turn it into an office typewriter.

Xerox offered Diablo $29 million. With the typewriter will come Diablo's disc drive line. Xerox also announced a deal with Itel, Diablo's principal backer, to acquire rights to a disc drive controller made by Itel's Information Storage Systems subsidiary.

In the other move, the name Xerox Data Systems was eliminated, and William G. Glavin, XDS president since 1970, was transferred from El Segundo, Calif., to Rochester, N.Y., as group president of the newly formed Business Development Group. Joining Glavin in Rochester is Harvey Cohen, the former XDS senior vice president of marketing. He becomes vp of advanced systems. Cohen is replaced by ex-IBMer Donald E. McKee, who has been with Xerox's marketing staff in Stamford, Conn., for four years.

McKee reports to the president of the newly formed Information Systems Group, headed by another ex-IBMer, David T. Kearns. That group will direct company's marketing, sales, service, and distribution in both the copier and computer markets.

Third is the Information Technology Group, headed by James P. O'Neill, who was president of the Business Products Group. This group will handle engineering and manufacturing. Reporting to O'Neill is William J. Vitek, former XDS senior vice president for development, who came to the company from IBM to bolster the computer operation's software capability.

The Xerox computer venture has not been a success. Cutbacks in government programs eroded much of the firm's traditional markets, and its software deficiencies cut into revenues. At one time the company was said to have had 33 Sigma 7s and 5s installed that were not collecting rent because the software wouldn't work.

With its reorganization, Xerox is believed to be committing itself strongly to the computer business — but also taking steps to hide the losses that go along with it. A disc drive development program has been under way off and on for years at XDS, but the firm still sells drives made by CDC. The Diablo and Itel deals give Xerox an in-house disc drive capability. And while the copier and computer marketing efforts still are separate, they now are within the one marketing organization, and the firm said it will emphasize the "interrelationships" between them. This could mean that Xerox's estimated 5,000 office products salesmen will be organized to seek out computer customers.

That is, if they aren't too busy trying to replace Selectrics.

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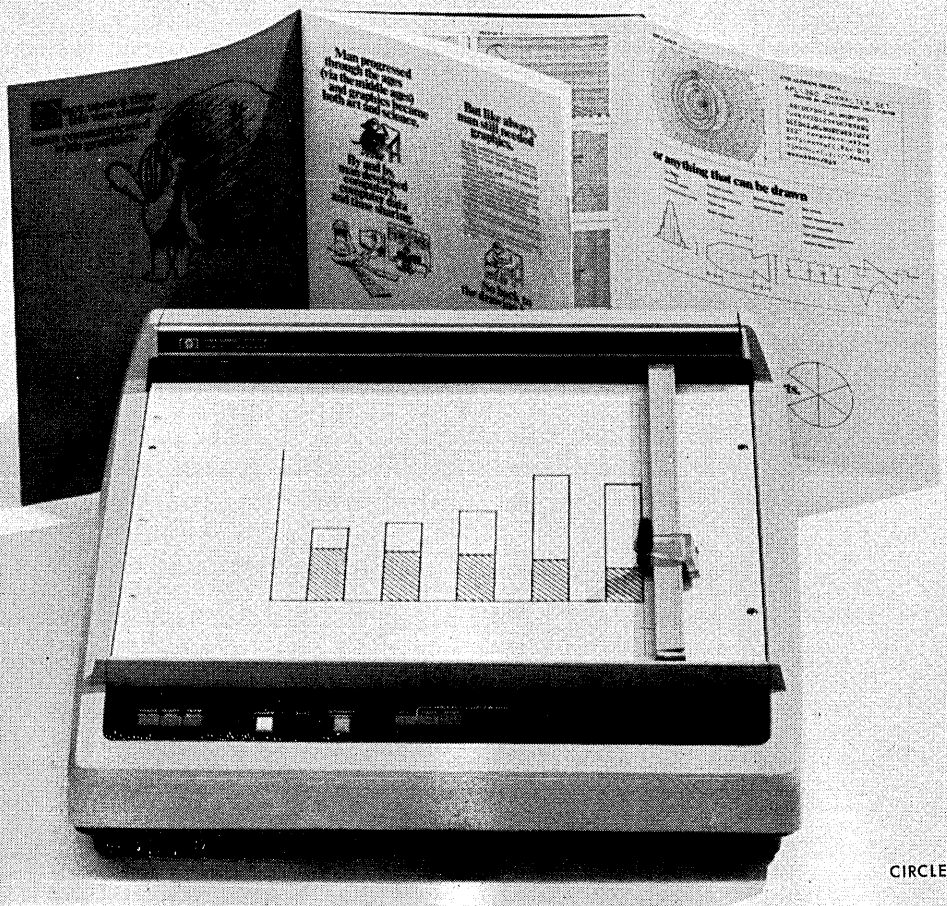


CIRCLE 29 ON READER CARD

112-07

news in perspective

Time-Sharing

Prosperity for the Prosperous

The time-sharing, or network information services, industry will have a minimum growth of 30-40% annually and profit potential of 25-30% pretax.

Minicomputers are not the threat to this industry they once were.

Many users are moving toward in-house time-sharing systems, but some will end up using both internal and outside services.

Remote services companies will begin taking over the "mom and pop" batch bureaus that make up the bulk of the service bureau industry today.

These are among the prognostications made by the presidents of three "time-sharing" companies before a recent meeting of the computer group of the New York Society of Security Analysts. It may sound like a rematch of predators of 1968, but the three men talking had better credentials in 1972 than anyone did in '68 — or '69 or '70 for that matter. Tom O'Rourke of Tymshare, Stewart Gold of Rapidata, and Richard Orenstein of National CSS each lay proud claim to a profitable 1971.

Gold, who is the one who made the seemingly outrageous statement on profit potential, worked his seven-year-old company into an 18.5% pretax profit — $992K on revenues of $5.4 million. Tymshare, though a little disappointed by year-end performance, did net almost $500K on $12.5 million in revenues. And National CSS should soon report more than $500K on $10 million. Gold expects independent publicly held firms to total $2 million in earnings in 1971, so the three speakers presumably represented most of these profits.

Gold gave figures on what should be done, but now *how*. Based on current technologies, he said a company with at least a $4 million revenue base should be able to operate on 75% of sales: 20% for hardware costs—10% for the network, and 10% for software; 15% for selling; 5% for promotion aids; and 15% for general and administrative.

This assumes — among other things — expensing certain items year-to-year, such as software. It also assumes that the firm is able to obtain enough throughput with its systems to generate sales that are more than five times the cost of hardware. Gold says three times cost is just break-even. Gold, O'Rourke and Orenstein have all made significant improvements to their systems through hardware and software changes. Gold says his GE-437 systems generate revenues five times the hardware cost.

The PDP-10 is said to be one of the most profitable systems in the time-sharing industry, and O'Rourke claims that Tymshare's will generate five-six times hardware cost. Gold thinks the PDP-10/70 that Rapidata will install soon will make possible a 7.8-8:1 ratio and, hence, profit expectations of 25-40%. He says '72 profits should be about 25%.

O'Rourke noted that minicomputers are no longer a threat to firms like Tymshare because the volume and complexity of files, programs, and data processed have outstripped the mini's capability. In-house time-sharing is an increasing trend, especially with the advent of the communications-oriented 370, he admitted. All three speakers conceded they'd lost business because in-house systems were installed, but all happily noted that customers are find-

ing that they can't develop the same service at the same price as the outside firm.

It was O'Rourke who thought that "mom and pop" service bureaus would be gobbled up by the larger network firms as they develop a range of services, from interactive to remote job entry, with which the small batch firms can't compete. Tymshare itself will make 60% of its business from rje in three or four years.

Actually, when the three speakers were finished, their optimism seemed to spread as far as their own companies, and perhaps a few others. Leasco, Gold claimed, was charging low prices just to cover hardware costs — certainly not to make a profit, and the likes of Honeywell were offering low-cost services as a stimulus for hardware sales. And Computer Sciences, well, nobody ran into them competitively very much, and they "have been trying to build the whole mousetrap and rush it into the market." **— Angeline Pantages**

Communications

ARPA Network to Go Commercial

"Many of our users have cut their costs significantly; some would have to invest a million dollars in additional systems if they didn't use the network."

Dr. Larry Roberts, the tall, quiet-spoken, pipe-smoking developer of the ARPA Network, was talking about his favorite subject — the first, and so far only, large-scale attempt to interconnect many specialized computers of different makes and offer their capabilities to a multitude of remote users.

Dr. Roberts' comments are particularly significant right now because ARPA — the Defense department's Advanced Research Projects Agency — wants the network to become a commercial service. The tentative plan calls for selling the federal interest "in about two years," Dr. Roberts said. Bids will be invited from both specialized common carriers and communications-oriented computer service firms. Between now and then, he added, ARPA may continue running the show, or the Arpanet may be transferred to another government agency. That decision will be made "shortly."

Illiac IV, the giant parallel processor developed by Burroughs and the Univ. of Illinois, will remain federal property even after the Arpanet goes commercial, Dr. Roberts said. Illiac was recently shipped from the Burroughs plant in Paoli, Pa., to Ames Research Center, Moffett Field, Calif., where it will be interfaced with the Arpanet.

Implementation of the network began late in 1969 with a "research and test" phase that included connection of the first 15 users (nodes). The system went operational in the summer of 1971. Last March, there were 21 nodes, and by this month or next, there should be a total of 26. Dr. Roberts indicated several more users were on the way. Apparently, there is plenty of room for expansion because ARPA has simulated a 200-node network. An even larger number of users can be accommodated without much difficulty, Dr. Roberts added.

A basic charge

Each user being added currently pays a basic charge of $16,500 per year. This covers the cost of the communications subnetwork required at each node and also allows the user to

send 4,500 "kilopackets" of data per month. A packet is 1K bits. If he sends more than this minimum amount of data, he pays 30¢ per kilopacket. The fee schedule is set up so that each new user pays nothing toward the cost of developing the system previous to the time he comes aboard. But if he generates enough traffic to require an increase in network capacity — i.e., if he generates more than 4,500 kilopackets per month — he pays the related costs.

The current charges per node will remain the same regardless of how many users are added, at least while ARPA is in charge, said Dr. Roberts.

An Arpanet terminal costs about $100K. Typically, it consists of a "terminal interface processor" (TIP) that connects directly with up to 63 console-type terminals and with the user's existing computer. The terminals can be local or remote, and can range from slow-speed teletypewriters up to crt's and high-speed line printers. An "interface message processor" (IMP), the component within the TIP that interfaces with the "host" computer, can be acquired separately by those users who don't need direct access to the network through terminal consoles. The IMP's, designed and fabricated by Bolt, Beranek & Newman, use Honeywell computers — the 316 IMP has a 500 kilobit per second throughput. The nodes are knitted together by three transcontinental 50 Kb/second long lines leased from the phone company.

The network transmits a message between any two nodes within 0.1 second. Long messages move at a rate of 80 Kb/second. Transmission downtime has averaged 2.3% for each 50 Kb line; but, because duplicate transmission paths exist between every node pair, the actual downtime rate is under 0.5%. Undetected errors amount to $1:10^{12}$ bits transmitted. Currently, traffic amounts to about 370 kilopackets/day, of which one-half to two-thirds is actual job data; the rest is test data. The job data is increasing rapidly, says Dr. Roberts.

The computers connected to the Arpanet include a large number of PDP-10s and 11s, but IBM, Burroughs, Honeywell, Univac, and XDS are well represented. The IBM complement runs the gamut from an 1800 at Rand Corp., Santa Monica, to a 360/91 at UCLA. The oldest machine is Lincoln Lab's TX-2. (See "Networks: An Introduction," p. 36.)

Many of the applications are highly scientific. Rand, for example, is modeling weather systems, using the 360/91 at UCLA and a 50 at UC Santa Barbara. The Univ. of Utah is using the 91 at UCLA to study the digital reduction of photographs. "Several people, " says Dr. Roberts, are accessing multiple data bases stored inside time-shared PDP-10s at Bolt, Baranek & Newman in Cambridge, Mass., and at Rand.

A more mundane application involved a computer conversion job at Stanford Research Institute (SRI) several months ago — from an XDS 940 to a PDP-10. SRI rewrote its existing programs, then used the Arpanet to test them on a PDP-10 at the Univ. of Utah. This was done before SRI's new machine was delivered. Within a month after delivery, the physical changeover was completed and the PDP-10 was running on a regular basis. Dr. Roberts estimates that SRI, by using the Arpanet and the Utah computer, shortened its conversion job "almost a year."

Doug Engelbart, who was in charge of this program conversion job, has developed a text-manipulation language, NLS, which ARPA hopes to use as the basis for an interactive "teleconferencing" system. The basic idea is to store speeches, scientific papers, and similar material in a remotely ac-

news in perspective

cessible data base so that other researchers can look at it on-line and add their own comments. People-people dialogs are also part of the plan.

ARPA has several other R&D projects under way or planned. They range from use of multiple computers at dispersed sites to process different parts of a single complex problem like simulated deployment of military forces — to experiments involving new methods of transmitting data via satellite. The Univ. of Hawaii, which will be connected to the Arpanet shortly via satellite, is undertaking the latter project. The university already has developed a data transmission system, using terrestrial broadcast channels, which permits much greater utilization of the bandwidth during peak periods.

Its commercial future

Regarding the Arpanet's future as a commercial data communications medium, Dr. Roberts believes "there are many possibilities. Visualize a network in which suppliers and their customers are each connected to the network via consoles and/or computers. Stock market information, simulation and modeling services needed by a company's engineering or marketing department, access to specialized statistical data bases, and additional computer support in the form of machine time and/or specialized software are just a few of the services that could be offered. Although these services are now available on-line in many areas, the user frequently needs a different terminal for each and has to learn a number of different communication protocols. Also, once he begins patronizing a given supplier, it's difficult to change.

"The network would eliminate these problems, since each user's terminal would be common to all applications, and a common communications protocol would be employed. Also, assuming more than one supplier of a particular service was accessible through the network, the user could shop around before contracting with any of them and could change suppliers easily later on if a competitor offered better prices or services."

— Phil Hirsch

EDP Veteran Tries Politics

Norman J. Ream can see the Western White House from where he lives in San Clemente, Calif.

But that isn't the reason he got into politics. Computer industry veteran Ream (formerly of Lockheed, the National Bureau of Standards, IBM, and Control Data Corp., among others) is running for Congress in a newly created Southern California district, the 42nd. His reasons for running aren't unusual. He's disturbed by "many things that are happening in this country" and he thinks he can do something about it.

Like a number of edp industry savants, Ream is no stranger to government, having served with NBS and as special assistant to the Secretary of the Navy; but he probably is the first from the industry to brave the political arena. His only previous political experience was working for the incorporation of the city of Downey, Calif., in 1956.

In the Republican primary for the new Congressional seat, June 6, Ream will be opposed by California State Senator Claire Burgener, a San Diego realtor; a self-described business advocate, Fred Gage of Oceanside; and a San Diego housewife, Gay Lewis. Ream says of the 42nd district: "The area is 70% Republican, so the primary is the election."

NORMAN J. REAM: a nonpolitician in politics.

Being of the edp industry, Ream has some thoughts on its behalf on its relationship to the federal government. Senator Burgener does, too, though his opinions often are modified by pleas of ignorance. Gage and Mrs. Lewis were late filers and unavailable for comment at writing.

Ream feels "the federal government is not taking advantage of advanced technology." To expedite this, he advocates "restructuring of the executive branch . . ." He would like to see some existing executive branch departments merged, "like Labor and Commerce," and a new department created to handle all agencies involved with technology, "like NASA and AEC," and maybe NBS, which now is under Commerce.

He feels the term privacy, as related to data banks, "has been overused in Congress . . . fear tactics have been employed by politicians. We live in a credit economy in this country, and to destroy the credit economy would be to destroy the national economy and our standard of living." He feels we don't today have the technical capability for a national data bank, but he doesn't fear the idea "as long as proper security is assured regarding access, and it couldn't be used for political purposes."

Senator Burgener pleaded ignorance regarding our capabilities but said he feels "there is a great need for centralization of data . . . but I wouldn't like to think Big Brother could have a complete and total file on me."

On government procurement, Ream said he would work to synthesize requirements to eliminate duplication. He would refine original systems procurement to make it more flexible, "to have systems bid both as totals and parts so independent peripherals manufacturers would have a chance at the beginning."

He would like to see NBS take better advantage of industry knowledge by using an associate program, permitted under its charter, that allows NBS to ask independent manufacturers to assign people to work with the bureau full time, still reporting back regularly to employers. "It's the one place various manufacturers can work together without violating antitrust laws."

Senator Burgener, who characterizes himself as "a generalist" and whose interest in government is in the fields of health and welfare, said he would look to people in the edp industry for advice and counsel on matters of concern to the industry. "In regards to any business, the best source of information is people in that business, keeping in mind, of course, that they represent a vested interest and attempting to equate that with the broader interests of the entire constituency."

Nonpolitician Ream said "it's about time other than politicians got into politics." Well, he's in, and win or lose June 6, he'll still be able to see the Western White House June 7, if the smog isn't too heavy.

— Edith Myers

Finke: Popular Honeywell Leader

"When there were so many disbelievers, Finke was the guy who insisted we could make it," said one top Honeywell executive in recalling Walter W. Finke, the former head of Honeywell's computer operation. Finke, who died in February, guided Honeywell's computer business from its beginnings in 1955 until 1967.

When Honeywell entered the business, there was great angst: everyone realized that profits were a long way off because so much computer equipment is leased. Finke, however, insisted that Honeywell could make it, and, of course, he proved to be right: Honeywell turned the corner in 1966 and has been profitable ever since.

As one of the pioneers of the computer industry, Finke earned a reputation within Honeywell as a morale builder and as an inspirer of men. He had a great common touch and was a popular leader within the firm. Customers were constantly surprised to find Finke making sales calls.

Finke joined Honeywell in 1951 after a stint in the Navy and after working as a lawyer and a teacher. Under his direction, Honeywell's computer business grew from virtually ground zero to more than $300 million annually. He left Honeywell in 1967 to become president and chief executive officer of the Dictaphone Corp. — a post he held until August of last year when he retired. Finke, who was 64, died in Palm Desert, Calif. He leaves his widow.

Shortlines

Tiny Louisville, Colo., tape drive manufacturer Storage Technology Corp., which recently entered into its first third-party leasing agreement (March, p. 143) is keeping its accounting staff busy. STC signed a four-year agreement with Information Storage Sys-

tems, Inc., under which it will buy and remarket ISS 3330/3830 disc subsystems. Financing for this $3.5 million and up to $10 million in purchases between now and Dec. 31, 1973, will be provided by ISS' parent, Itel Corp. STC also received a commitment from First National City Bank of New York as agent to enter into a new credit agreement providing for maximum borrowings of $20 million to support leasing. Participating with First National City Bank are Union Commerce Bank, Cleveland; and Security Pacific Bank of Los Angeles. And STC said it will file a registration statement with the SEC for sale of 500,000 common shares. The company also has received a contract from the Social Security Administration which could total more than $5.5 million in sales of tape subsystems ... Computer Machinery Corp., Los Angeles, is moving ahead in international markets. The key-to-disc company signed a distributorship agreement with Nissho Iwai Co. Ltd. of Japan for sale and service of its systems in Japan, the Ryuku Islands, and Korea; and CMC France, a subsidiary, said it received an order for more than $1,600,000 worth of systems from Cheques Postaux, a department of the French government ... Two student paper competitions are underway: The Association for Computing Machinery competition for 1972-73, open to students who will not have received a bachelor's degree or equivalent before April 1, 1972, will give preference to authors who submit a notice of intention to compete by June 12. Final manuscripts are due Sept.11.Winning papers will be published in the Aug. 1973 issue of *Communications of the ACM,* and authors will receive awards to be specified later. Correspondence should go to: ACM Student Editorial Committee, Computer Science Dept., Carnegie-Mellon Univ., Pittsburgh, Pa. The American Society for Information Science (ASIS) is staging a contest called "ASIS Student Member Paper Contest." It's limited to anyone who is an ASIS student member for 1972 or was a student member in 1971. Papers may be on any topic of interest to information scientists. The winner will receive round-trip travel expenses and full registration for the 1972 ASIS Annual Meeting, Oct. 23-26 in Washington, D.C. The winning paper will be published in the Sept./Oct. issue of the *Journal of the American Society for Information Science.* Deadline for submission is May 1. Papers should go to ASIS Education Committee, 1140 Connecticut Ave., N.W., Washington, D.C. 20036 ... Mohawk Data Sciences is growing. The company has agreed in principle to acquire Computing Efficiency Inc., parent of Bucode, Inc., a manufacturer of magnetic tape drives, including an IBM-compatible line. And MDS said it will begin construction this spring of a new multistory headquarters building at the Oneida County airport, Utica, N.Y.... American Management Systems, Arlington, Va., received a five-month, $100,000 contract to assist Burlington Northern railroad in design of a computerized freight revenue accounting and reporting system ... Sorbus, Inc. signed a nationwide maintenance contract with Sycor, Inc., producer of intelligent terminals ... System Development Corp. received a contract from the Army Advanced Ballistic Missile Defense Agency for development and operation of "an advanced computer and data processing research center" ... Digital Computer Controls, Inc., Fairfield, N.J., agreed to acquire Construction Technology, Inc., a company which developed a computerized system for sheet metal fabricators ... Recognition Equipment Inc., Dallas, signed a $1,140,000 contract with Microdata Corp. for Micro 800 and Micro 1600 minicomputers to be used in its Input 3 and OCR/S 2000 systems. □

Hardware

Product Notes . . .

Our memory must be failing us. Itel told us that its semiconductor memories for the 370 models 155, 165, and 145 (March, p. 114) would be available in July, Sept., and Nov. of 1972. The 1973 delivery date applies only to the 135 model.

It seems that Midland Bank Ltd., London, England, likes to collect Burroughs B 6700 computers. It already has two of them servicing several thousand bank branches on-line throughout the U.K., and it has put in an order for two more of the large-scale computers. That makes $39 million worth of business between Midland and Burroughs—so far.

The National Society of Professional Engineers has named the Staran parallel-processor, manufactured by Goodyear Aerospace Corp., Akron, as one of the 10 outstanding engineering achievements of 1971. The latest application mentioned for the superfast machine (Jan., p. 75) is to monitor orbiting space "junk" and calculate where it might land when it returns to earth.

Get 'em while they last. Digital Equipment has 165 used PDP-8 model I and L computers for sale, fully reconditioned, prices starting at $2500.

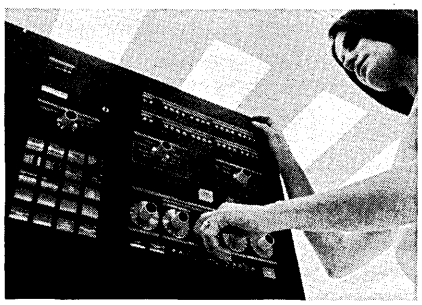
An independent consultant has just completed a reliability survey of all IBM 370/165 computers in California. Some findings: The average unscheduled IPL rate was about one every 10 days, with the worst case being one a week. "After only six months in the field, the 165s are at least as reliable as the 360/65 was after six years, even though the 165 has four times as many components."

While on the subject of IBM reliability, it appears that problems reported with 370/155s using 3330 disc drives (Jan., p. 8) were not being caused by the HASP monitor, but rather by hardware glitches in some of early production models of the 3330 drive. Our sources indicate that the problems have disappeared.

Beckman Instruments, Inc., Fullerton, Calif., liked the design of the True Data Corp. card reader (March, p. 123) enough that it has agreed to produce it for the new firm. Beckman thus gets a piece of the peripheral manufacturing action, and much smaller True Data Corp. doesn't have to buy lots of expensive equipment to get started.

Commo Processor

Following the example set by several others, IBM has *finally* decided that there should be such things as programmable communications processors to unburden cpu's from menial message handling tasks. The 3705 can be used with most IBM terminals and all models of the 370 line. Its heart is a 1.2-usec cpu that operates on from 16-240K of memory to handle up to 352 active lines. These can range from 45-baud asynchronous lines to 50-kilobaud synchronous links. Officially called the communications controller, the unit controls the communications network, performing polling functions and character and buffering tasks. It also assembles complete messages before handing them over to the cpu for processing.



The 3705 is programmed from the host computer using a network control program. This high-level macro language program interprets user specifications for precisely what functions are to be performed by the 3705, and generates the required code. The 3705 communicates to the host computer via the familiar TCAM module. An emulation program is offered to current 2701/2/3 users at no charge until the user can upgrade his operation—and until IBM can get the network control program ready.

Also featured in the 3705 are automatic error recovery procedures for transmission errors, and the capability to link it to two computers for backup. It may also be attached to two separate channels on the same cpu for channel backup. The 3705 controller can run for a short time if the host system is inoperative and be programmed to notify users of a system problem if the down time exceeds a certain period. This insures a pretty good "fail soft" capability.

IBM took the opportunity of introducing the 3705 to announce a new lease plan that provides an initial 24-month contract with an unlimited number of one-year extensions.

Rental of the 3705 starts at $1200/month for 16K of memory, sufficient to support four lines. Lines can be added in sets of two up to the 352-line maximum, which rents for approximately $9500/month. First shipments for the 3705 and the emulation programs is this July, with the more sophisticated network control program due out in March of next year. Can virtual memory be far behind? IBM CORP., White Plains, N.Y. For information:

CIRCLE 254 ON READER CARD

Remote Job Entry *

If these two IBM-compatible remote job entry configurations—called the DECcomm 11D21 and 11D26—look a lot like PDP/11s with 8K of memory, ASR ttys, and synchronous communication line interfaces, you're absolutely correct. The two systems have identical hardware and are designed to allow users to expand their IBM 2780 rje capability. The DECcomm 11D21 comes with a full set of Comtex 11 system control and interface software, source listings, and source tapes. The minimum configuration starts at $22,350.

The DECcomm 11D26 system costs $18,350, with enough Comtex binary code software supplied (no source tapes) for full IBM 2780 emulation. This model is designed primarily for the PDP-11 minicomputer users who needs some part-time IBM 2780 capability in addition to their normal run mode. DIGITAL EQUIPMENT CORP., Maynard, Mass. For information:

CIRCLE 243 ON READER CARD

Printer/plotter *

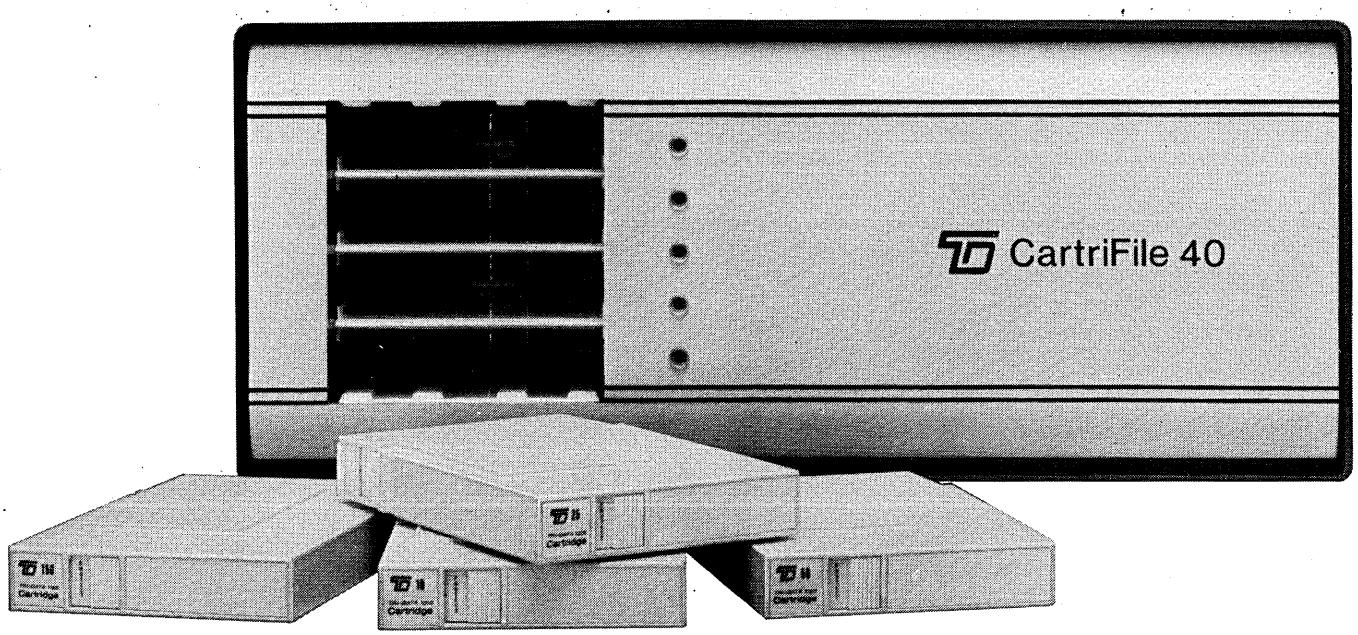
Since scientific applications rarely require multiple copies of either printing or plotting results, why have two separate units for doing roughly the same job? It would seem that the Statos 30 incorporates most of the features found in both printers and plotters. It prints 132-column lines at a 1000-lpm rate, drawing from a standard 96-character ASCII set that has been augmented with 24 additional characters for printing French and German. Characters are 7x11 dot matrix variety for good legibility.

In the plot mode, the 30's 1,408 individual stylii (100 per inch) plot synchronously and asynchronously at 220 steps/second—or a full page of plotting in about five seconds, regardless of plot density.

Another nice thing about the 30 is

*European distributor has information on this product.

MANY-TAPE MINI



Put these FOUR mag tape drives to work and you'll add real flexibility and power to your minicomputer system. Each drive in the CartriFile® 40 is independently controllable—and reads or writes up to 18,000 bits per second. You can use each drive by itself or in combination with the others.

CartriFile 40 comes complete with electronics (read, write, and controller) plus integral power supply. Also, interfacing, cables, and basic software for all popular minicomputers.

It operates with convenient, single-tape cartridges: new Tri-Data 1000 Series. These are available in 10-, 25-, 50-, and 150-foot lengths. With four 150-foot cartridges, the system can store nearly 13 million bits.

And the price? You'll like it. Only $4950 with interface; $3015 in small OEM quantities (without interface).

Get all the facts on the "many-tape mini"—CartriFile 40.

TRI-DATA

800 Maude Avenue / Mountain View / CA 94040
Phone (415) 969-3700 / TWX 910-379-6978

Two ways to save money on practically any time-sharing service.

Z.V. Zakarian, president, Western Union Data Services.

Model 33 ASR accoustically coupled terminal. $65 per month.

Model 33 ASR for data access arrangement $75 per month.

With about 150 in the U.S. there is no shortage of time-sharing services. What there is a shortage of, is low-cost terminals and service for them.

So about a year ago we decided to offer terminals that would be compatible with virtually every time-sharing service. And we offered terminals at the lowest prices ever. Add to that nationwide support and it's not surprising that we have leased literally thousands of terminals.

We offer models for every purpose. The Model 33 ASR with acoustic coupler works with any standard telephone. And we can provide Model 33 or Model 35 for use with Data-Phone* or data access arrangements.

Regardless of which data terminal configuration you select, you can depend on Western Union Data Services Company for nationwide servicing, applications engineering, training and support.

Interested in the most economical and efficient data terminal for your needs?

Contact me at Western Union Data Services Company, 16 McKee Drive, Mahwah, New Jersey 07430. Phone: 201-529-1170. Outside N.J. call toll-free 800-631-7050. Telex: 12-5077.

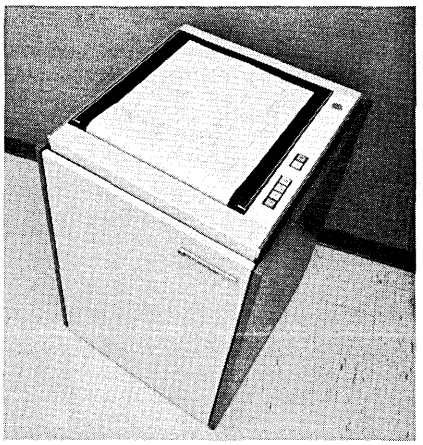
*Registered trademark of AT&T.

western union data services company

that there is no need to reformat commands coming to the plotter via direct-memory-access channels of minicomputers. The commands are handled in standard form by hardware functions in the plotter. This also has the advantage of reducing the size of the software support module.

Several different grades of fan-fold and roll paper are offered in 15-inch widths. The paper is toned as a function of speed so that problems of wet output shouldn't occur.

Interfaces, including software, are available for most major minicomputers. These are typically priced in the $1500 range. The Statos 30 is priced at just under $9K, which seems



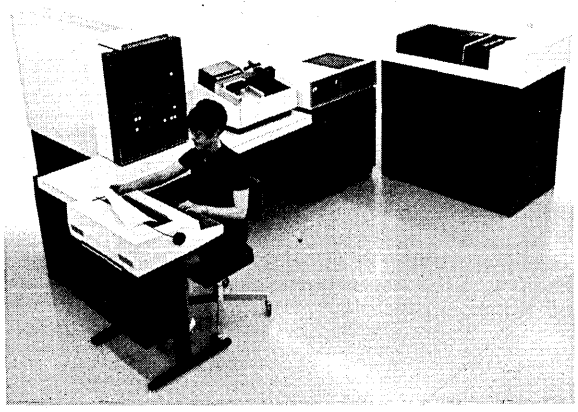
very reasonable and ought to assure the product of a good future. Deliveries begin in June. VARIAN DATA MACHINES, Los Altos, Calif.. For information:
CIRCLE 260 ON READER CARD

Line Printers

The models 246 and 306 medium-speed impact line printers will be ready for delivery by summer. Both use rotating drums, differing primarily in speeds: 200 132-column lines/minute for the 246, and 300 lpm for the 306. Options for both models include 12-channel vertical formatting, special character fonts, 230-volt operation, parity checking, six or eight lines per inch spacing, and pedestal stand. All models are generally sold in oem lots. 750 units of a sister model, the V132, have been shipped. Prices are approximately $5500 and $6100 for orders of 50 units. DATA PRINTER CORP., Cambridge, Mass. For information:
CIRCLE 244 ON READER CARD

Hybrid/Control Computer

The PACER is an 8-32K 16-bit computer intended for dedicated and hybrid systems applications. It features a 1-usec core memory; hardware multiply/divide (5.6/6.6 usec execution times);



product spotlight

The Memorex Computers *

The company that has grown from a garage-based manufacturer of computer tape to an $80 megabuck international corporation in 11 hectic years has built its first computers. Tired of attaching 2311-type disc units to hundreds of IBM 360 model 20s and watching the majority of the revenue from those installations head for White Plains, Memorex has decided to offer the 360/20 user an alternative. And if the performance of the MRX models 40 and 50 is anywhere near as impressive as the system specifications read, there might be a real assault coming on one of IBM's more important revenue bases.

For openers, there are eight individual processors on the 40 and 50. Four control I/O operations, and four do the processing. The processors are managed by a microcoded control store and are multiplexed to share addressing and data paths. There are approximately 150 basic instructions in the cpu, which has a two-byte data path.

The difference between the two models is the speed of the all-MOS memory—1.8 usec for the 40 and 900 nsec for the 50. All arithmetic, except floating-point, is done in the hardware. Rounding out the mainframe are a number of interregister instructions, 16 general-purpose registers, and a choice of channels: a 555 KB/second selector channel equivalent, and an 1100 KB/second channel that can be compared to a multiplexor channel.

The designers believe that small systems in this category are often hamstrung in their performance for a lack of I/O capability rather than because the cpu's aren't powerful enough. That's the thinking behind these computers: Cut down on task switch time, and make the channels fast. A full range of peripherals will be offered for attachment to those channels.

For software, there will be a disc-based batch operating system called MRXOS. A telecommunications submonitor is also available. FORTRAN, COBOL, and RPG are the languages offered, and there is an emulation program for the 360/20 the MRX machines hope to replace. This program runs in one of the two multiprogram partitions in the machine, so the computer doesn't have to be dedicated to emulation. Except for the high-level languages, the software is bundled.

Pricing was still being pegged for the model 40 at press time. But a model 50 with multiprogramming and remote processing capability, 48K of memory, console, 600-lpm printer, three 29-megabyte disc drives, and two asynchronous and one synchronous communication lines will be around $6K/month. If the 40 comes in at a price substantially under that, it could be a good competitor to the IBM System/3. First shipments are scheduled for September. MEMOREX CORP., Santa Clara, Calif. For information:
CIRCLE 258 ON READER CARD

72 levels of automatic interrupts; relative, direct, and multilevel indirect addressing; automatic restart, etc. More than 150 applications and monitor programs are offered, including a FORTRAN IV compiler, a hybrid operations interpreter, debugging packages, a real-time monitor, and plotting packages. Prices start at $28K for hybrid models, $44K for automation control systems, and $22K for graphics-oriented versions. ELECTRONIC ASSOCIATES, INC., West Long Branch, N.J. For information:
CIRCLE 219 ON READER CARD

Graphics Terminal *

When users started buying oem-oriented graphics terminals from this manufacturer, the company decided there must be more of an end user market for the devices than they originally thought. So, they went back to the drawing boards, and the Vector Graphics 11 is the result. It's a stand-alone graphics system based on several models of the Digital Equipment PDP-11 product line (11/05 through 11/20 for now, 11/45 possibly in the future).

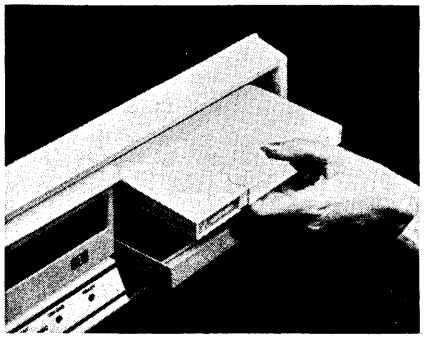
A 13 x 14-inch screen with 4K x 4K resolution is used. The vector genera-

hardware

tor is good up to 18,000 ips without flicker, and there are 32 intensity levels. Up to four displays can be attached to a display controller, and the system can accommodate up to four display controllers. A price of $36,700 includes 4K of memory, an ASR 33 tty, scope and controller, selective blinking, vector generator, and 90° image rotation. A hardware character generator is an additional $4K. VECTOR GENERAL, INC., Canoga Park, Calif. For information:
CIRCLE 248 ON READER CARD

Disc Storage *

Users who are looking for auxiliary storage with more speed and capacity than cassettes, but who don't need a full-fledged (and expensive) disc unit, might be interested in the IODISC Series One. The storage medium is a flexible disc with a 250-kilobyte capacity that is contained in a sealed cartridge. The



drive contains two spindles, providing an on-line capacity of 500 kilobytes that can be accessed in 60 msec and transferred at 150 KB/second. A very low noise level is claimed for the system, qualifying it for office applications. The basic unit, including power supply, is priced at $5500. Interfaces for a good number of minis are available, ranging in price from $750 to $1600. The Series One "Cartridisc" storage units will be available this summer. IOMEC INC., Santa Clara, Calif. For information:
CIRCLE 255 ON READER CARD

Crt Terminal

The TELERAY crt terminal is aimed at the tty replacement market, and it's claimed that the unit is compatible enough with tty's that the two types of terminals can be operated in series. A 12-inch diagonal screen is used to display a choice of 12 or 24 lines containing 40 or 80 5 x 7 dot matrix ASCII characters that are refreshed at 60 Hz. The unit's electronics are contained on only two pc cards, which probably accounts for the TELERAY's low base price of $1400. Delivery schedules are approximately 60 days. RESEARCH INC., Minneapolis, Minn. For information:
CIRCLE 256 ON READER CARD

Touch-Tone Terminal

The model 101 data entry terminal consists of an acoustic coupler, 10 numeric and 5 special function keys, a buffer memory for eight entries, and a

light-emitting diode display that permits verification of data before its transmission. A small speaker is also included for answer-back data verification. ASCII and EBCDIC models are offered. The price is $525, with delivery from stock to three weeks. COMPUTRAN, INC., Gardena, Calif. For information:
CIRCLE 226 ON READER CARD

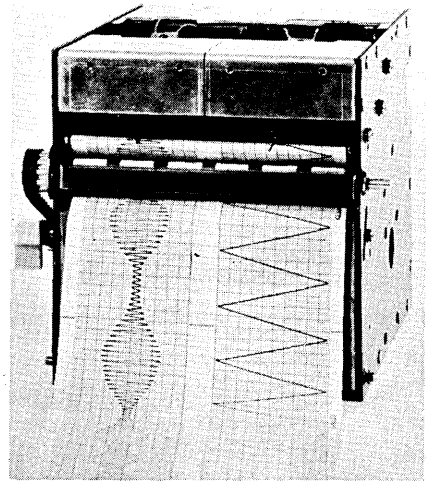
Disc Storage *

The 6330 disc storage system is the latest entry in the IBM 3330 replacement derby. Since its 800-megabyte storage capacity, 30-msec average access time, and 806 KB/second transfer rate are very close to everything else that's offered, users will probably just want to know the rental terms. The 6830 controller rents for $2150/month, including maintenance, on a one-year lease. The two-channel switch option is $150/month extra. Each 6316 spindle rents for $585 on the one-year contract—which is actually 13 months. Three-year contracts get an additional seven months' free rental. Deliveries of the 6330 start this summer. TELEX COMPUTER PRODUCTS, INC., Tulsa, Okla. For information:
CIRCLE 251 ON READER CARD

Strip Chart Recorders

The "Bare Bones" series of electronic chart recorders will probably appeal to the person who values function over form, as the units come without paneling, controls, etc. The series complies with American Heart Association specifications (which includes extensive precautions against transient voltage shocks), but might also find applications in aerospace, automotive, chemical, food, pollution control, and other

fields. The galvanometers measure frequencies up to 125 Hz and beyond, with a sensitivity of 10 millivolts per millimeter. The chart speeds are 25 and 50 mm/second, for single or dual-channel units. Slower speeds are offered as options. The Bare Bones units



look like oem products but are intended for end users. They are supplied with input and output connections at the rear, controls in kit form, wiring diagrams, and parts lists. Prices start at $286 for a single-channel model, and $575 for dual recorders. ASTRO-MED, West Warwick, R.I. For information:
CIRCLE 224 ON READER CARD

Off-line Printing

The 514 off-line print station consists of from one to four 2314 disc drives, a 24K minicomputer, and a choice of a 300- or 600-lpm printer. The interface is said to be compatible with DOS software and features automatic fail-safe record addressing, hardware error checking, and variable record lengths up to 2K words. The basic price is $59,750, including one disc drive, the 300-lpm printer, the mini, and supporting software. Delivery is 90 days. ULTIMACC SYSTEMS INC., Maywood, N.J. For information:
CIRCLE 221 ON READER CARD

Card Reader/Punch

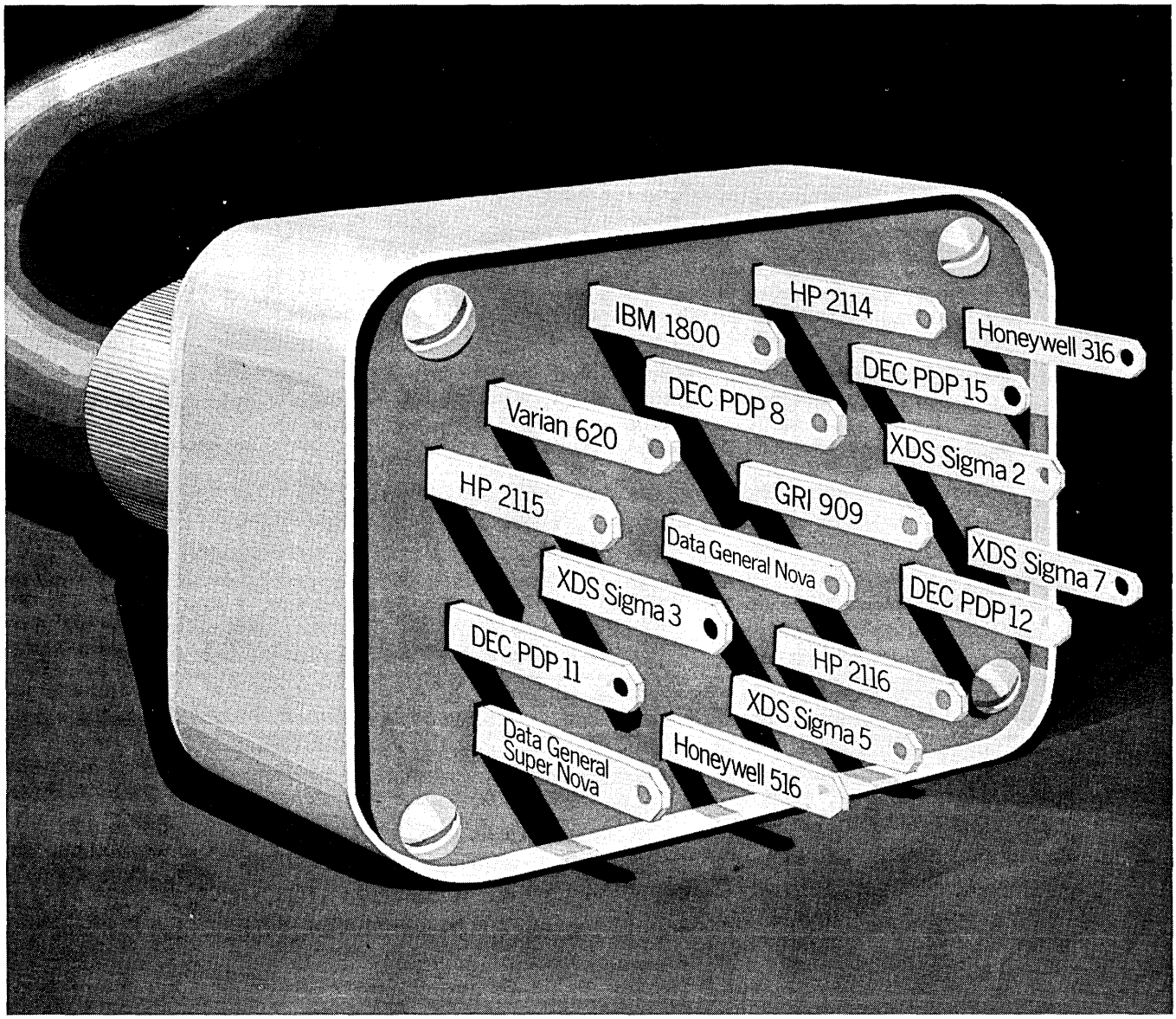
At a maximum speed of 112 cards per minute, the high-speed card terminal seems inappropriately named. But it's claimed that no other similar unit on the market can simultaneously read, punch, and interpret what it punches at that speed. The terminal was developed for the government, and it has turned out that a number of users started buying them. An optional keyboard turns the terminal into an off-line keypunch and interpreter. The price of $18K seems high—but the vendor feels there are not very many potential customers. If it turns out that there are more than he thinks, the prices will drop accordingly. Delivery is 90 days. FUTURONICS CORP., Freeport, N.Y. For information:
CIRCLE 253 ON READER CARD

Card Reader *

The model C450 reads 80-column cards punched in any format column-by-column at 450 cpm. Its input and output stackers have 1,000-card capacities, which may be loaded or unloaded on the fly. The C450 is available in both table-top and rack-mount models. Attention lights indicate output hopper full, input hopper empty, and three unsuccessful read attempts. The price to oem's in orders of 100 is $1230/unit, with single units listing for $1795. PERIPHERAL DYNAMICS INC., Norristown, Pa. For information:
CIRCLE 223 ON READER CARD

Communications Aid

Here is a simple little product that might reduce communication costs and make the communication operation much more convenient. It's called the Data Sig 100, and it allows operators at either end of synchronous communication links to signal each other (with a flashing light and beeper) that they wish to talk in voice mode. That eliminates having to drop



The Matrix Printer is plugging into Europe.

During the past two years Matrix non-impact Printer/Plotters have been working in hundreds of applications in the U.S.

Silently. And successfully.

Now, we're off to Europe. Today the line of Matrix Printer/Plotters is available through sales representatives in the United Kingdom, France, Italy, Switzerland, West Germany, Belgium, The Netherlands, Sweden, Norway, Denmark, Finland, and Austria.

12 countries in all.

This is good news for Europe, as well as for us.

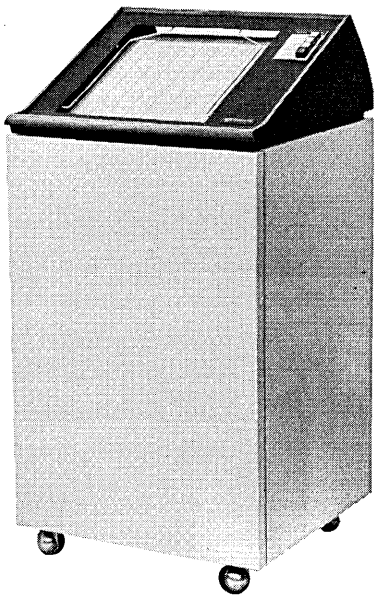
Europeans now have available a highly advanced, electrostatic printer/plotter that takes the noisy "bang" out of printout. A printer that operates at up to 600 LPM . . . 80 or 132 ASCII characters per line . . . and does raster scan plotting with up to 1024 points per scan.

Cost-conscious Europeans will also be pleased to know we've already developed software and controllers for 18 mini- and midi-computers. Our Matrix Printer/Plotter can be plugged in almost anywhere . . . without undue expense.

So better make note of our address.

In the U.S. it's still Versatec, 10100 Bubb Road, Cupertino, California 95014.

But in Western Europe you can now get literature—or the location of the nearest sales and service organization—from Sintrom Europe, Ltd., 2 Arkwright Road, Reading, Berks, England.



VERSATEC

CIRCLE 111 ON READER CARD

the link each time voice communication is desired. The RS-232-B compatible unit can be configured to signal under both computer and manual control. It's priced at $500. DIVERSIFIED SYSTEMS INC., Irving, Texas. For information:
CIRCLE 247 ON READER CARD

Custom Crt

The model 500 custom video terminal is standard enough in many respects. It consists of a 12-inch diagonal screen for displaying up to 24 80-character lines, has a 64-character ASCII set, and refreshes at 60 Hz. But the product is for the "non-IBM" world," says its developer. For that reason, the basic tty model 33-style keyboard is a separate component of the terminal so customizing can be done easily. Some features of the 500 are answer-back; selective blinking; tab controls; character and line editing; and numerous formats, data transmission speeds, and line control disciplines. The RS-232 interface handles asynchronous data rates of 110-1800 baud, or synchronous transmission at up to 9600 baud. The basic 500, including a tty model 33 keyboard and 12 72-character lines, is priced at $1450. The small new firm is quoting delivery in 60 days. LIBERTY SYSTEMS GROUP, Canoga Park, Calif. For information:
CIRCLE 252 ON READER CARD

Plotter

Having built a number of flat-bed plotters during the last several years, this firm has decided to try its hand at producing a drum plotter. The models 3600 and 3600M are basically similar units with 34-inch wide drums, 2.5- and 5-mil increment sizes selected either manually or by program control, absolute repeatability, and 25-msec pen up/down times. The models differ in that the basic 3600 plots at 450 and 900 increments per second (for 5 and 2.5 mils, respectively), and the 3600M runs at twice those speeds. Ball point, fiber tip, and ink pens can be used. The price for the 3600 is $12,200, and the M is $14,900. Interfaces are available for a number of minicomputers, including the H-P 2100 and PDP-8 and 11, and are in the $1K price range. A remote controller, priced at $3675, allows plotting at up to 810 steps/second over 30-cps voice-grade lines. ZETA RESEARCH, Lafayette, Calif. For information:
CIRCLE 246 ON READER CARD

360/22 Memory Upgrade

As soon as users receive their bright shiny new 360/22, they may want a little more memory capacity than the 32K that IBM supplies. This vendor offers the ARM-22 memory in either 32K or 64K sizes, with cycle times of 1.5 usec. A two-year lease on 32K runs $960/month, including prime shift maintenance. Delivery is immediate. AMPEX CORP., Marina del Rey, Calif. For information:
CIRCLE 262 ON READER CARD

Commo Minicomputer

RACE is the name of this microprogrammable minicomputer intended for incorporation into larger peripheral and instrumentation systems. The control ROM—up to 256 64-bit words—is used to implement 190 basic machine

hardware

instructions. A dual memory bus architecture permits from 1-16K bytes of 1.25-usec MOS memory and up to 2K bytes of 250-nsec bipolar ROM to be used. The MOS memory can be expanded in 1K increments; and the ROM, which is designed to hold permanent programs that have been checked out in the read/write memory, can be expanded in 32-byte steps.

There are three general-purpose registers; 2's complement, binary, parallel, and fixed point arithmetic; and an I/O bus that takes up to 32 devices. Options include a hardware bootstrap loader, interval timer, battery backup, and direct-memory-access capability. Software includes a 4K symbolic assembler with built-in editing features, a debug package, and a multiprogramming monitor that can optionally be made to run out of the bipolar ROM. The base price of $3900 includes cpu, 4K bytes of memory, 64 words of control ROM, power supply, and control panel. INTELEX, INC., Garland, Texas. For information:

CIRCLE 249 ON READER CARD

Batch Terminal

While the minicomputer above is strictly intended for oem's, it has been incorporated into a batch terminal called the model 3000 for users. Communication speeds go up to 9600 baud for both ASCII and EBCDIC character codes. There are emulation packages for the IBM 2780 and 360/20, the Univac 1004 and 9000, and the CDC User 200 terminal. With 4K of MOS memory, emulation package, a 300-cpm reader, and 100-cps printer, the 3000 rents for approximately $550/month on a one-year contract, including maintenance. A full line of peripherals is offered. INTELEX INC., Garland, Texas. For information:

CIRCLE 250 ON READER CARD

PDP-8 Add-on Memory

These two memory systems for the PDP-8E and 8I are different from most others we've seen. They are MOS memories instead of the usual core or plated-wire replacements. The 8E replacement plugs into the Omnibus, uses the mini's existing power supply, and is said to be completely transparent to the machine in operation. From 4-28K of the 1.2-usec memory can be supplied, with a 4K replacement priced at $1630. If more than 4K is to be added, the first 4K is $1795, and each additional 4K is priced at $1200. That's the least expensive memory offered for this computer that has come to our attention.

It's a similar story with the PDP-8I. From 4-24K is offered for mounting directly into the rack assembly of the mini. The first 4K is priced at $3920, and each additional 4K is $1200. Both memories are available approximately 60 days ARO, and prices include necessary cables and a one-year warranty. SIGNAL GALAXIES, INC., Van Nuys, Calif. For information:

CIRCLE 245 ON READER CARD

Crt Terminal

The Elite 1500 is a tty-compatible crt display terminal that operates in either full- or half-duplex mode at any two customer-specified data rates in the range of 50-1800 baud. Data enters the display on the bottom line and then upshifts until the screen is full. The

keyboard is of the model 33 tty variety, and the number of 5x7 dot-matrix characters that can be displayed ranges between 480 (6 lines of 80 characters) and 1,920 (24 lines of 80 characters). The 1500 also can drive an external printer and slave monitors. Automatic answer-back is offered as an option. Prices start at $1375, and delivery is approximately 60 days. DATAMEDIA CORP., Pennsauken, N.J. For information:

CIRCLE 225 ON READER CARD

Control Console

The L1000 control console could be used in multicomputer installations and in real-time data-switching applications. Numerous status and indicator lights show whether particular peripherals are on-line or can be used to indicate active communication lines. Each installation of the L1000 console would be a custom job, and for that reason prices are approximate. A system for controlling several large computers would be priced typically at $75K. The vendor is a subsidiary of Western Union Corp. TELEPROCESSING INDUSTRIES, INC., Mahwah, N.J. For information:

CIRCLE 222 ON READER CARD

TAB DATA MEDIA CABINETS

Tab Data Media Cabinets are designed for storage of whatever needs storing. Reels, disk packs, printouts, manuals, binders, cards, microfilm rolls, cartridges or fiche, even the company coffee pot! It's the clear-span interior and roomy 36" by 16¾" width and depth that do it. Plus a wide selection of roll-out trays, shelves and inserts to tailor Data Media Cabinets to the exact storage functions you need. Two, three and five compartment models in your choice of computer-compatible colors. For full information, write Tab Products Company, 2690 Hanover Street, Palo Alto, California 94304.

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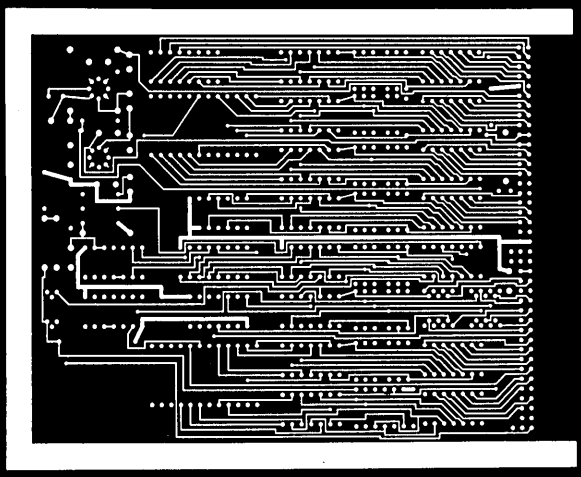
PRODUCTS CO.

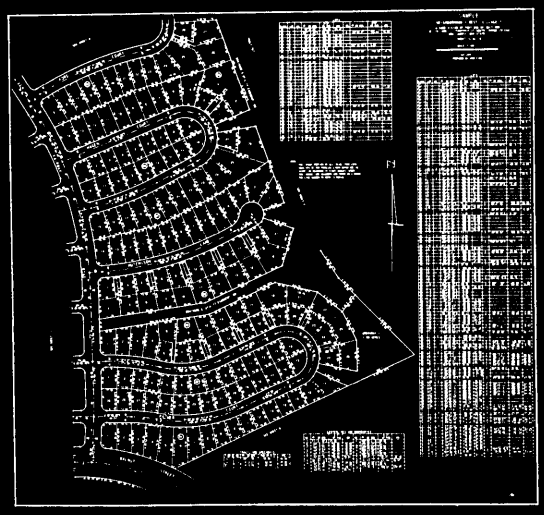
16 Years Ago- We found a need & filled it!

CIRCLE 41 ON READER CARD

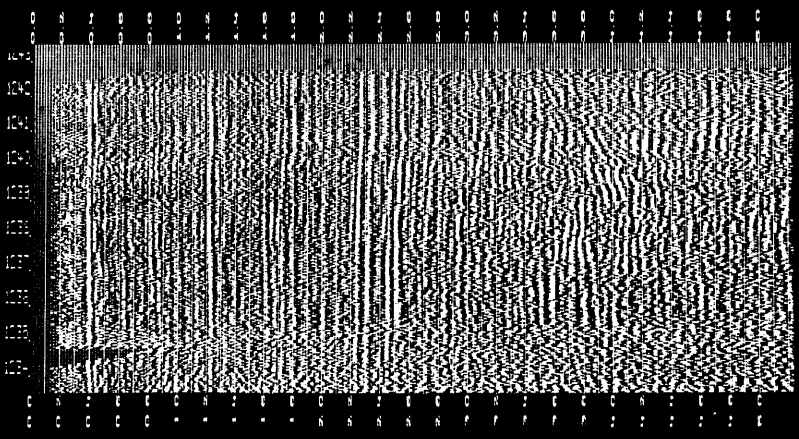
Speed isn't everything.
High resolution isn't everything.
Upwards expandability isn't everything.
But all three together?
That's everything.



Printed Circuit Board



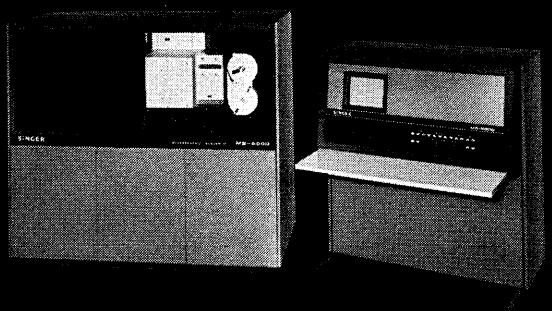
Subdivision Map



Seismic Plot

And that's the new Singer COM plotter/printers. Here today. Yours tomorrow.

MS-5000 works off your digital computer, on line or off line. MS-6000 works off its own internal digital computer. For technical literature and applications assistance, write: Singer Micrographic Systems, Binghamton, New York 13902.



Computer Output Microfilm Systems by SINGER

SINGER Consumer Products, Industrial Products, Aerospace & Marine Systems, Education & Training Products, Business Machines.

CIRCLE 57 ON READER CARD

hardware

ROM Programmer
This read-only memory programmer consists of an input keyboard, a paper tape reader/punch, and control circuitry. The unit can be used to create or verify ROM program tapes, generate a tape from a ROM or a RAM, or to modify ROM contents manually using keyboard input. The price is $3500, and delivery is 30 days. DATA I/O, San Jose, Calif.
CIRCLE 227 ON READER CARD

OCR Typing Element *
A growing number of ocr readers read from a bar code that appears directly beneath the alphanumeric character on IBM Selectric typewriters and equivalents. IBM part number 1167659 is the Selectric element with these bar codings. The price is $18 per element. IBM CORP., White Plains, N.Y.
CIRCLE 228 ON READER CARD

Data Entry Options *
Two additions to the KeyProcessing data entry product line: The first is the CMC 762, a standard line printer that prints at 245 lpm for a full 132-column line of text and rents for $500/month. The other, a crt keystation that displays 128 characters (112 data characters plus a 16-character message indicating column number, field number, format level, and other status information), can be used along with model 105 keystations on the CMC Key-Processing system. The model 103 rents for $70/month. COMPUTER MACHINERY CORP., Los Angeles, Calif.
CIRCLE 231 ON READER CARD

Cassette Option
Cassette storage is now available for this manufacturer's 8- and 16-bit ALPHA and NAKED MINI computers and the CAPABLE logic tester. Up to three Philips-type cassette drives, each providing over 500 kilobytes of data, can be specified. The single drive sells for $2950, and the triple cassette is $4850. COMPUTER AUTOMATION, INC., Newport Beach, Calif.
CIRCLE 229 ON READER CARD

OEM Acoustic Coupler
A Western Electric 103-compatible acoustic coupler is offered to manufacturers. The unit operates in full- or half-duplex and features —50 db reception sensitivity at data rates greater than 300 baud. Prices drop under $100 in quantity. COMMUNICATIONS LOGIC, INC. Houston, Texas.
CIRCLE 230 ON READER CARD

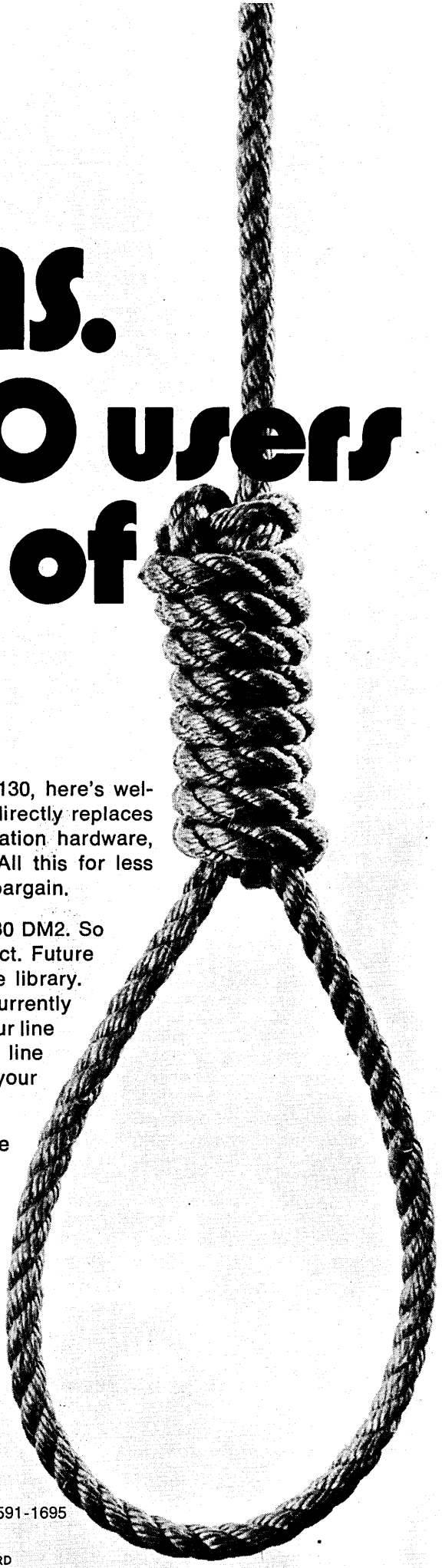
Printer Interface
This new company has decided to specialize in building controllers and peripherals that are not usually offered. It's first product is an interface for the venerable IBM 1403 line printer, allowing it to be attached to some of the more common minicomputers. The company is primarily interested in the oem market, but it will sell to end users. A purchase of ten 1403 interfaces would run $5500/each. SPUR PRODUCTS CORP., Santa Monica, Calif.
CIRCLE 234 ON READER CARD

Patch Panel
The data patch and monitor module provides normal terminal-to-modem connections on the digital side of data sets and multiplexors. When switched to the patch mode, the connections are broken to allow manual patching and rerouting among available spare or back-up terminals and modems. The price is $260. INTERNATIONAL DATA SCIENCES, INC., Providence, R.I.
CIRCLE 232 ON READER CARD

Voltage Monitor
The model W115 PowerGuard records power levels on a strip chart in the 0-300 volt range. The unit sells for $1175 (or $385 without the recorder). DATA RESEARCH CORP., Fort Lauderdale, Fla.
CIRCLE 233 ON READER CARD

A/D Multiplexor
The AN5800 series provides up to 64 multiplexed 8- to 15-bit ADC channels. A 2000 Megohm input impedance is presented to analog signals in the 0-10V, 0-5V, 10V, and ±10V, and ±5V ranges in single-ended or differential mode. An 8-channel unit, including sample-and-hold capability, a 12-bit A/D converter, and cables, is priced at $1260. ANALOGIC, Wakefield, Mass.
CIRCLE 235 ON READER CARD

The GA DMS. For IBM 1130 users at the end of their rope.



If you're at the end of your rope with a throughput-bound IBM 1130, here's welcome news: General Automation's 18/30 Disk Monitor System directly replaces the 1130. With increased throughput, faster memory, 4th generation hardware, expandability, even real-time and communications capabilities. All this for less than you're paying for your 1130. It's a true price/performance bargain.

GA's 18/30 DMS operates directly with programs written for 1130 DM2. So all of your existing software and programming effort is left intact. Future programs are probably already waiting for you in our extensive library. And you'll probably get at least five times the throughput you are currently getting on your 1130. What's more, you'll be able to choose from our line of faster peripherals — like mag tapes, big disks, card readers, line printers and plotters. It all adds up to a system designed to suit your needs for years to come.

The 18/30's role as a superior, economical replacement for the 1130 is a field-proven fact. A General Automation representative will be glad to show you why dozens of customers have already switched to the 18/30 DMS, and what it can do for you. To find out, give him a call. We maintain offices with complete field service and technical support in principal cities in the United States and Europe. And we're growing by leaps and bounds.

For more information on the 18/30 Disk Monitor System, write us today. We'll also send you your very own length of rope and a book, "Knots and Splices." All very handy for people at the end of their rope.

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CIRCLE 52 ON READER CARD

hardware

Tape Drive Option *
A 9-track, 800-bpi tape unit called the model 2401 is now offered to users of this manufacturer's data entry system. The 2401 is said to be equivalent in channel characteristics to the IBM 2400 series drives. The 12.5-ips speed of the unit provides a transfer rate of 10 KB. On a one-year lease, rental is approximately $250/month. INFOREX, Burlington, Mass.
CIRCLE 238 ON READER CARD

Portable Punch *
The model 58A is a portable paper tape punch that can be used for 5-8 channel punching operations. Each channel has a key corresponding to it on top of the unit. Features include an automatic counter with a reset button, space bar, and automatic advance. A splicer is offered as an option. The basic price is $220. DATA PRODUCTS CORP., Woodland Hills, Calif.
CIRCLE 239 ON READER CARD

Disc Storage
All models of the Hewlett-Packard 2100 series minicomputers equipped with the direct memory access feature can be hooked to the 2923 disc storage system. The 2923 is an IBM 2315-type disc cartridge device, providing the H-P computer with over one megawords of storage. The access time is 70 msec, and the transfer rate is 98,000 words/second. Prices start at $10,950, including all interfacing, and a choice of a real-time executive, a standard DOS, or a system for operating under the H-P BASIC system. DACONICS CORP., Sunnyvale, Calif.
CIRCLE 240 ON READER CARD

Printout Storage
Up to 3 inches of standard 14⅞ x 11-inch computer printout can be stored in each Tote-Binder, which is similar in appearance and function to a standard filing cabinet folder. Binders are priced at approximately $2.75 each, and the company can also supply storage cabinets for the binders. OXFORD PENDAFLEX CORP., Garden City, New Jersey.
CIRCLE 241 ON READER CARD

Cassette Storage *
The model 810 cassette recorder is for use with this manufacturer's MRD 700 and Consul 880 crt terminals, providing them with up to 50,000 characters of storage. Recording is done at switch-selectable speeds ranging from 110 to 2400 baud. The price is $1850. APPLIED DIGITAL DATA SYSTEMS, INC., Hauppauge, N.Y.
CIRCLE 242 ON READER CARD

Printer for 1130s
An interface has been developed that allows the 250- and 750-cps A. B. Dick Videojet printers to be attached to the IBM 1130. The package consists of the printer, interface, and necessary software. Prices start at $10,900 for a 250-cps printer. TC SYSTEMS, INC., Houston, Texas.
CIRCLE 259 ON READER CARD

Microfilm Duplication
The model A-9 printer exposes both diazo and vesicular film on a two-up basis. It's priced at $895. A companion is the D-11 diazo developer that uses an atomizer arrangement for vaporizing ammonia into the heat chamber, instead of the usual wick approach. This unit sells for $185. MICRO-SCAN SYSTEMS, INC., Pearl River, N.Y.
CIRCLE 236 ON READER CARD

Printer Enhancement
The model 101A is similar to the model 101 introduced in December 1970 (p. 59) but has 9x7 dot-matrix characters instead of 5x7 characters. A single unit of this 165-cps printer is priced at $4130. CENTRONICS DATA COMPUTER CORP., Hudson, N.H.
CIRCLE 237 ON READER CARD

Multiplexor
From 4 to 64 communication lines operating at speeds up to 9600 baud can be accommodated by this multiplexor which can be used by all the Nova computers. Each circuit board contains four lines, allowing modular expansion, and each card costs $1500. DATA GENERAL CORP., Southboro, Mass.
CIRCLE 261 ON READER CARD □

Software & Services

Software Notes . . .

Computers across the nation worked overtime March 2 to help launch Pioneer Jupiter 10 on its mission to give scientists their first close look at the sun's largest planet. In addition to the normal computer-monitored launch procedure, computers were busy at Cape Kennedy analyzing weather conditions that were barely acceptable for launch and deteriorating rapidly—threatening to postpone the launch until next spring. Wind information was relayed to San Diego, Calif. for Convair Corp., builder of the Atlas booster. There, computers adjusted the Atlas' onboard computer program until just moments before launch to insure as accurate a traiectory as possible for the 500 million mile flight. The result? Jupiter 10 is traveling at 20,000 mph on a near perfect course to the planet, due to arrive there in December of next year.

Member companies of the former APT Long Range Program have formed a new organization called Computer Aided Manufacturing International (CAM-I). Firms that would like to aid in the computerization of a model describing all the functions of manufacturing are invited. IIT Research Institute at 10 W. 35th St., Chicago, Ill. 60616.

The USAF has developed a management information system it calls LAMIS to keep tabs on its R&D procurement effort. Information on over 4,000 projects worth nearly $1 billion resides on a CDC 6600 at Wright-Patterson AFB near Dayton, Ohio. In addition to the standard weekly, monthly, quarterly, and annual reports, LAMIS automatically generates exception reports and bulletins on critical items. The system is said to be a money saver (that means ours) and more efficient than the manual methods it replaced.

A competition was recently conducted by Northrop Corp. (Hawthorne, Calif.) to select a more modern report generation system than the one it had been using. After documentation for a dozen of systems was reviewed, the two finalists were benchmarked on a 370/165 in the preparation of 11 weekly analysis reports from a complex high-volume engineering file. The winner? ASI-ST, from Applications Software Inc., in nearby Torrance, over Informatics' MARK IV. "I don't know if it's the best package or not, but for our application it's better than the others we looked at," said a Northrop dp head.

Efficiency Measurement

The Direct Access Performance Software (DAPS) package is designed to measure the efficiency (or inefficiency) of 2314- and 3330-type direct storage devices operating on IBM systems. A series of graphic and tabular reports is generated which can then be used to better balance the channel loads. Approximately 1% of cpu overhead is needed, depending on the sample times and run duration. The only restriction placed on the DAPS package is that it may not be time-sliced or rolled in or out. DAPS is written in BAL, and operates on 360 and 370 models running OS MVT or MFT, with submonitors ASP, HASP, and LASP. The memory requirement depends on the number of devices and options. DAPS may run as a problem program or be cataloged as a system task. The price for the package is $3500. ALLIED COMPUTER TECHNOLOGY, INC., Santa Monica, Calif. For information:

CIRCLE 275 ON READER CARD

Library Maintenance

Biblio-File permits DOS 360 users the use of the tape librarian features found on the larger OS 360s. Tape usage data is automatically captured when files are opened or closed on standard label tapes, as well as second generation and unlabeled tapes. A series of reports is produced showing active files, available scratch tapes, tape maintenance history, etc. Biblio-File has two components: a capture module that is said not to require any memory; and the reporting module, which can run on 32K systems. The price for the entire system is $6K, or $3K for each module purchased separately. The program also may be leased. SYSTEMATICS, INC., Miami, Fla. For information:

CIRCLE 276 ON READER CARD

AED for CDC

The AED system has been around for many years, but is just now reaching the Control Data 6000 series users. It is a FORTRAN-compatible language complete with compiler and a library of routines to aid users in building application systems. Also included in the AED package is a set of basic runtime routines and a language definition module. AED runs under version 3.3 of the CDC SCOPE operating system, requiring approximately 28,000 words. With minor modifications, the compiler can be implemented on CDC's CYBER 70 computers. The charge for AED is an installation fee of $8K, plus a monthly maintenance charge of $800. Membership in the AED User Group is included, entitling installations to all machine-independent maintenance as well as that specific to the CDC machines. SOFTECH, INC., Waltham, Mass. For information:

CIRCLE 277 ON READER CARD

1401 to Cobol

There must still be a large number of 1401/40/60 object decks written in SPS and Autocoder that could use some translation into a more modern language like COBOL. This service uses a translator that examines the original program for its logical intent instead of just making a literal translation that might have to be extensively rewritten before it could be efficiently used. In addition to the COBOL source deck generated, a listing accompanies the program showing the source definitions that were entered, the loader used, a 1401 memory map, a cross-reference listing of the original 1401 program showing both mnemonics and indexing, a diagnostic list of nonexecutable instructions, and others. The charge for the service is $50 plus 20¢/card for SPS uncondensed to $1/card for Autocoder condensed. C-S COMPUTER SYSTEMS, INC., New York, N.Y. For information:

CIRCLE 278 ON READER CARD

Financial Information

This batch-oriented financial information program includes modules for performing accounts receivables and payables, payroll, mortgage and loan accounting, etc. Some of the features include trial-balance reporting, budget controls and reports, and a chart of accounts (up to 23 digits and 6 levels) that can be tailored to fit company needs. More than 50 output reports, including checks, statements, and regional reports, are produced by the RPG program, which requires approximately 24K bytes. The program rents for $500/month and requires at least three months for installation. EDWARD STARK ASSOCIATES, LTD., Needham, Mass. For information:

CIRCLE 279 ON READER CARD

Fortran IV for S/7

The little sensor-based System/7 computer can now run FORTRAN IV programs generated by the FORTRAN IV host compiler and library program which runs on the larger 360 and 370 systems. Typically, 64K bytes are required on DOS machines, 128K on OS models, and the System/7 must have at

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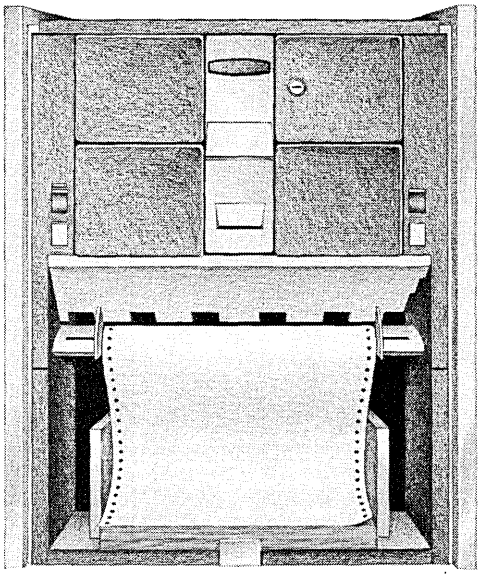

And while it may not have the blinding speed of cathode-ray COM systems, Inter/COM can give you all the benefits of microfilm, right now.

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

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least 6,000 16-bit words of storage. Deliveries are scheduled for around the end of this year, and rental for the compiler will be $125/month. IBM CORP., White Plains, N.Y.

CIRCLE 280 ON READER CARD

General Ledger

Up to 400 total accounts for ledger processing may be accommodated by this general ledger/financial management program. It's written in ANSI COBOL, requiring 55K bytes of core on 360 systems. The reporting consists of 12 management reports, produced by profit center and consolidated by company, which include validating reports for transactions, check registers, general journal list, miscellaneous entry list, sales analysis list, etc. The program uses the concept of double-entry accounting and maintains general ledger history for two years to provide comparative figures for current and previous periods. The program sells for $10K, and can also be leased. The package includes all necessary documentation, system source tapes, a source maintenance program, and three man-days of installation support. A maintenance contract is also offered. GTE DATA SERVICES INC., Tampa, Fla. For information:

CIRCLE 281 ON READER CARD

Accounts Receivable

A service designed for manufacturers, wholesalers, and distributors is available from NCR's 40 data centers across the U.S. and Canada. The open item accounts receivable system generates monthly customer statements, credit analysis, cash flow projection, and sales analysis by salesman and territory. Input may be in the form of optical-print paper tape, punched paper tape, punched cards, or magnetic tape. There is a one-time charge of $350 plus 20¢ per account to set up a master file. Processing charges depend upon the volume, but the minimum monthly charge is $150. THE NATIONAL CASH REGISTER CO., Dayton, Ohio. For information:

CIRCLE 282 ON READER CARD

Data Entry Monitor

The 3270 information display system introduced nearly a year ago is offered a software support module called Video/370. The features include step-by-step guidance for the operator in entering information; automatic error detection, with errors highlighted on

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the screen for correction; support for teleprocessing applications; some editing features; reporting capability showing the types and quantities of data entered; and security codes. Video/370 will run on the minimum memory allotments for OS and DOS systems, and will be available in the third quarter for a monthly charge of $210. IBM CORP., White Plains, N.Y. For information:
CIRCLE 283 ON READER CARD

Minority Employment

An excerpt from paragraph 2C, Order No. 14, U.S. Dept. of Labor, Employment Standards Administration, dated January 14 of this year, is the basis for this service. It reads: "An acceptable affirmative action program must include an analysis of areas within which the contractor is deficient in the utilization of minority groups and women. . . ."

The service is called the minority analysis program. It is based partly on data from the 1970 census and provides employers a report on how they compare with other manufacturers in employment practices. This is further broken down into manufacturers of similar products within the same region and city. Information that must be supplied to the vendor of the service includes the location, SIC number, number of employees, and other information that is on form EEO-1 filed with the government by firms employing more than 25 persons. The charge for the service is $50 to $250, depending on the number of facilities. EQUAL EMPLOYMENT OPPORTUNITY SERVICES CO., Long Beach, Calif. For information:
CIRCLE 284 ON READER CARD

1401 Sorting on 360s

The 1400/360 sort program permits 360 users to sort 140X files without emulation. It does this by reading in the original 1401 sort parameters and altering them so that they are acceptable to the regular 360-SM-483 sort. The BAL program is supplied as a macro that is added to the source library. Its machine requirements are a 360/25 or above with 48K, decimal arithmetic, and 2311 or 2314 disc drives. The price of the program is $350, including documentation and any maintenance that may be required. A 30-day free trial is offered. GENERAL ELECTRONICS, Lyons, Illinois. For information:
CIRCLE 290 ON READER CARD

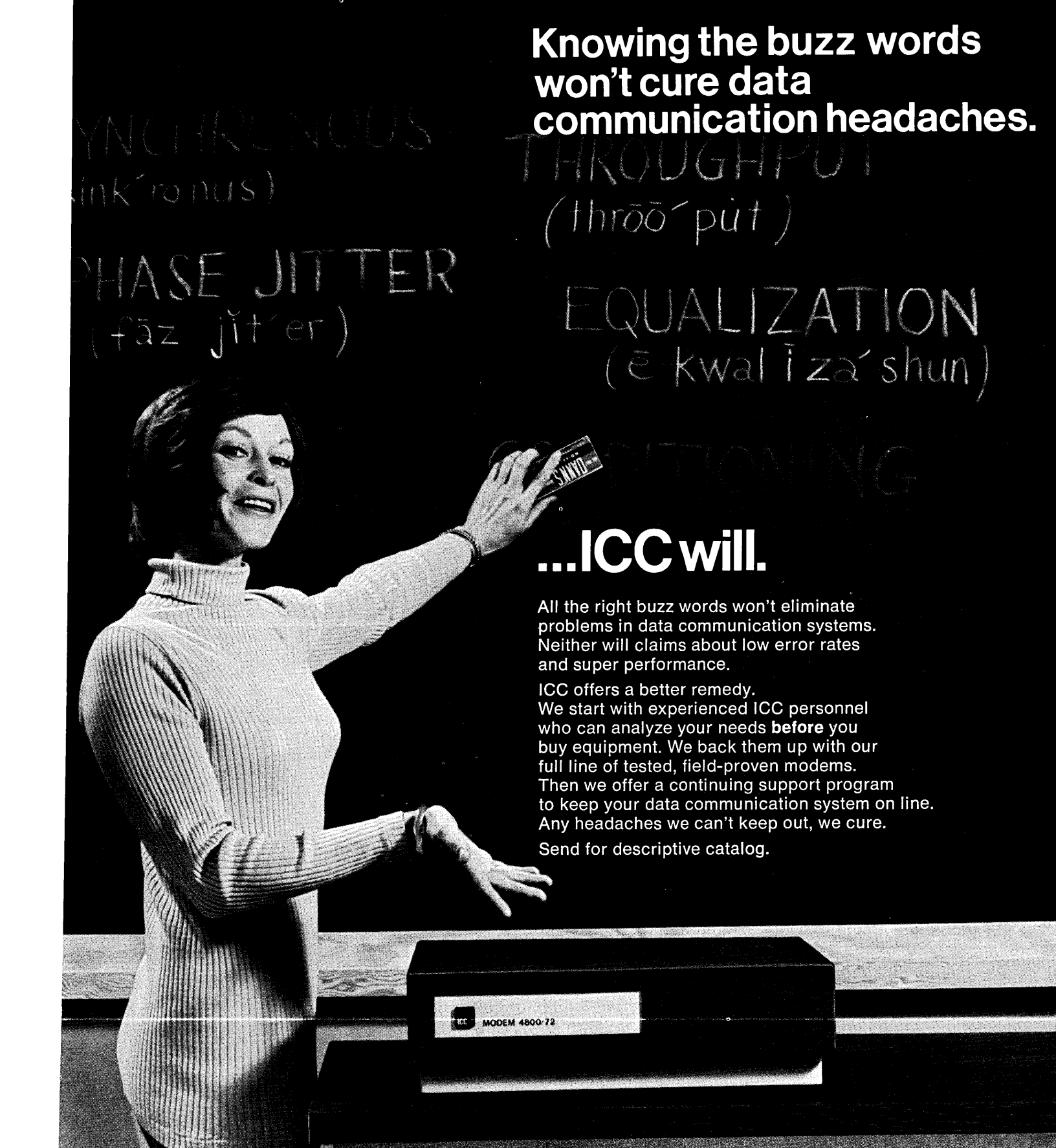
Performance Measurement

The DOS job monitor measures the cpu and memory utilization of 360 and 370 computers operating under DOS release 25 and up. An itemized list of the programs run daily is produced, and each day's work is compared to the performance during the past 30 days. Memory utilization information is presented in the form of graphic reports. A 30-day free trial is offered on the program, which is priced at $700, including maintenance, documentation, updates, and performance warranty. WESTINGHOUSE TELE-COMPUTER SYSTEMS CORP., Pittsburgh, Pa. For information:
CIRCLE 291 ON READER CARD

Data Editing

Editor is a 4K BAL program for IBM 360 models above the 22 running DOS. The program uses utility parameter cards to control the editing of all types of files (sequential, indexed sequential, etc.) and perform range checks for "reasonability" of data. The user can instruct the program to flag, accept, or bypass selected records. Editor has linkage to call user routines or can be called from COBOL programs. Purchase price is $5K; leases start at $1600/year. SYSTEMATICS, INC., Miami, Fla. For information:
CIRCLE 292 ON READER CARD □

Knowing the buzz words won't cure data communication headaches.



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CIRCLE 39 ON READER CARD

Literature

Power Pang Prevention
Prevention of faults or interruptions in the power input to computer systems is the subject of a four-page bulletin, "Does Your Computer Have Power Pangs?" which suggests use of uninterruptible power systems to avoid data errors or losses, unscheduled equipment shut-downs, and equipment damage. CYBEREX, INC., Willoughby, Ohio. For copy:
CIRCLE 203 ON READER CARD

EDP Industry Directory
The 1972 EDP Industry Directory from DATAMATION lists more than 20,000 products and services offered by 2,500 vendors, sorted and indexed by computer to provide easy access to specific topics. Listed are 302 computers; 1,519 peripherals; 440 terminals, 1,809 software packages; 615 communications units; 450 special-purpose systems; 536 auxiliary units; 960 supplies/accessories; 3,151 services; and 99 environmental products. A separate section profiling vendors is cross-referenced to products offered. Price is $25 in the U.S. and Canada and $35 in other countries. EDP INDUSTRY DIRECTORY, TECHNICAL PUBLISHING CO., 1301 S. Grove Ave., Barrington, Ill. 60010.

32-bit Computer
Brochure describing vendor's Systems 85 computer calls it "the lowest priced 32 bitter on today's market." Performance features of the line are summarized. SYSTEMS ENGINEERING LABORATORIES, INC., Fort Lauderdale, Fla. For copy:
CIRCLE 206 ON READER CARD

Disc Storage Drive
Data sheet describes a new voice coil disc drive which provides track-to-track access times of 6 msec and average access times of less than 30 msec. Data storage of 29.176 million bytes is provided with the use of an IBM 2316 disc pack or equivalent. POTTER INSTRUMENT CO., Melville, N.Y. For copy:
CIRCLE 207 ON READER CARD

A Piece of the World
"It's a New World, Carve Out a Piece of It for Yourself," describes in five pages the opportunities a career in data processing holds for "the person who has what it takes to meet the challenges" and the educational opportunities offered by this vendor. GTE DATA SERVICES, Tampa, Fla. For copy:
CIRCLE 208 ON READER CARD

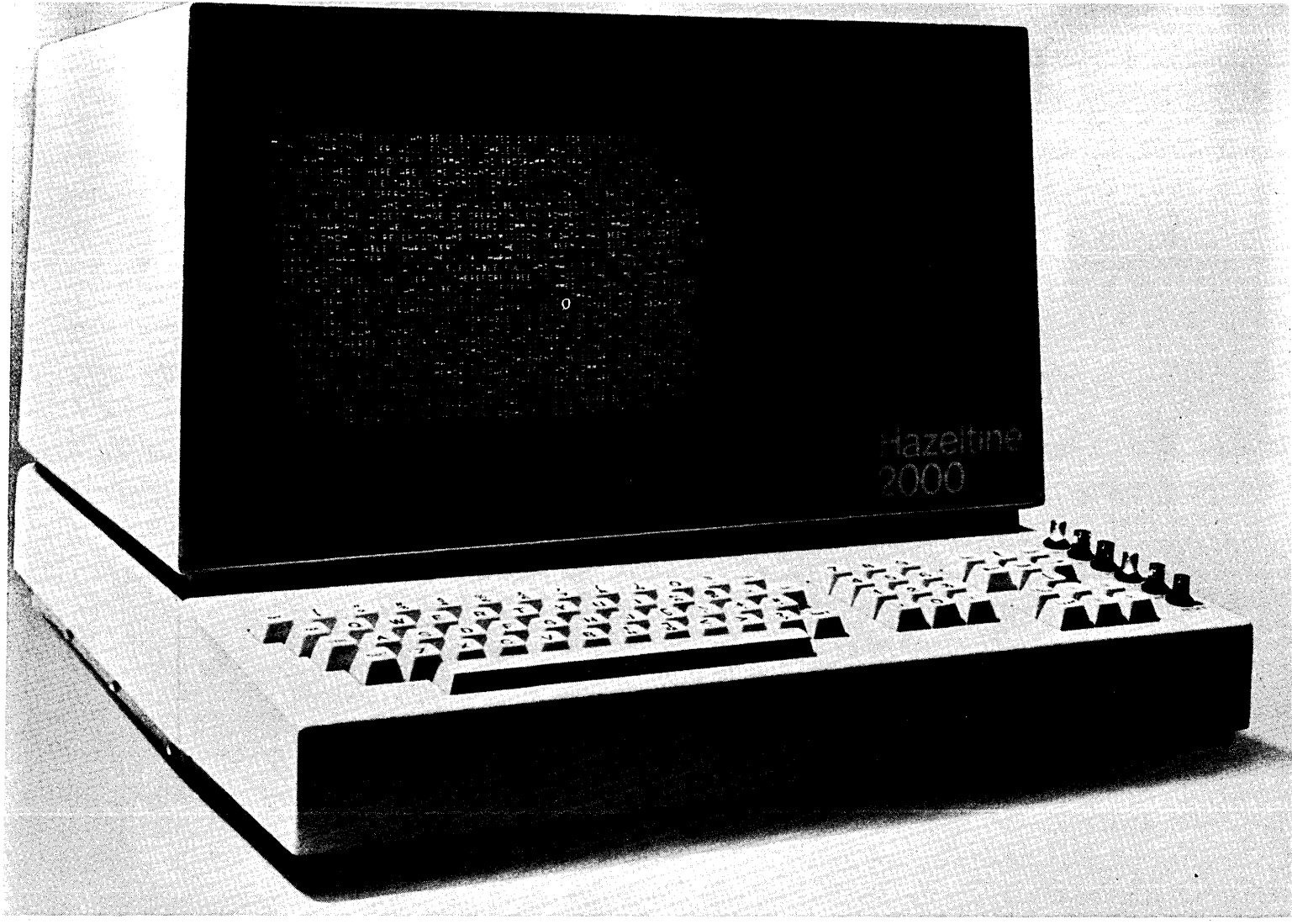
Computers and Noise
"Computers—A White Collar Hazard," an article in the January/February *Pollution Engineering*, covers noise problems in computer laboratories, their measurement and solution, and notes that while attention has been focused on these problems because of "the relatively simple and recurrent errors made by programmers possibly as a result of distraction induced by the very high noise levels under which they were working, it turned out that the first order of business proved to be protection of hearing itself." POLLUTION ENGINEERING, Barrington, Ill. For copy:
CIRCLE 200 ON READER CARD

Network Test System
A data transmission test system for data networks is described in a four-page brochure which explains how the system can be used with any existing network on a plug-in basis to pinpoint data transmission faults, either in the transmission line, data modem, or data terminal equipment. DATA PRODUCTS, Woodland Hills, Calif. For copy:
CIRCLE 201 ON READER CARD

Systems Technologies
Sixteen-page brochure, "Systems Technologies for Tomorrow," was designed to provide an overview of this company's capability in joining systems engineering and computer technologies. It is divided into three major sections: public systems, aerospace and communication systems, and defense systems. COMPUTER SCIENCES CORP., Los Angeles, Calif. For copy:
CIRCLE 202 ON READER CARD

Videofile Seminars
Brochure describes a range of seminars designed to acquaint different levels of company officials with the role this vendor's Videofile information system could play in their records management operations. Separate seminars are aimed at: records managers, systems and procedures personnel, advanced project analysts, and executive management. AMPEX CORP., Redwood City, Calif. For copy:
CIRCLE 204 ON READER CARD

For Editing Typewriters
This eight-page booklet was designed to examine and undo "eight myths about editing typewriters and word processing equipment." They are: editing typewriter systems are so complicated a typist has to have special training; human error is still a factor when you have an editing typewriter; the secretary has to keep, store, and retrieve extra notes when an editing



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CIRCLE 49 ON READER CARD

literature

typewriter is used; editing on such a machine is cumbersome; special installation facilities are required; most organizations do not generate enough paperwork to make economic use of an editing typewriter; a total examination of the economics of editing typwriter use would not justify its installation; and the best features are on machines produced by the largest company in the business. REDACTRON, Hauppauge, N.Y. For copy:
CIRCLE 212 ON READER CARD

Time-sharing Report

Offerings of 68 commercial time-sharing companies are summarized in a 27-page, management-oriented report, "All About Computer Time-Sharing Services," available at $10 per copy. The report was designed to aid executives in selecting and using time-sharing services effectively. DATAPRO RESEARCH CORP., One Corporate Center, Route 38, Moorestown, N.J., 08057.

Display Systems

Features and configurations of a display system with plug-to-plug compatibility with standard IBM hardware and software and which requires no reprogramming are detailed in data sheets which describe four models of the system. ITT DATA EQUIPMENT AND SYSTEMS DIV., East Rutherford, N.J. For copy:
CIRCLE 209 ON READER CARD

Data Acquisition System

Six-page brochure on a data acquisition system includes a close-up view of the face panel with call-out options, complete specifications, and price. DIGITEM DIV., MICROWAVE/SYSTEMS, INC., East Syracuse, N.Y. For copy:
CIRCLE 216 ON READER CARD

Terminal Systems

Information on hardware peripherals and all standard software available with this vendor's 88-23 data terminal is contained in a 16-page brochure that also includes systems information designed to enable the reader to establish the architecture for a terminal system that could be integrated with his present operation. COMPAT CORP., Westbury, N.Y. For copy:
CIRCLE 214 ON READER CARD

103-Type Data Sets

Bulletin describes data sets compatible with Bell 103 models which provide asynchronous, full-duplex digital data communications at 300 bps over voice-grade telephone lines. TELE-DYNAMICS, Fort Washington, Pa. For copy:
CIRCLE 210 ON READER CARD ☐

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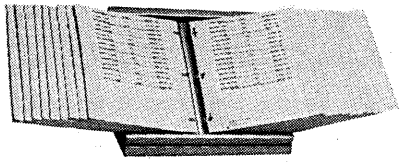

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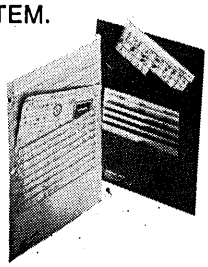

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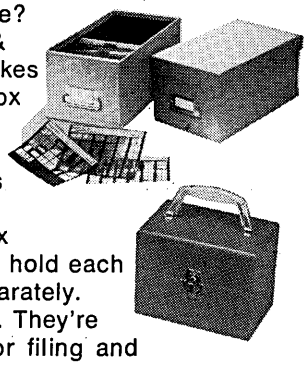

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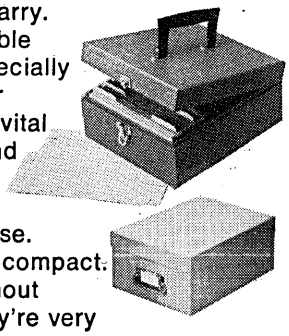

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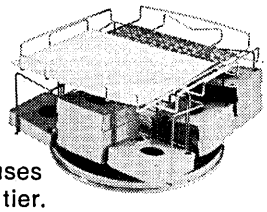

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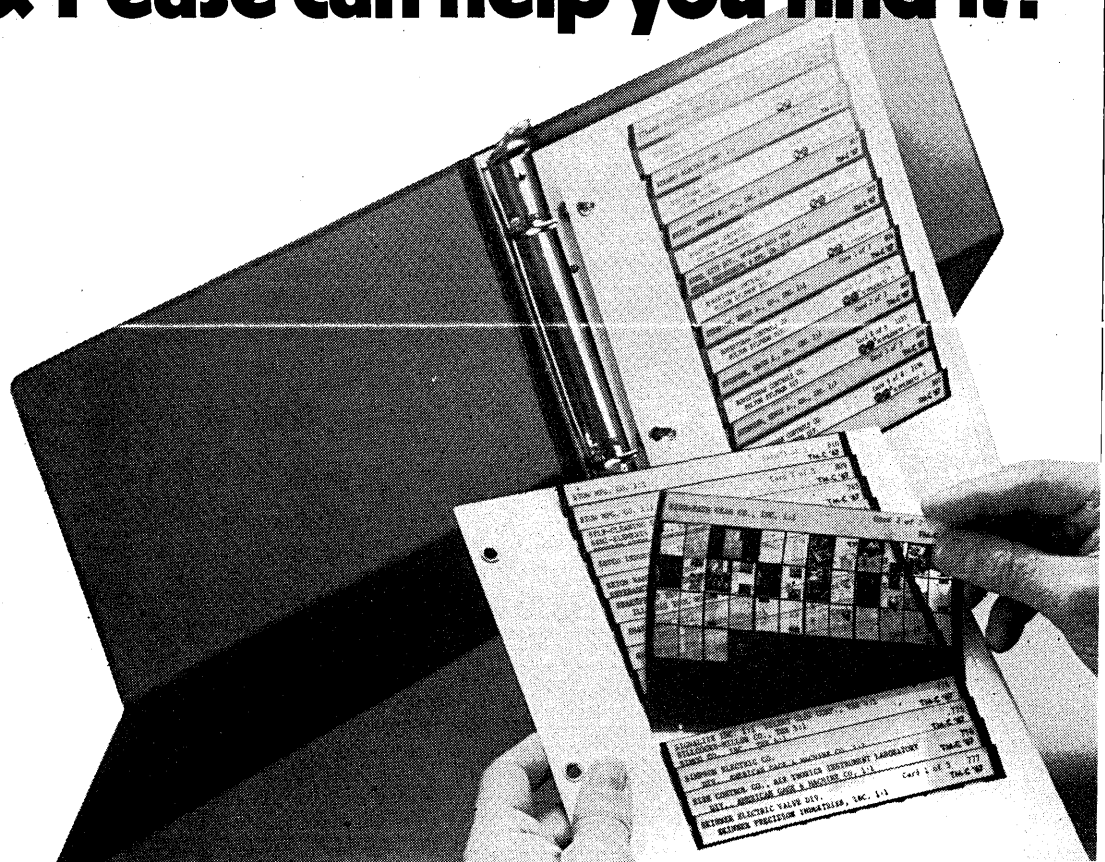

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Books

The Psychology of Computer Programming

By Gerald M. Weinberg
Van Nostrand Reinhold, 1971
288 pages, $9.50

This is certainly the best book about programming yet to be published and the fact that it is so good makes it difficult to review. Each time I started to write a paragraph about *The Psychology of Computer Programming,* I realized that nothing I could put on paper would be as convincing as would a paragraph of equal length taken from the book itself. By induction, one can conclude that the best way to review such a book is simply to reproduce it. Since *that* cannot be done, I will try to describe what you can expect to find in this fascinating work.

To begin with, do not be put off by the word "psychology" in the title. You do not have to know anything about psychology to appreciate this book. Occasionally, the author relates the behavior of computer programmers to what he calls a "psychological phenomenon," but he is careful to explain matters first. Thus, he refers to the oft-observed inability of a programmer to find bugs in his "own" program as an example of "cognitive dissonance," but he first explains what "cognitive dissonance" is, with examples from observations in other fields.[1] As Weinberg himself points out, psychology provides us with few models which are directly useful in describing or understanding the social behavior involved in computer programming.

The most enjoyable—and, perhaps, the most valuable—feature of this book is the examples. Each major point is illustrated by examples of what went wrong (or right) in actual programming efforts. If you have ever been into a programming effort which involved more than one person, you will find many points of similarity with Weinberg's examples. The interactions he describes between programmers and their managers, and among programmers themselves, contain elements of tragedy, comedy, frustration, and the ultimate triumph of informed resourcefulness over ego-centricity and incompetence.

The unique assumption underlying this book is that the human effort involved in programming computers is different enough from other kinds of effort to require study in its own right, and the resulting characteristic which distinguishes this book from others is its profusion of descriptive material.

I think that an accurate, short description of this book would say that it is concerned with studying the factors responsible for the success and failure of programming efforts. I say "concerned with," because the first point emphasized is that we lack objective criteria for measuring success and failure of such efforts. Weinberg uses any technique which will help in setting criteria, and in isolating the elusive factors referred to above. He is primarily interested in project or team efforts, and he looks for explanations of the variation in performance within and between such groups in the social factors which characterize them. Indeed, in an early chapter entitled "How Can We Study Programming?" the author says, "The social science that provides us with the most useful overall model for computer programming is anthropology."

Within this framework, and in the pursuit of these goals, *The Psychology of Computer Programming* discusses a rich variety of topics, including the role of coordinative functions in programming projects, the quest for "egoless" programming, alternative ways of organizing teams, project continuity in the face of change, and the effect of the tools (problem-oriented languages, diagnostic tests, operating systems, documentation, etc.) on the trade.

In discussing the individual programmer, Weinberg examines the current mythology about factors contributing to the programmer's performance. He points out the inadequacy of available personality testing, and the vagueness of the concept of aptitude. He devotes several pages to a devastating account of the shortcomings of the so-called Programmer Aptitude Test, which even today is the most widely used selection tool in programmer hiring. The author then discusses intelligence, problem solving ability, motivation, training, and experience as factors which are assumed to contribute to the performance of people who do this work, and he shows how poorly thought out these concepts are.

Since the ways in which programming projects are staffed and administered are closely related to performance, Weinberg discusses a number of issues which might be lumped under the heading "Follies of Programming Management," and they include such gems as applying performance standards borrowed blindly from other kinds of work, requiring reports whose content and schedule undermine the entire work effort, hiring on the basis of unreliable tests, and treating female programmers as essentially inferior people. While many of the comments

[1] It is to his credit that the author never attempts to use a "psychological phenomenon" as an *explanation* (he never, for example, says that programmers are unable to find bugs in their own programs *because of* cognitive dissonance), a practice all too common in some writings on psychology.

made in this area are pertinent to other kinds of work as well, this fact does not detract from their importance in the programming setting.

There are 13 chapters in this book, and each is followed by a block of questions addressed to managers, a separate block of questions addressed to programmers, and an extensively annotated bibliography of source material. All in all, Weinberg's *The Psychology of Computer Programming* can be unconditionally recommended to anyone who is now, or ever might be, involved in programming computers. It is especially important for those who manage people who program computers, whether or not they themselves are programming veterans. This book presents a fresh way of thinking about persistent problems in our field. Whether or not Weinberg's comments stand the test of time, they will be discussed for years to come. It is to his great credit that he raised these issues, and that he did so in a readable, interesting, and provocative form.

—James L. Rogers

Book Briefs

Computer and Software Security

W. F. Brown, ed
Advanced Management Research, New York, N.Y., 1971
208 pp. $29.50

The purpose of this book is to help those with the responsibility for developing computer security to evaluate their present state and needs and to carry out an effective program to bring about necessary improvements. Topics covered include an overview; plan development; physical, hardware, and software security; securing data transmission; cryptographic protection; legal safeguards; edp auditing; insurance; and contingency planning. One of the appendices is a rather complete bibliography of articles, reports, and books on various aspects of the security issue that were published up to the fall of 1971.

Although the price of this book may temporarily throw you, remember the words of R. V. Jacobson, one of its major contributing authors, who said in a recent letter published in DATAMATION: " . . . understand that losses are as much an expense of doing business as payroll and as such should be included in the budget of the organization."

EDP Systems for Credit Management

by C. D. Whiteside
Wiley-Interscience, New York, N.Y., 1971
191 pp. $11.95

The first section of this book is written for financial and credit management concerned with obtaining the necessary working tools and other credit-oriented information from a computerized receivables system. The second section contains considerable technical information and is written for systems analysts. However, it is recommended that the general credit manager read this part also, so he and the systems analyst can communicate.

Computer Science: The PL/1 Language

by A. L. Anger
John Wiley & Sons, Inc., New York, N.Y., 1972
133 pp. $4.95 (paperback)

This is one of the language supplements in a group of textbooks comprising an introduction to programming. This series is said to be especially useful for those courses paralleling ACM's Curriculum '68 recommendations. The author states in his preface that this supplement is not self-sufficient except for those already experienced with some other programming language and basic numerical algorithms. For others, it can be used with *Computer Science: A First Course*, the basic book in the series. The purpose of the separate supplements is that the student can see the distinctions between the specific coding details of the individual languages and the general principles, concepts, and techniques which are treated in the main textbook. Many of the original examples and exercises are reprinted in this PL/1 supplement to reduce the need for continual cross-reference.

Principles of Systems Analysis

by P. R. Coldicott
Macdonald & Co. Ltd., 49-50 Poland St., London W/A2LG, England, 1971
152 pp. £2 (U.K.)

In addition to being of interest to trainee systems analysts, this book is intended for the line managers and others who are on the receiving end of the systems analyst's efforts so that they can understand what he is trying to achieve and how they can help him. The major applications discussed are payroll, stock control/sales ledgers, clerical system redesign, and the like. The type is large and easy to read, and the text is jargon free. The illustrations and examples, taken from the author's work experience, are clear, clean, and practical. □

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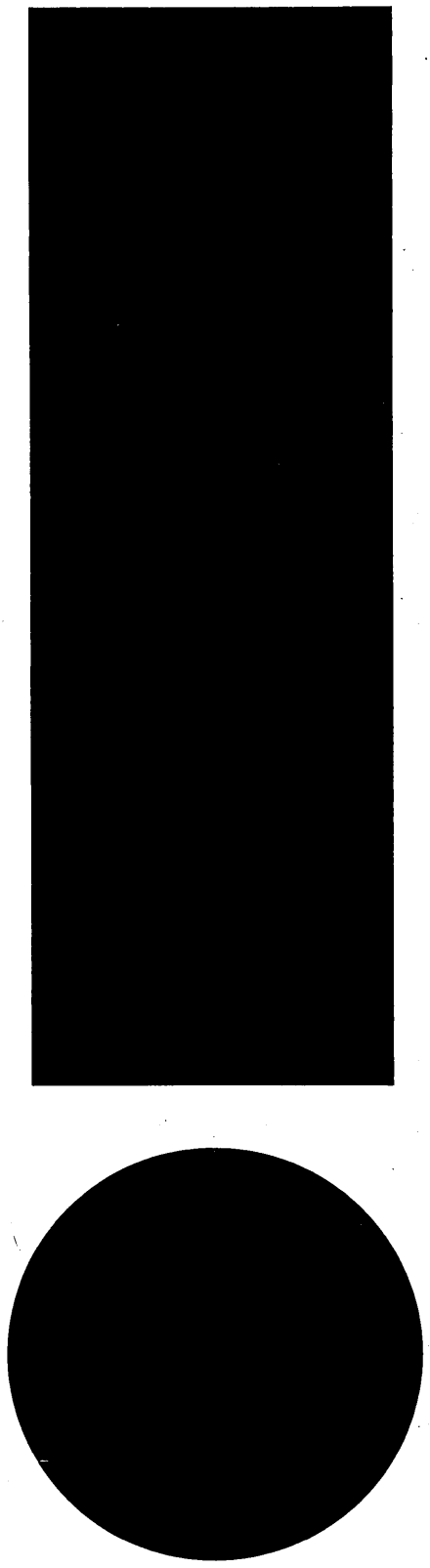

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People

Equitable Life Assurance Society is rapidly becoming a hotbed of industry activists. Following JOHN GOSDEN (ex-Mitre) and TOM STEEL (ex-SDC) is the champion of the user, critic of the computer industry, and revered contributing editor to Datamation, PHILIP H. DORN. His new post is senior manager in the technical services department. Dorn comes to the insurance firm after a five-year stint at Union Carbide, where he was manager of advanced and special projects and—after considerable political shuffling at Carbide recently—their "very last angry man."


Philip H. Dorn

Among Dorn's credentials as the users' spokesman are years of toil within IBM user group SHARE, including a year as president, membership in computer societies and standards activities, and countless articles and speeches worldwide lambasting the industry for its ills. His perennial cause is to push edp customers to assert themselves more with the vendor, but he feels their power is degenerating—illustrated by his cynical description of the history of user group meetings: "What began as a cooperative attempt to influence the basic architectural design of computer systems, to structure and in some cases actually implement software, and to provide a forum for the exchange of programs and ideas has become a swap shop for system patches."

"The vendor," says Dorn, "has used the user mercilessly, and the user has smiled and loved it." About his favorite target, IBM, Dorn does agree with pundits who claim that "it isn't that IBM's so good, but that the rest of the industry is so inept."

Dorn was at System Development Corp. from 1958-61, where he was involved in the training of programmers for the SAGE project. From '61-65, he worked on the design and implementation of the pioneer DAC-I graphic design system at General Motors Research Laboratories; and from '65-66, he managed such projects as ISAM development at Computer Applications Inc.

At Equitable there are now enough standards experts for an ANSI meeting—Dorn, Gosden, Steel, and other newcomers PETER INGERMAN and MARGE GREEN, RCA refugees.

"We plan to get more involved in occupational health and safety matters, international trade, and computer technology," said VICO HENRIQUEZ, who recently succeeded CHARLIE PHILLIPS as director of BEMA's data processing group. The association, he indicated, is particularly concerned about implementation of the 1970 Federal Occupational Safety and Health Act; it allows the feds to impose sanctions against an employer who fails to comply with industry safety standards. Henriquez explained that some of these standards, because they were developed originally for other industries, may be a hardship for edp manufacturers.

Henriquez, 41, was formerly the association's standards director. He expects to continue pushing for outside development of standards by special interest groups so that users can play a bigger role. Asked about finances (part of BEMA's Washington headquarters has been sublet), Henriquez said, "the industry seems to be recovering; our revenue is tied closely to theirs, so we're not worried."

Phillips will continue as a BEMA vice president until

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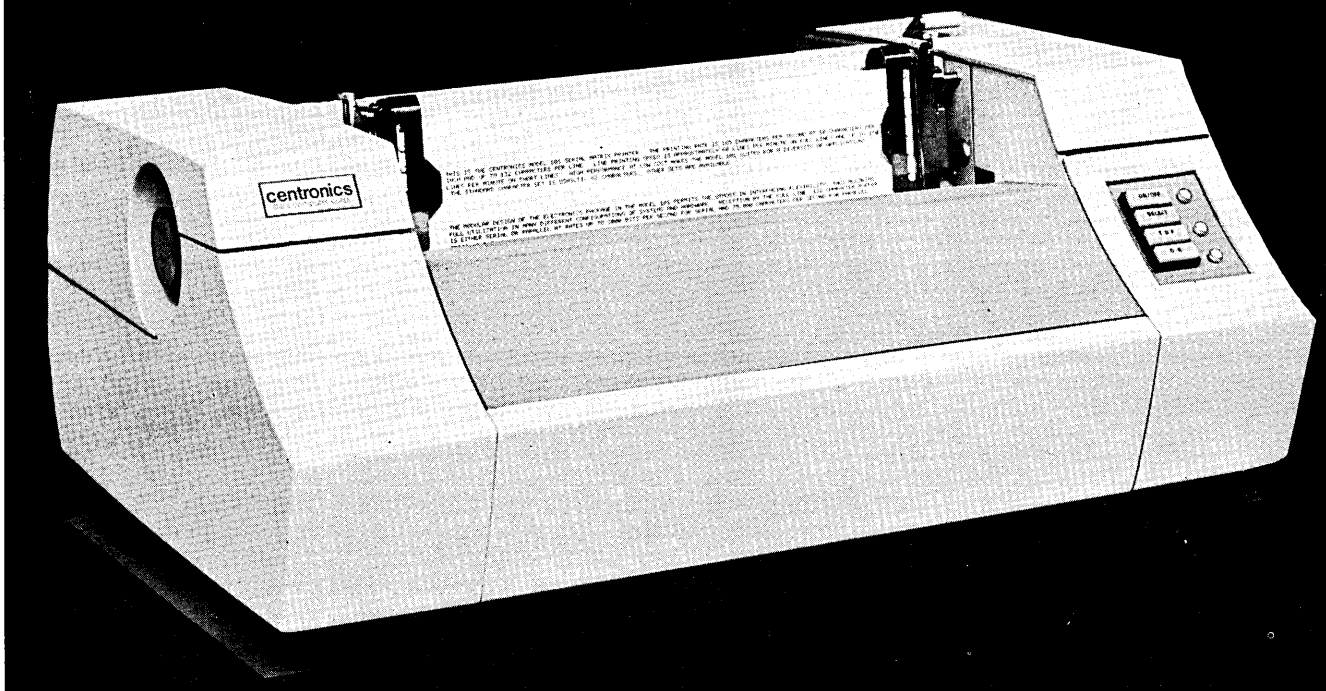

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September, when he retires from the association. But "I'm not retiring, or even semiretiring from the dp industry," he added.

BOB BROWN, Henriquez' former assistant, succeeds him as standards director. Before joining BEMA in April 1970, Brown had primary responsibility for standards activities in the Air Force.

"We're getting ready to go operational, and we needed someone with proven ability to manage a new enterprise," said a Datran official when asked why GLENN E. PENISTEN was recently appointed president and chief executive officer of the company.

The new Datran exec was described as a "fast-moving, hard-working manager who has had engineering, marketing, and legal responsibilities in one of the nation's best managed companies and thoroughly understands how to use a budget as an operating tool." Penisten, 40, comes to Datran after 15 years at Texas Instruments. He had several engineering and marketing posts there, became a corporate vp in 1967, and most recently was manager of the new enterprises division, which is responsible for semiconductor research and special projects. Before TI, Penisten spent a year at Bell Telephone Labs.

Datran's previous chief executive officer, SAM WYLY, remains chairman of the board. Previous president, SY JOFFE, continues as the company's chief marketing officer.

Simultaneously with the announcement of Penisten's appointment, Datran also named as directors ERWIN CANHAM, editor-in-chief of the Christian Science Monitor, and ROBERT STRAUSS, treasurer of the Democratic National Committee.

Associate professor ROBERT M. CHASE of Cornell Univ. is spending his sabbatical leave practicing what he preaches. Chase, who teaches courses in information systems at Cornell's School of Hotel Administration, has been named director-computer installations for the Computer Equipment Div. of Electronic Engineering Co. of Calif. (EECO), producer of mini-based systems for hotels. "Interactive computation of hotel procedures is the most technically challenging area in hotel information work right now, and EECO is the most aggressive company in the field," said Chase, whose first assignment is supervising installation of an expanded EECO system for two Sheraton hotels in Honolulu with a total of 2,200 rooms. The hotels have been using a system for registration and reservations. The new system takes on the added job of guest ledger accounting, which, says Chase, makes it three times as complex. It's the third such system to go in anywhere in the world; the other two are an EECO installation in Puerto Rico and a system in the Disney World Hotel in Orlando, Fla., run by Disney-owned computers in Burbank, Calif. If all goes well for Chase and EECO in Honolulu, he should complete that assignment within two months of the April 1 delivery of the system and move on to supervise installations at five additional Sheraton hotels before his busman's holiday is over.

Robert M. Chase

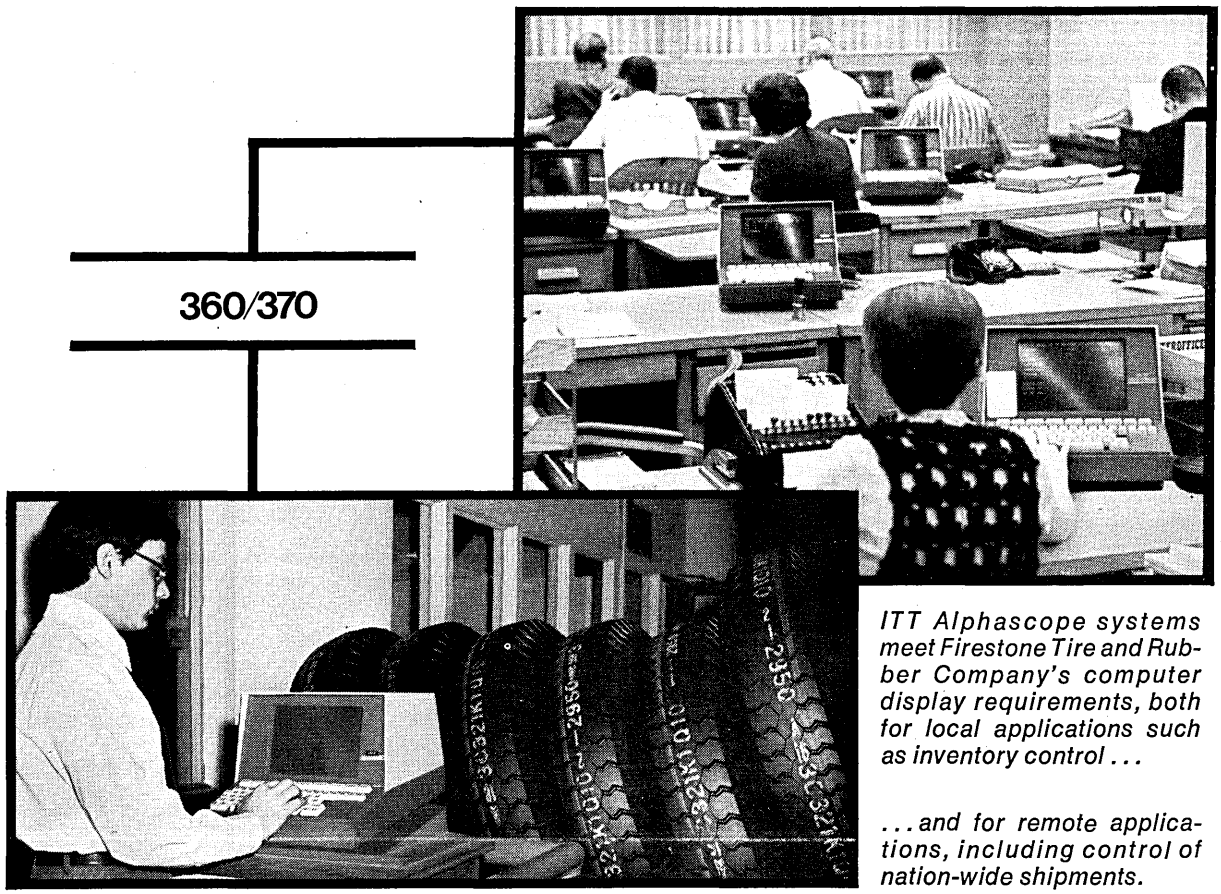
people

In his new position as assistant director of computing and data processing at Hughes Aircraft, Fullerton, Calif., Dr. ROBERT R. BROWN finds a completely new set of problems than those he dealt with four years ago at North American Rockwell's space division.

At that time, "the communications network aspects of computing were minimal" said Dr. Brown. "There was lots of planning going on, but very little actual operation compared with today. We had ATS on separate computers, IMS just coming on-line, and TSO didn't even exist."

Today he and his boss, Carl Reynolds, face the challenging task of centralizing all Hughes computer activity (now divided between Fullerton, Tuscon, and the airport at Culver City) in the main Fullerton installation—where they have a 165 and soon will have another. There are now 200 terminals hooked to the 165 (by late summer there probably will be 500, and 1,000 in the foreseeable future) for a variety of functions—remote-job entry calculations, engineers' time-sharing, data texting, changing files, and remote high-speed printing for eliminating message transmission. Eventually almost all of the 500 employees in the dp organization will be in Fullerton.

Dr. Brown moved to Hughes with a long and diversified background in computing and data processing. After an eight-year stint at IBM, he went to the Univ. of Southern Calif. in 1961 as head of the computing department. In 1962 he joined Aerospace Corp., went from there in 1964 to Washington, D.C., for a year as a government advisor on computing, then to North American as director of computing. Prior to his present position at Hughes, he was vp of systems development, Arcata Corp. □



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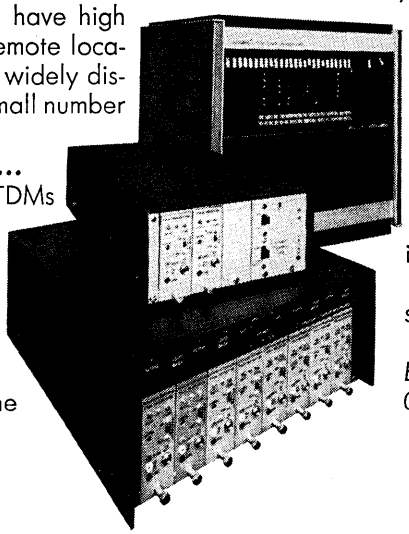

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letters

(Continued from page 23)

tions belonging to a task until the current task assigned a value, either dynamically or during program loading. Of course, the definition of "task" would have to provide for loading of program segments in an overlay structure.

Considering rules for default initialization in a machine-independent manner, and the difficulty of revising ANSI standards, the present system is a satisfactory compromise. The value is undefined.

W. M. COMPTON
Dhahran, Saudi Arabia

Boxed in

From your most interesting article (Feb., p. 32) on the direction the Postal Service is taking to sort mail by imprinting a bar code on the lower right-hand corner of the envelope, it appears that the present ZIP code will not be a major input to that bar code, since I gather that only alphanumeric name and address information will be used.

Would there be any merit to considering the Japanese experiment which requires all types of envelopes to be preprinted with prelocated ZIP code boxes in the lower right-hand corner? Start and stop ocr marks could also be used. The addresser would enter the ZIP code in the prescribed boxes either hand-written or typewritten. Computer-addressed labels would be applied such that the ZIP code falls in the box area.

This scheme would permit a higher percentage of mail to be optically scanned, since ocr equipment is available to read combinations of constrained handwriting as well as machine-printed numerics. This appears to be the direction that the European Giro system is heading.

ARNOLD OSHIN
New York, New York

Mr. Dumey replies: As my article points out, the ZIP code uses the first 17 bits of bar code, the balance being house number and street name, or equivalent.

The Japanese system would work, if we could import Japanese to address our letters. Americans, when they condescend to use the ZIP code, often get it wrong. Whether they would go for putting constrained number shapes into little boxes is a tough question. At this point, the idea is to get the large volume mailers to cooperate.

Incidentally, the work described in my article was performed as a consultant to the Institute of Defense Analyses under its contract with the Post Office Dept.

Never heard of it

Once again IBM scores in that game called "Let's Follow Big Brother." You saw the article in the February issue (p. 32) on "Computer Addressed Letter Mail"? Guess how the data is encoded: BCD. Whatever became of ASCII?

TOM PITTMAN
San Rafael, California □

Meet the mind expander. Monolithic Main Memory from ITEL.

Now there's an easy, economical way to expand IBM System/360 or 370 memory: add on Monolithic Main Memory from ITEL. (The Monolithic Main Memory is manufactured to ITEL specifications by Advanced Memory Systems of Sunnyvale, California.)

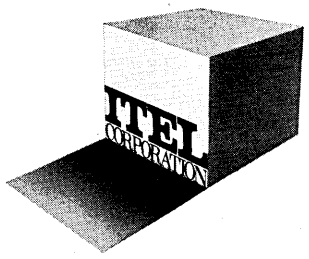
This monolithic memory lets you upgrade core at a lower price than core. It's far more reliable than core. And you can maximize capacity. For example, you can expand the 360/30 to 128K, the 360/40 to 512K, the 360/50 to 1024K and the 360/65 to 2048K. For the 370, we match IBM byte for byte, and offer substantial savings in cost and space.

The secret of ITEL's superiority over IBM core is found in its basic monolithic memory module. This semiconductor chip contains 1024 bits of storage. These memory elements are fabricated in batches of thousands, which cuts costs dramatically. And most wired interconnections are eliminated, so there are far fewer potential sources of failure.

But even monolithic memory elements can sometimes fail. That's why ITEL has ECC: Error Checking and Correction. Should a memory element fail, ECC corrects the error instantly. There is no effect on computer operations or processing. The operator is notified by an error light and maintenance can be performed without interrupting the memory's operation.

The Monolithic Main Memory from ITEL means savings in cost. Savings in speed. Savings in maintenance. And, in some cases, savings in floor space. It's completely compatible with IBM System/360 and 370. Handles all memory size changes. And it can be leased as well as purchased, so you can meet your immediate memory needs now without a large outright purchase.

ITEL is out to improve the system. With technical advancements. Complete corporate sales support. National field service. Around-the-clock maintenance. And with the people and financing policies that can create a customized solution to your particular problems. So meet all the ITEL mind expanders at your nearest ITEL office.



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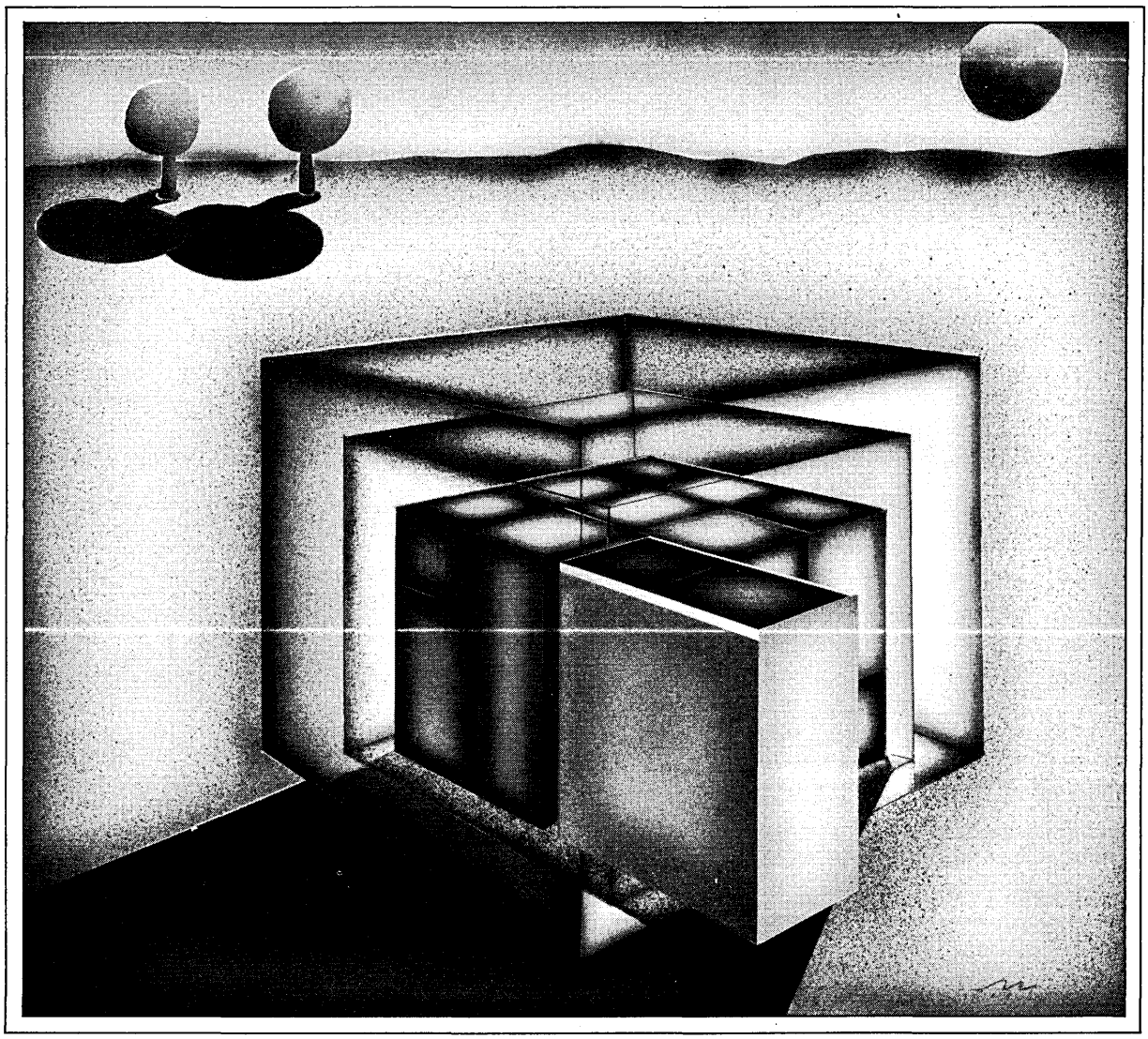

CIRCLE 33 ON READER CARD

Amex expects to save about $1 million a month.

The American Stock Exchange is expanding its trading floor automation with a Collins computer/communication system.

By 1974, Amex specialists will be using "electronic books" to make locked-in trades. All data will be captured and displayed the instant the trade is made.

The system is expected to recover its development costs in about one year. From that point, the exchange anticipates operating savings of close to $1 million a month.

The savings will stem directly from the Collins processor. It will enable the Amex to make more efficient use of the information system it already has.

It creates a computerized exchange, or loop, which interconnects all Amex input and output sources.

Because of the tremendous routing capability of the Collins processor, the expensive conventional computers on the loop can be used 100 percent for computation.

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Collins: where computers are born communicators.

COLLINS

Look Ahead

(Continued from page 8)

RAND BUILDING GIANT MICROPROGRAMMER

Rand Corp. hopes to develop the largest microprogramming system ever built. To do so, it has bought a prototype cpu and the development rights to the IC 9000, a microprogrammable computer that had been under development two years by Standard Computer Corp., of Santa Ana. Standard ran into financial problems last summer and dropped development of the processor, which it had called the MLP 900.

Rand will put a Cogar control memory into the processor and then hook the system to a 256K PDP-10. The DEC computer will be used to manage the system and tie it into the ARPA network. Possible uses? Rand wants to develop new programming languages and to emulate conceptual computers at hardware speed--but Rand scientists won't know what that speed will be until next year. One Rand spokesman ventures this comment, though: "It should be the largest hands-on microprogramming system ever built--by an order of magnitude."

FAST RESPONSE

A record in response time to an IBM product release should go to PHI Computer Services, Inc., which is said to have developed a software package that gives 360 users the same remote terminal network control functions as IBM's recently announced 3705 programmable communications controller. Although the 3705 will be marketed to both 360 and 370 users, 360 users will not be offered the Network Control Program which makes it truly programmable. On 360s, the 3705 can run only emulation programs for the 2701, 2702, and 2703 communications gear.

PROTECTION IN EUROPE FOR THE 20

IBM has been quietly proposing its 370/125 for several weeks in Europe, largely as a last-ditch effort to protect model 20. Many think the machine will be manufactured in IBM's Mainz, West Germany, plant, which leads to speculation that it will have bipolar semiconductor memory. (IBM makes its 145 with semiconductor bipolar memories at the Mainz plant.) One possible reason the wraps were lifted early in Europe: The model 22, designed to protect the model 20, was never announced in Europe.

EUROPOURRI

Honeywell is preparing a third and fourth launching of the H 58. It's been selling well in facilities management and turnkey contracts, so Honeywell will fit it with a value-added tax package when that tax is implemented in the U.K. next year. The read-only-memory machine also will be doctored to look like a 2780 to unsuspecting IBM installations...At writing, we await ICL's announcement of its new line, which is supposed to put it back into the ballgame coached and managed by ex-IBMer Tom Hudson (p. 90)...Univac will admit to only three 1110 orders in Europe, but we hear there are a dozen for the machine that everyone said wasn't making it...Burroughs, said to have captured most of Ford Motor Co.'s computer business in Europe (mostly 2500s and 3500s), is expected to build its new 1700, 2700, and 3700 machines in Liege, Belgium. The 1700, which totally outstrips the more

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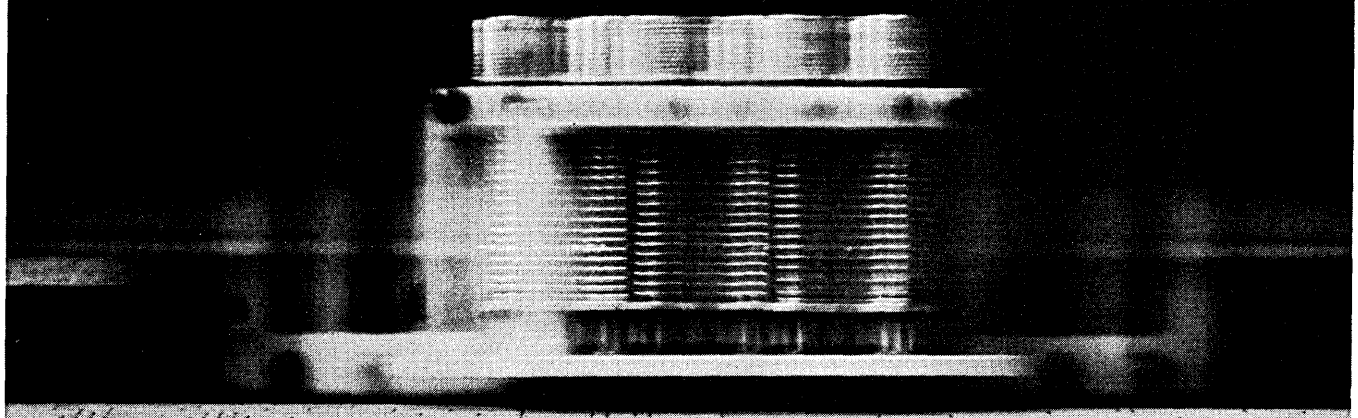

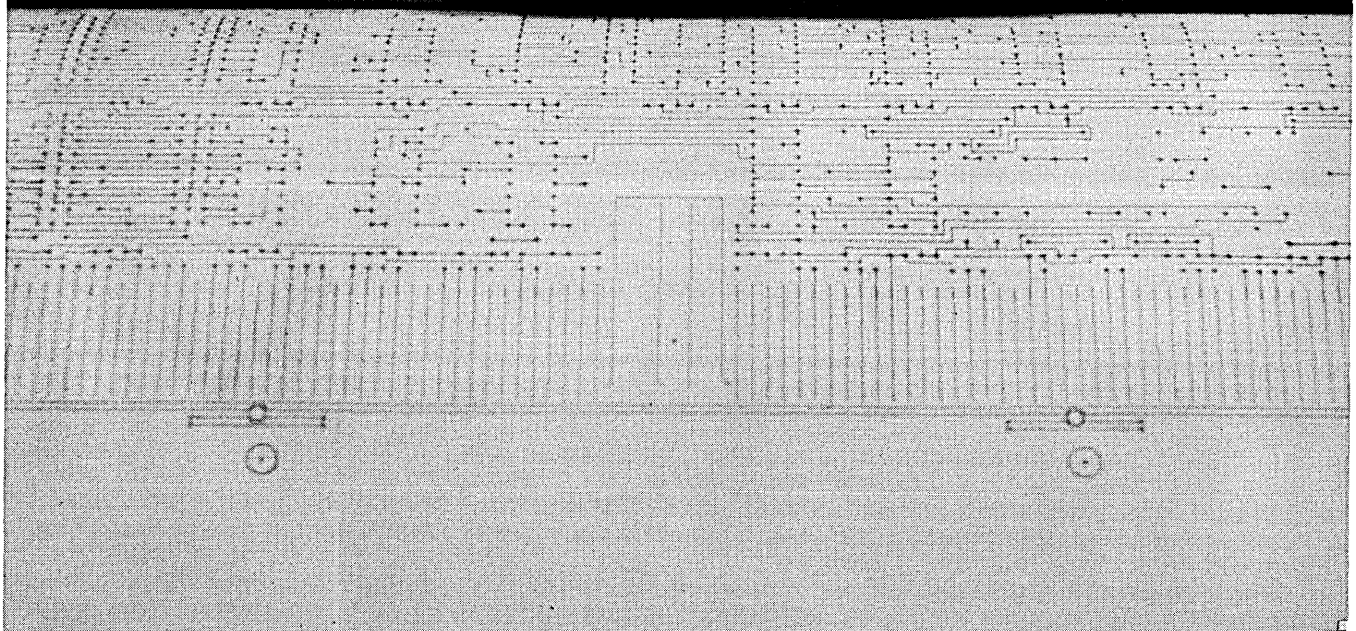

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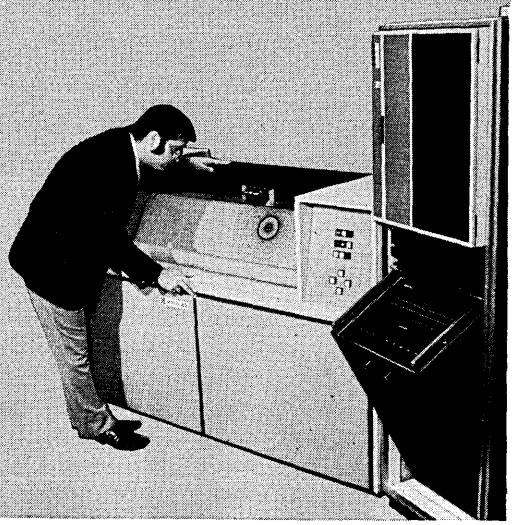

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expensive IBM System/3 in cost and performance, is said to be unbundled and to use a 96-column card.

FIRMS SEEK ESCAPE HATCHES

After seven years as an aerospace industry subcontractor, a small Northridge, Calif., company has a product for the computer industry: a cassette in which data can be recorded accurately at 4,000 bpi. The company, Samuels Engineering, Inc., says its product won't be much more expensive than 800-bpi cassettes currently in wide use. If this is so--and we'll know when it's introduced later this year--the product will impact manufacturers of standard tape transports and make possible cheaper, more powerful terminals.

Another aerospace company--Aerojet-General Corp.--is entering the commercial information processing field through its newly formed Aerojet Data Systems group. First product is Spectrovision--a programmable IBM-compatible peripheral that generates high-resolution displays in color and black and white from digital input. Applications are seen in medical, pollution, and space research.

SHOULD IBM SHARE R&D FINDINGS?

Competitors of IBM don't want the computer colossus broken up. "I'd rather compete against one strong IBM than against three strong IBMs," says the head of one mainframe company. The idea is spreading, too. Watch for IBM competitors to oppose a wholesale breakup of IBM. Many feel that the tight shell of secrecy that IBM surrounds itself in should be lifted. Some competitors will push for measures that will make the company's massive R&D efforts (about $450 million a year according to Fortune magazine) more readily available to all; others will advocate a quasi-public status for IBM that would open up the super-active firm to more public scrutiny.

RUMORS AND RAW RANDOM DATA

A supercomputer being developed by ex-IBMer Gene Amdahl, one of the architects of the 360, is still possibly a year away from announcement. But there is word, which Amdahl Corp. won't confirm, that it already has its first order, and it's from a Japanese company...Ovonic Memories, Inc., formed last year to make a 3330-like disc drive with 10 times IBM's density (see Oct. 1, p. 7), ran into financial problems, chopped the staff to 13 from 38, cancelled its order for an IBM 145, and is six months behind in making a prototype. But we're told a demonstration is planned for late summer...Tucked away in the Telex communications division plant in Minneapolis is a 20-man data communications group making digital cassettes and transports. One use is point-of-sale data collection, and the firm is said to have a big order from a midwestern retail chain. Next product, we hear, is a head-per-track disc drive for use as auxiliary memory in teleprinter terminals...Data Action, the data entry equipment maker with some 600 keystations installed, has been rescued from the brink by National Computer Systems, a Minneapolis neighbor involved in test scoring services. NCS late last month agreed to acquire Data Action after it had gone through its original $14 million investment and the bank debt was soaring. The firm was down to 50 people from 250 a year ago.

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Hyland Laboratories, a dynamic Orange County medical products firm has immediate openings for Programmer Analysts.

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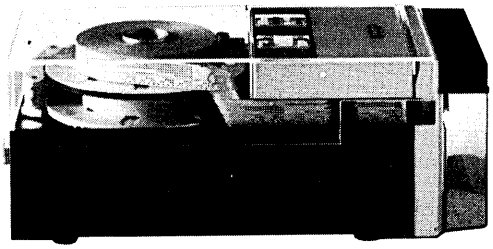

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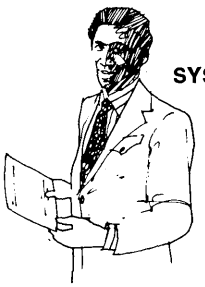

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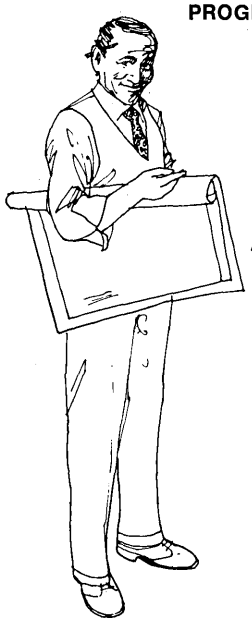

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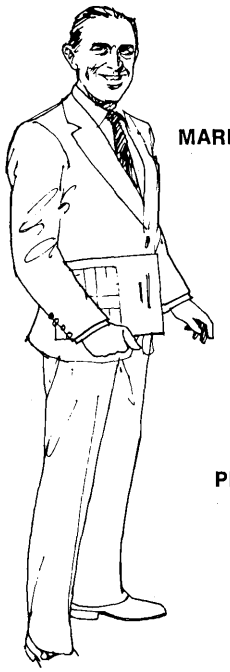

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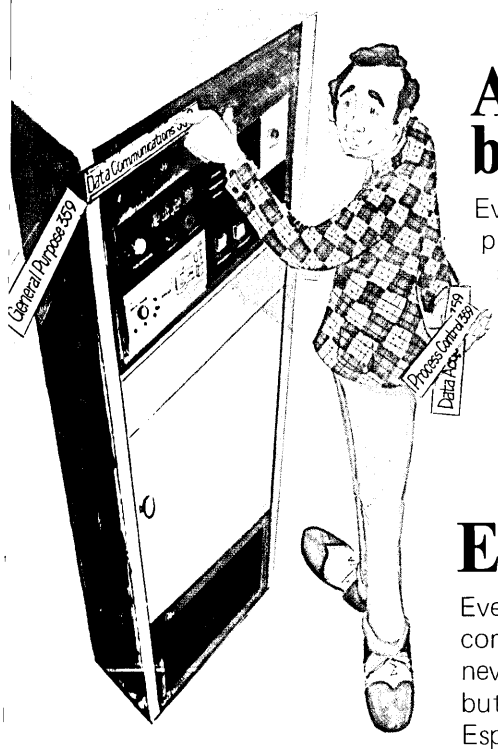
CIRCLE 131 ON READER CARD

What the industry taught us about data communications.



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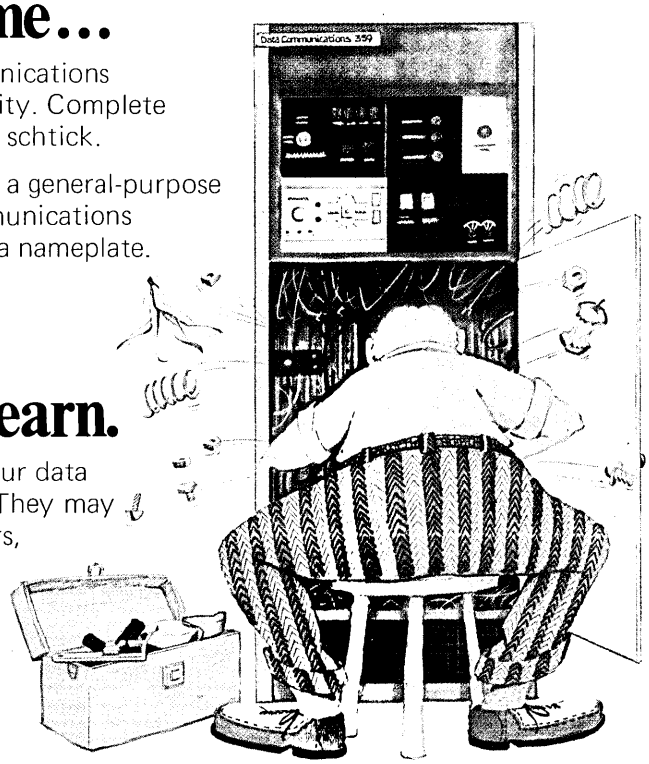

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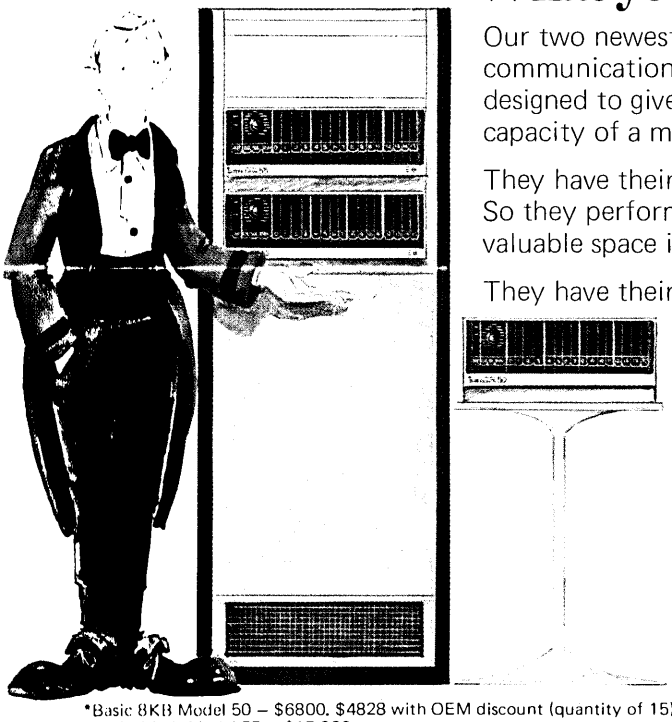

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