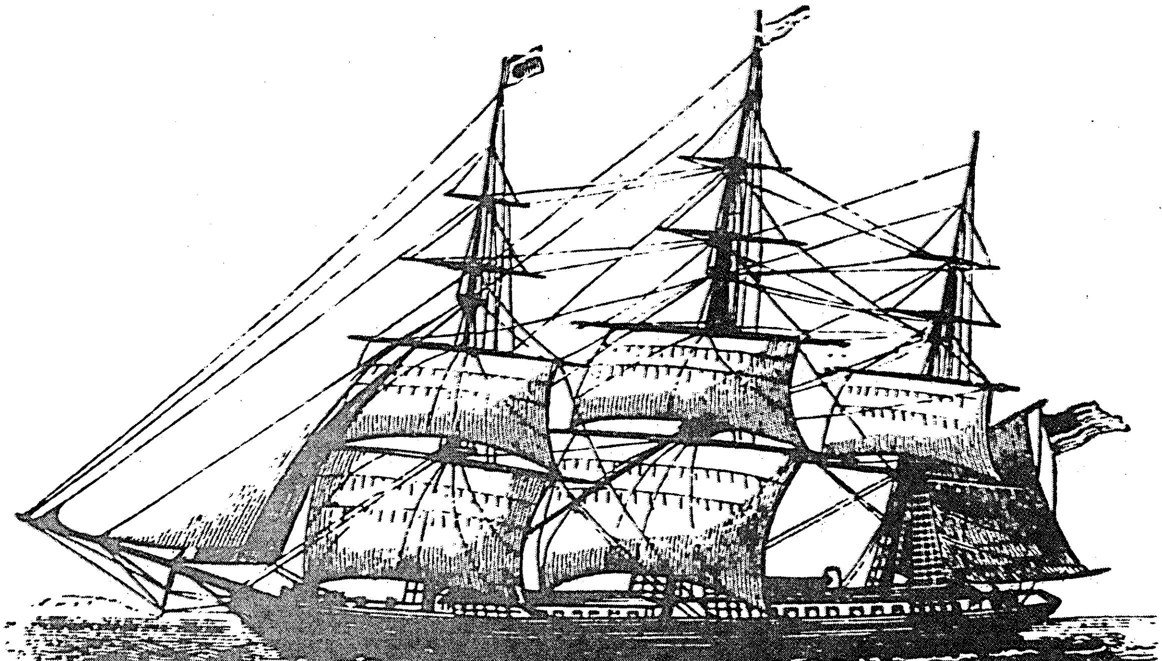
DATAMATION® 69
April



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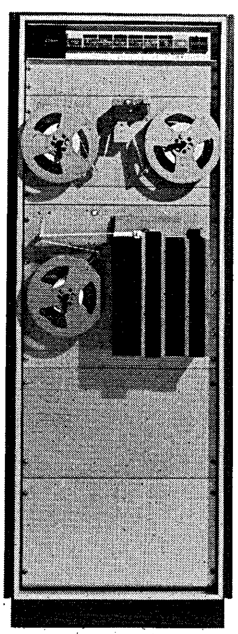

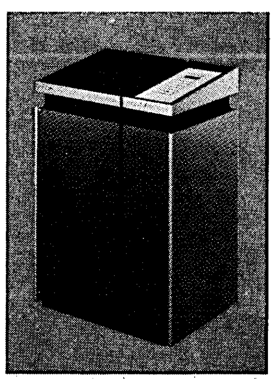

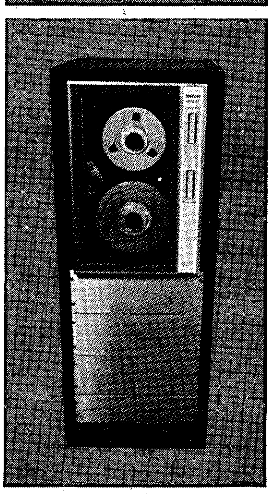

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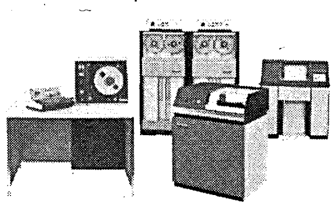

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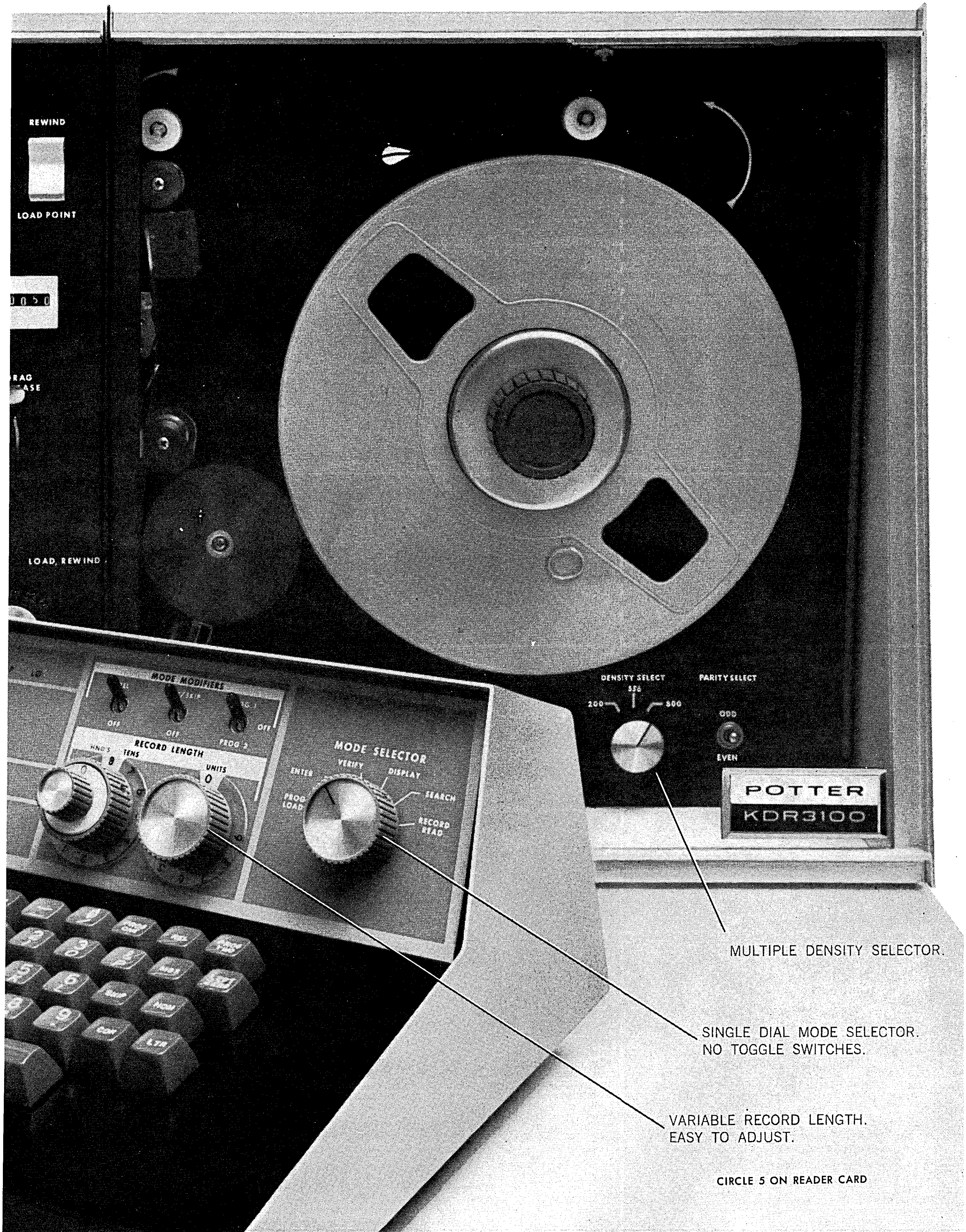
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april
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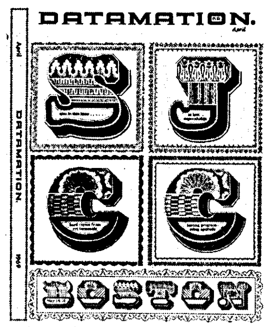

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volume 15 number 4




**automatic information processing for business industry & science**

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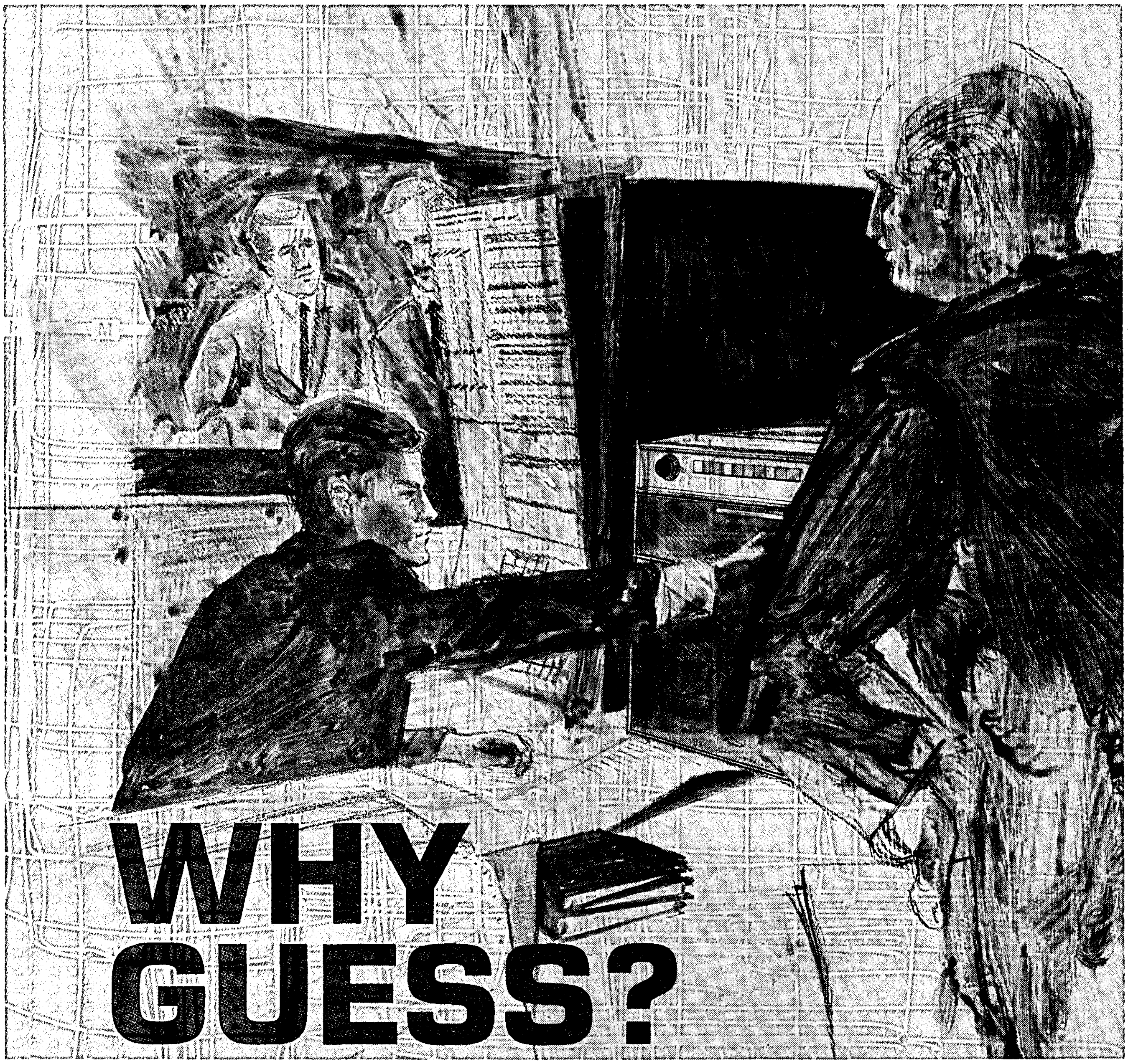
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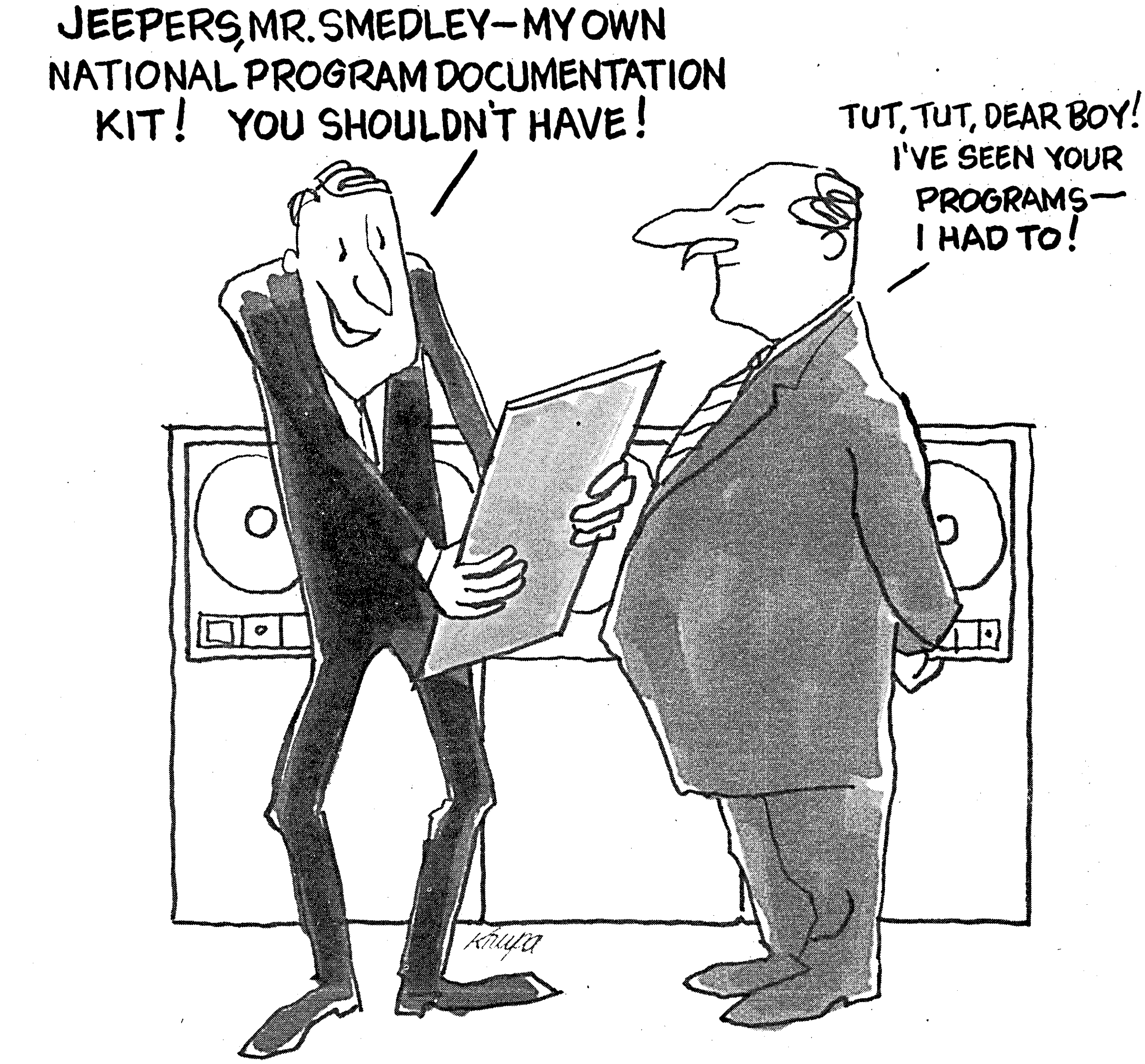
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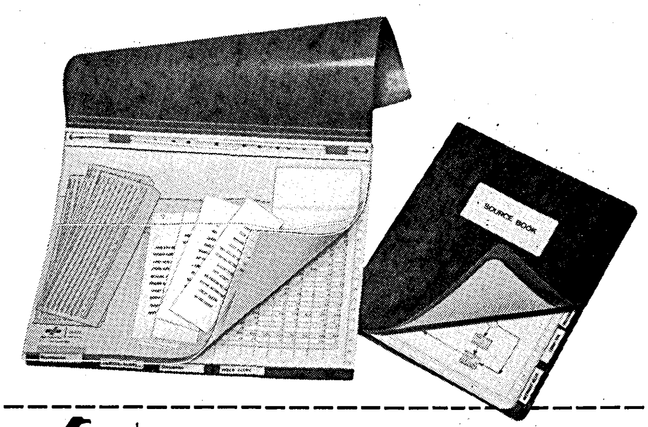
Krupa

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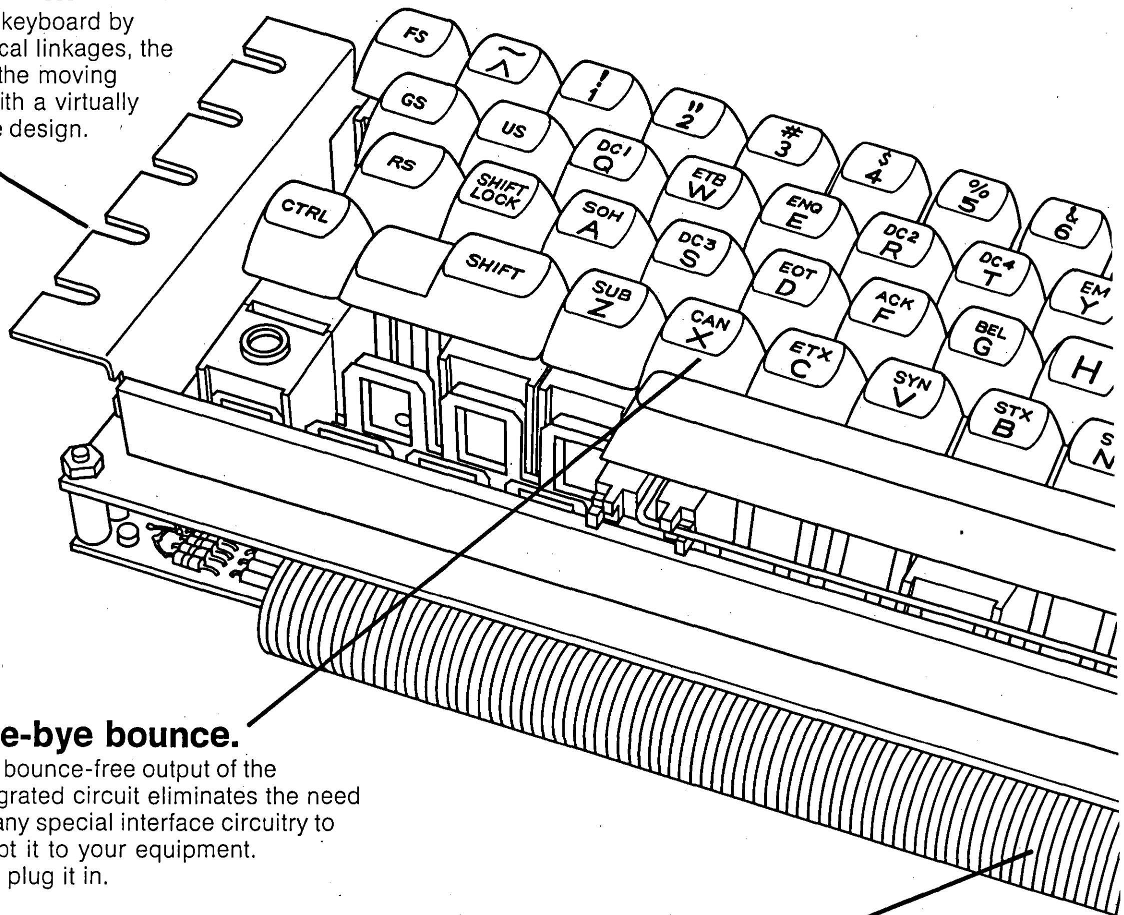


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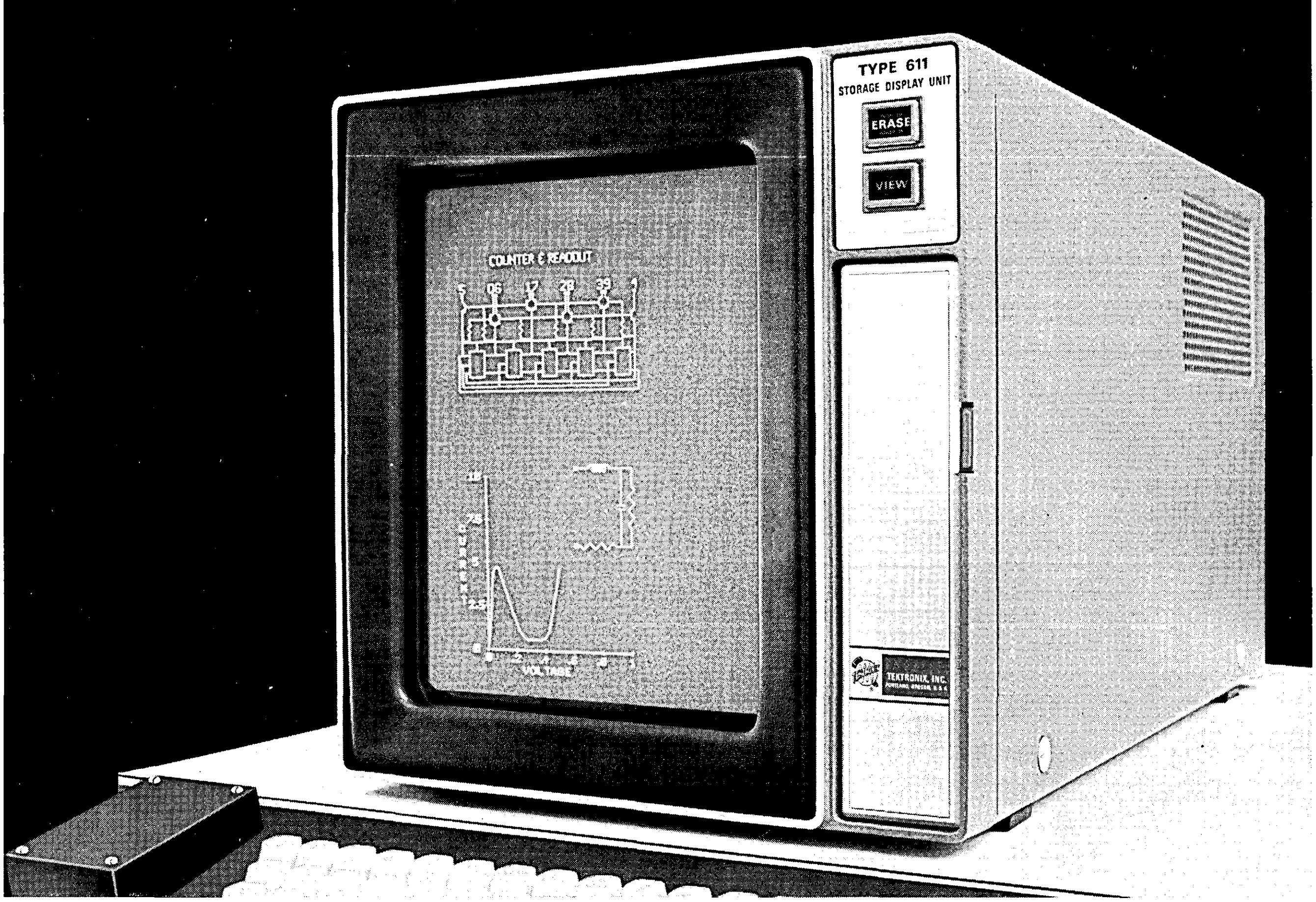


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CIRCLE 18 ON READER CARD

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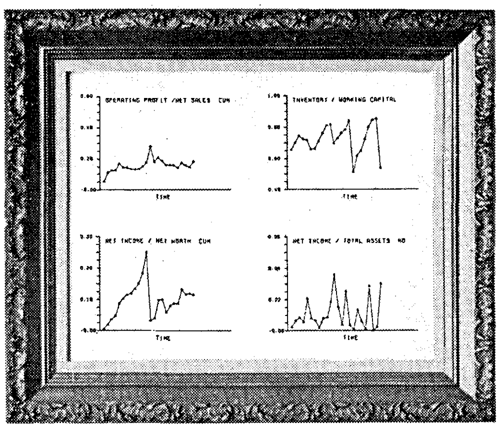

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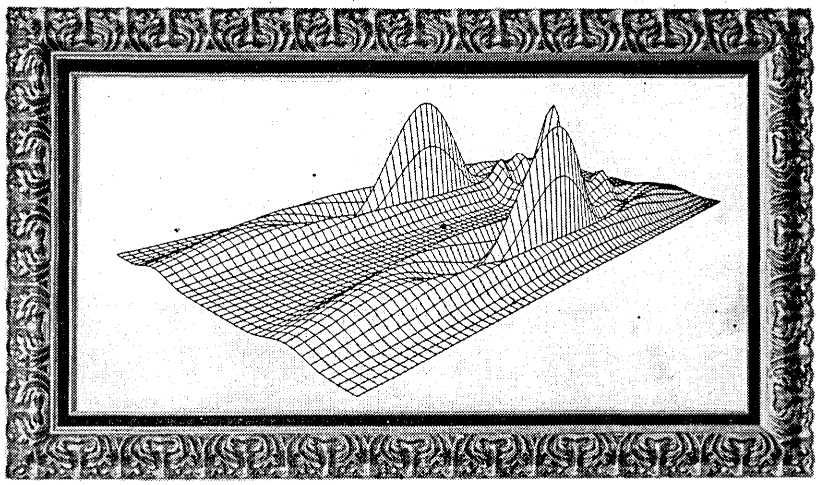
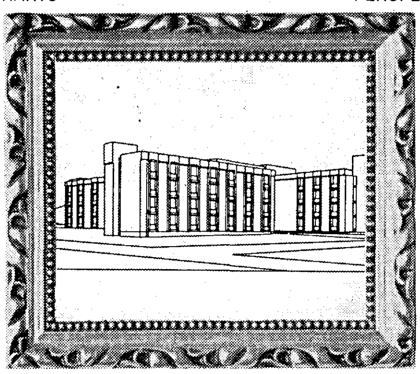


PERSPECTIVE DRAWINGS



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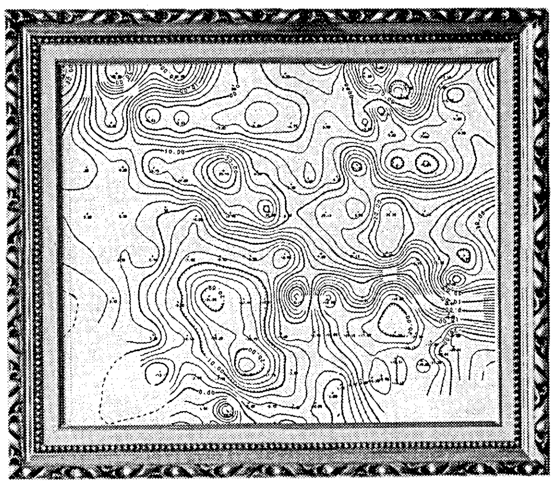

CONTOUR MAPS

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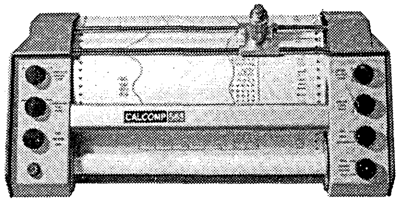


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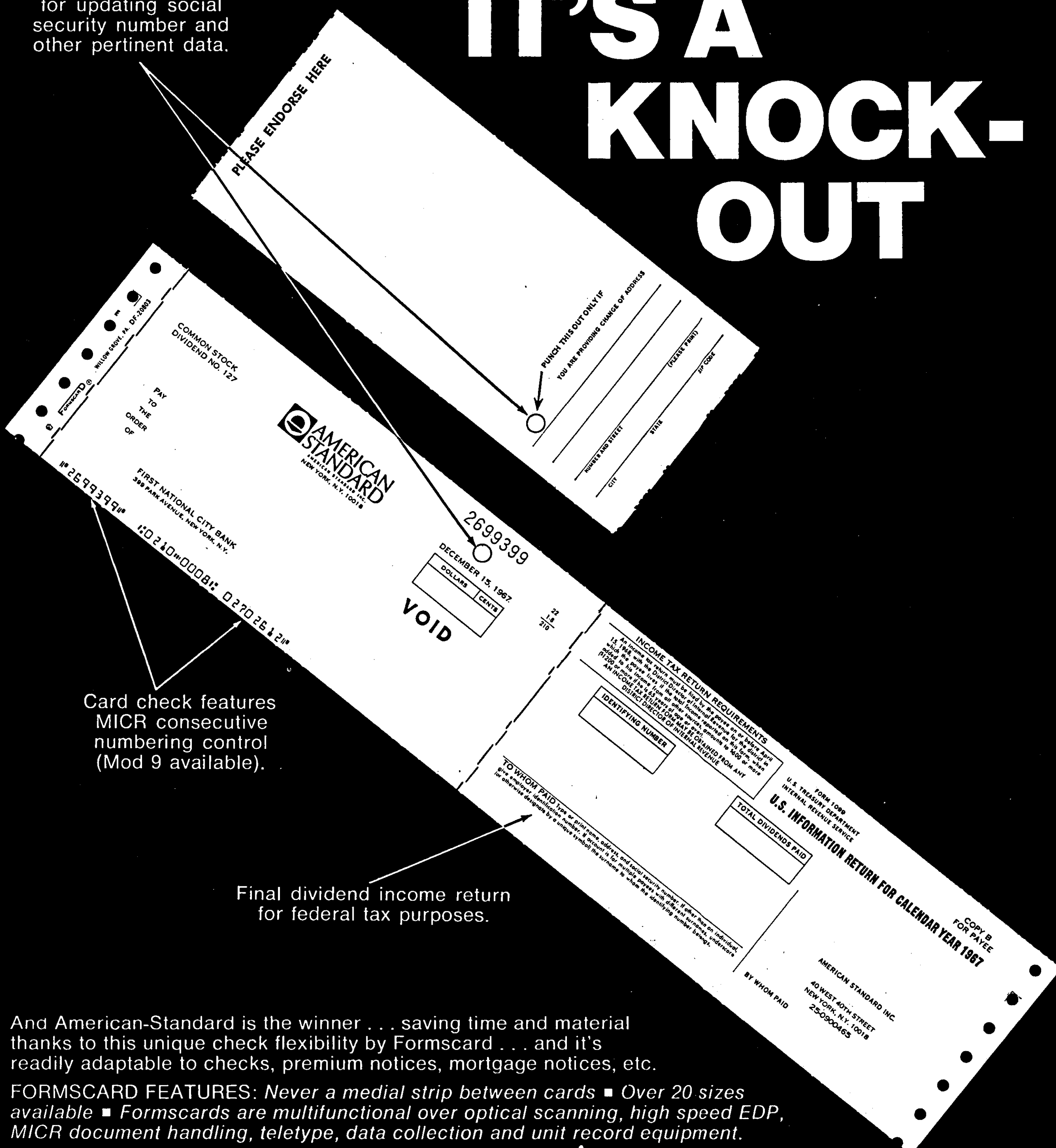


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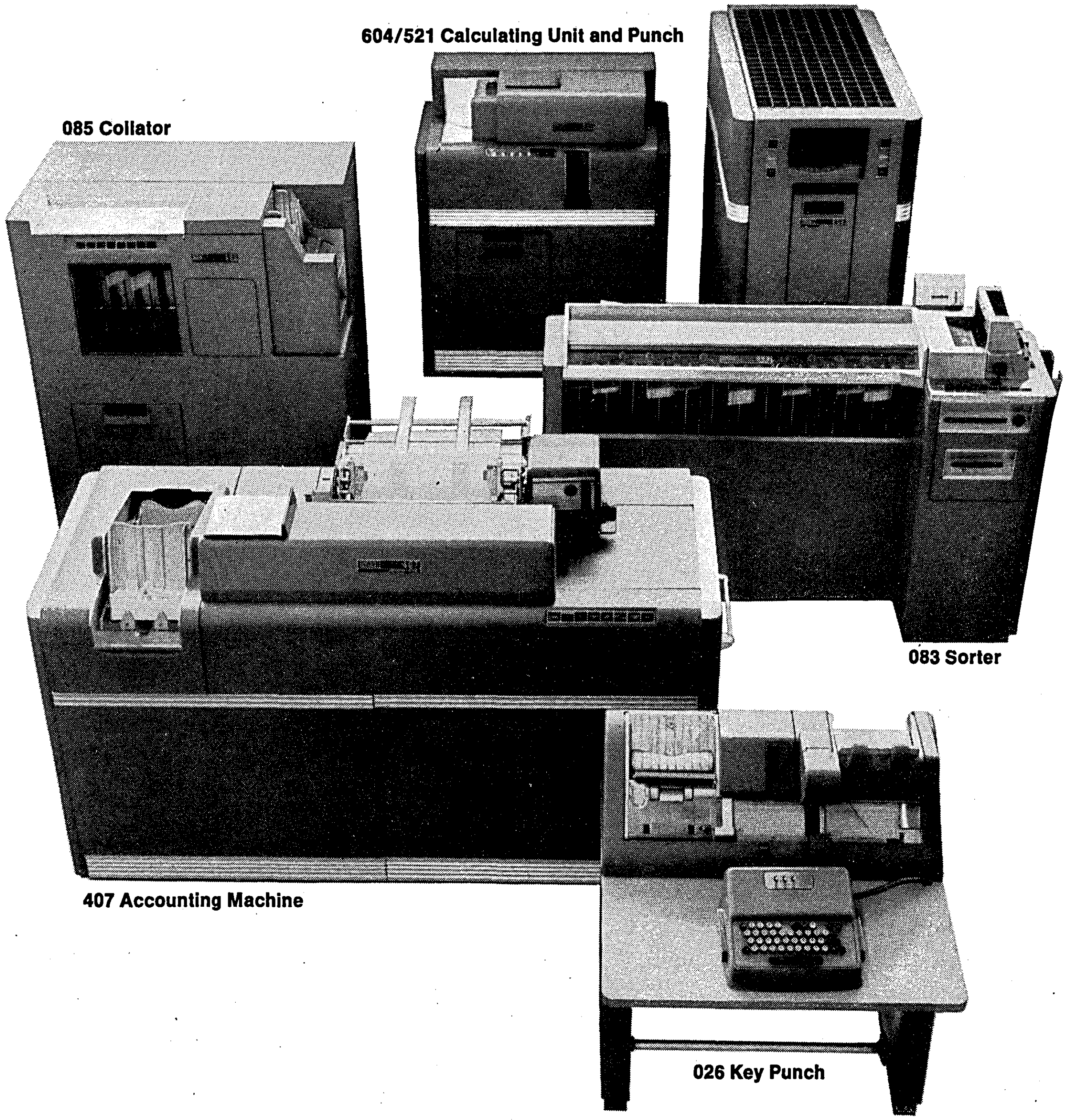
| April 30-May 2 | Electronics Components Conf. | Washington, D.C. | EIA, 2001 Eye St. N.W. Washington, D.C. 20006 |
| May 4-9 | 22nd Annual Int'l Communications Assn. Conference | Beverly Hills, Calif. | ICA/Larry G. Cahill Singer-General Precision, 808 Western Ave., Glendale, Calif. 91201 |
| May 5-7 | Symposium: Automata & Compatibility Theory | Los Angeles | ACM/Patrick C. Fischer, University of Waterloo, Waterloo, Ont., Canada |
| May 5-8 | Design Engineering Conference | New York City | ASME/Clapp & Poliak 245 Park Ave., New York, N.Y. 10017 |
| May 6-8 | 18th Annual Microfilm Assoc. Convention | Boston | NMA/Charles P. Yerkes, 250 Prince George St., Annapolis, Md. 21404 |
| May 7-9 | Int'l Conference on Artificial Intelligence | Washington, D.C. | AFIPS/ACM Dr. Donald E. Walker MITRE Corp. Bedford, Mass. 01730 |
| May 13 | Symposium: Extensible Languages | Boston | ACM/Carlos Christensen, Mass. Computer Assn., Lakeside Office Park, Wakefield, Mass. 01880 |
| May 14-16 | Spring Joint Computer Conference | Boston | AFIPS, 210 Summit Ave., Montvale, N.J. 07645 |
| June 16-19 | Int'l DP Conference & Business Exposition | Montreal | DPMA, 505 Busse Hwy. Park Ridge, Ill. 60068 |
| June 17-19 | Computer Group Conference | Minneapolis | IEEE/Robert M. Kalb Univac Div., Sperry Rand, 2276 Highcrest Drive, Roseville, Minn. 55113 |
| June 30-July 1 | Continuous System Simulation Languages Conference | San Francisco | ACM/Robert Brennan IBM Scientific Center 2670 Hanover St. Palo Alto, Calif. 94304 |
| Aug. 19-22 | Western Electronic Show and Convention | San Francisco | WESCON, 3600 Wilshire Blvd., Los Angeles, Calif. 90005 |
| Aug. 25-29 | Datafair | Manchester, England | British Computer Society, No. 23 Dorset Square, London, N.W. 1, England |

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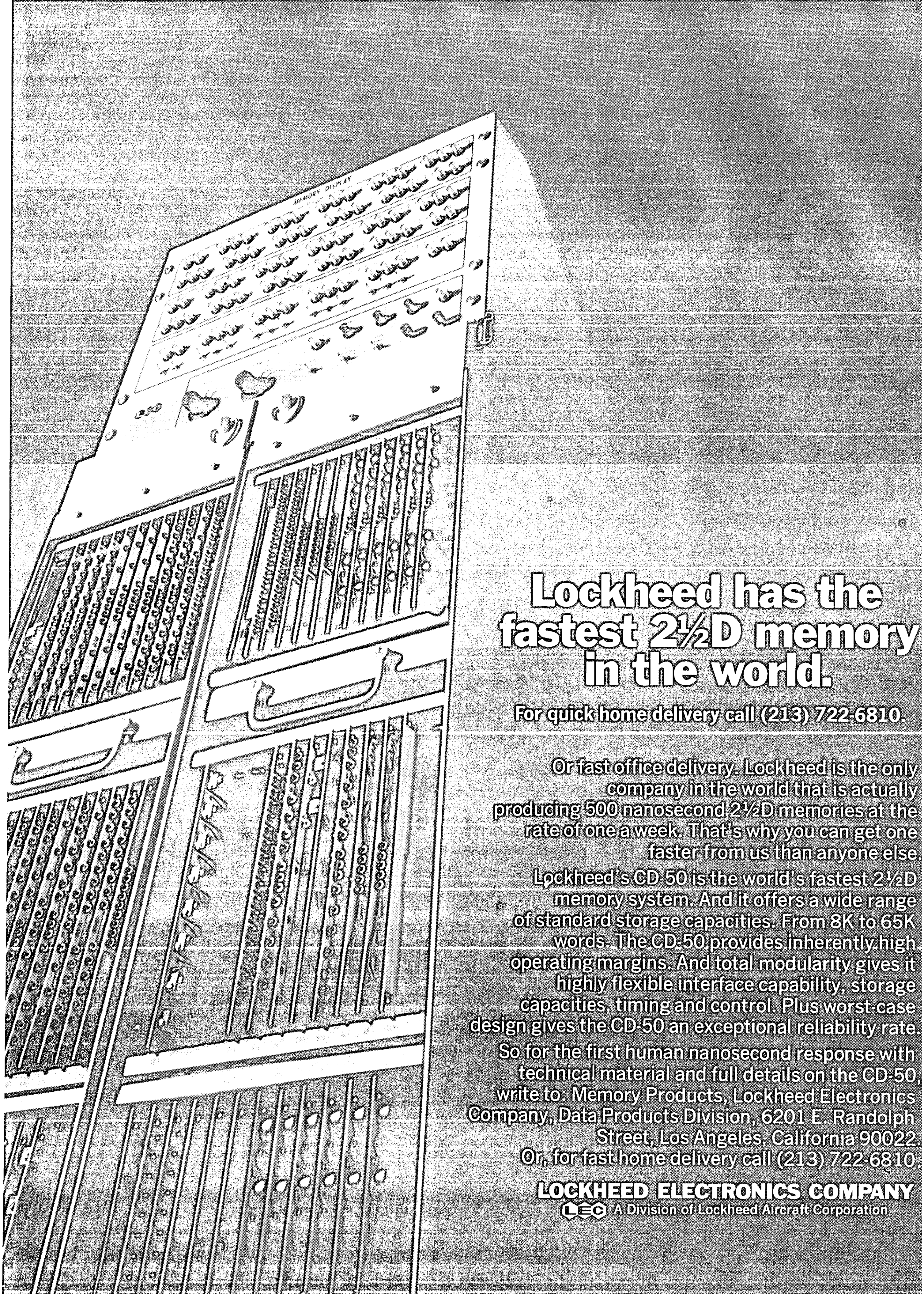
CIRCLE 31 ON READER CARD

FOR LOCKHEED CIRCLE 32 ON READER CARD →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# letters

## reguspatoff

*Sir:*

I was alarmed to read that the question of computer program patentability is hinging on the patentability of "mental processes" (Jan. '69, p. 78). Use of this legal term not only groups programs with such processes as hypnotism and mind-reading, but also tends to reinforce the frightening image that computers hold for much of the public.

In many aspects the software situation is similar to that of hardware. Memory is a mental process. The ferrite core is not a mental process, but it is a device for making a machine capable of memory. The magnetic core is clearly a patentable device. Similarly, a program should not be described as a mental process. It is, rather, a set of instructions or an algorithm which can specialize a general purpose machine to make the machine capable of performing a mental process. Thus, the program is more like the core, providing a capability, than it is like the process itself.

I have not resolved in my own mind whether programs should, or can, effectively be patented, but the resolution of this question should not be based on programs being mental processes.

BENJAMIN HORNE
*Waltham, Massachusetts*

## dumb dora

*Sir:*

William J. McKune's comments on computer gender (Jan. '69, p. 124) mention that in Spanish the word for computer is masculine (computador).

That may be what his dictionary says, but here we call them *computadora*. Which is feminine.

It even has some intriguing possibilities for double meanings, since the second and third syllables may be taken as referring to a feminine profession much older than edp, and the last two of course make a girl's name. Which may explain why my wife is suspicious of the amount of time I spend with her.

PAUL C. BERRY
*University of Puerto Rico*
*Rio Piedras, Puerto Rico*

*Sir:*

Let's lay the matter of "Computer Gender" (Jan. '69, p. 124) to rest without the bother of appointing committees to decide the issue. Since the beast is not a "computim," but a "computer," the gender must be feminine. Since it's an "er," not an "im," there should be no question.

FRANK STERN
*Ashland, New Jersey*

## obsoletely

*Sir:*

Having recently made an extremely satisfactory position change, Mr. R. L. Patrick's article "Obsolescence: People Plateaus" in the January issue was of considerable interest to me. I concur wholeheartedly with his observations that climbing above the edp field requires much broader experience and training. It is unfortunate that so few professional placement agencies and so many employers do not recognize this aspect. They still seek the "machine-specialist" in most cases.

Conversely, I disagree with the supposition that a man whose resume does not show courses taken, papers submitted or public services offered for five years is obsolescent. Growth in a job can, and most frequently does, occur. The tasks of selecting, applying and directing new equipment, applications and policies are a highly satisfactory educational process in themselves. In addition, many "unwritten" papers are created and used which are of benefit to the firm. I do not believe that publishing papers should ever be any criteria for judgment—else we slip into the university routine of "publish or leave." As far as public service goes, this should only be treated as a "plus," not an "and" factor. Professional associations like the Association for Systems Management (formerly SPA), DPMA, AMS, etc., are rewarding to both firm and individual—but what if company policy or job requirements prevent high activity therein? Should we downgrade the man?

I think Mr. Patrick's supposition as posed is too much of the formula approach—too pat, and highly pessimistic. It would be better to root out the true growth than purge the individual from consideration for a lack of the three points used by the author.

FRANK C. ARDSLEY
*Richmond, Virginia*

*Sir:*

A comment upon Mr. Head's "Obsolescence in Business Organization and Management." A vice president for information systems should have the inside track to the president's chair. However, he is not "heir-apparent."

Mr. Patrick's position that aspirants to top level jobs know "something other than computers" must be given more than cursory acknowledgment. It constitutes a challenge to the professional computer community.

Organizations are, or should be, created to fulfill specific objectives. The cumbersome middle-management positions of a decentralized organization can become obsolete by advancement of computer-supported information systems farther into the decision-making loop.

For the information specialist to implement a plan which results in a reduction in the number of levels in an organization is not enough. He must fully understand the organization's objectives and contribute significantly in their fulfillment. For this he must be the well rounded individual depicted by Mr. Patrick. Otherwise he has no hopes of being president, unless he is a relative.

R. H. NIETUBICZ
*Silver Spring, Maryland*

## pl/1 more time

*Sir:*

Lois Frampton's comments on PL/I standardization (Jan. '69, p. 15) were particularly apt, since so much of the discussion of the issue has been on totally nontechnical grounds. It is not clear, however, what position she is espousing. Certainly delay of standardization can lead to a proliferation of dialects; also possible is the acceptance of a *de facto* standard (echoes of EBCDIC) which must be displaced at great cost to nearly all users. However, the peril of early standardization will (one fervently hopes) not produce so obsolete a monster as USASI FORTRAN IV. PL/I is much more complete and open-ended than the old FORTRAN and it seems less likely that the next generation will bring drastically new concepts (such as direct-access I/O was to the second generation) into the range or needs of the language user.

The other side of the coin is that

# letters

PL/I is perhaps too comprehensive. Many of the features which are most useful (e.g., string & text manipulation) do not lend themselves well to the hardware of those manufacturers who carried the fixed-field (word) length concept into the third generation. Even IBM, in the cases of System/360 models 44 and 91, has chosen occasionally to sacrifice the "general purposity" of the variable-field-length instructions for higher floating-point number-crunching power per dollar. Implementations of PL/I on such machines would certainly not be particularly more efficient at execution time than FORTRAN, which is the natural language for use on hardware with a purely scientific instruction set.

While modern concepts of multiprogramming have given many installations incentive to share hardware between commercial and scientific users (PL/I, of course, providing a sharable language) there is still a market (because of the generally lower cost/computation) for the dedicated-commercial and dedicated-scientific machines. Since implementations of PL/I on either type of system would probably produce mutually exclusive subsets of the language, programmers would quite likely be trained in their appropriate subset. If commercial programmers wind up using only the COBOL-like features of PL/I while scientific programmers use only the FORTRAN-like features, most of the arguments in form of the one-language shop fall to pieces, even when hardware is shared.

PL/I can only justify its existence when every user is at least conversant with the full power of the language. It represents a trend toward generality of purpose which has only somewhat been picked up by hardware and not at all by programming staffs. The problem is not one of suitability of PL/I but, in fact, of education of users into a realization of what they are missing in their anachronistic attachment to the use of state-of-the-art equipment in a specialized, second-generation oriented environment. Philip H. Dorn, in the obsolescence panel discussion in the same issue, notes the passionate desire on the part of edp management to have the latest hardware, and that the 7090 (also 1401, although it wasn't mentioned) is almost universally unwanted. Yet, commercial shops which replaced 1400 series equipment with a 360/30, 40, or even 50, and scientific users who replaced a 7094 with a 360/65 or higher, still sit side by side at the same company, even after converting past the emulation phase. If separate hardware and staffing were truly necessary, these shops should have kept their 1401 and 7094.

To summarize, PL/I, multiprogramming, and general-purpose hardware combine to offer a complete break from the second generation. If the break is not made complete, then the cost of any one of those three concepts is hardly likely to permit realization of the increase in cost/performance ratios from second to third generation such as those quoted by Lowell Amdahl in the same issue.

J. V. DOODY
*Niagara Falls, New York*

### standing up for standards

*Sir:*

Perhaps this note can be kept sufficiently brief for you to avoid a serious case of technical influenza upon reading it despite the fact that it deals with the "vital, . . . stimulating topic of . . . standards." With some surprise I translated your commentary in the February Editor's Readout, discovering that a concatenation of Noah Webster (fervent: warm in feeling, ardent) and Clifton Fadiman (Ennui, felt on the proper occasions, is a sign of intelligence) leads to the inference that the citizens of Tasmania (presumably all 379,628) await the 1969 American League pennant race with ardent intelligence. That they are apathetic is to be expected if they are Angel fans.

Three fashionable objections to current data processing standardization activities can be heard: (1) who needs it, (2) the wrong things are being standardized, and (3) the objectives are right but the execution is wrong. I judge you to be in the last camp, regrettably the one holding the most valid position. I say "regrettably" because that situation is the most difficult to fix. To cease and desist or change goals radically is far easier than evolving a new *modus operandi* within an existing framework.

The first two points can be treated with an observation and an admission that clearly standards of some kind are needed in almost all enterprise. What is human language but a complex and, as yet, ill-described standard? Could the West have been settled without a standard railroad track? Would data processing be as developed today with many incompatible varieties of punched cards? Whether one needs to go as far as ASCII machines is another kind of question, really relating to the second point.

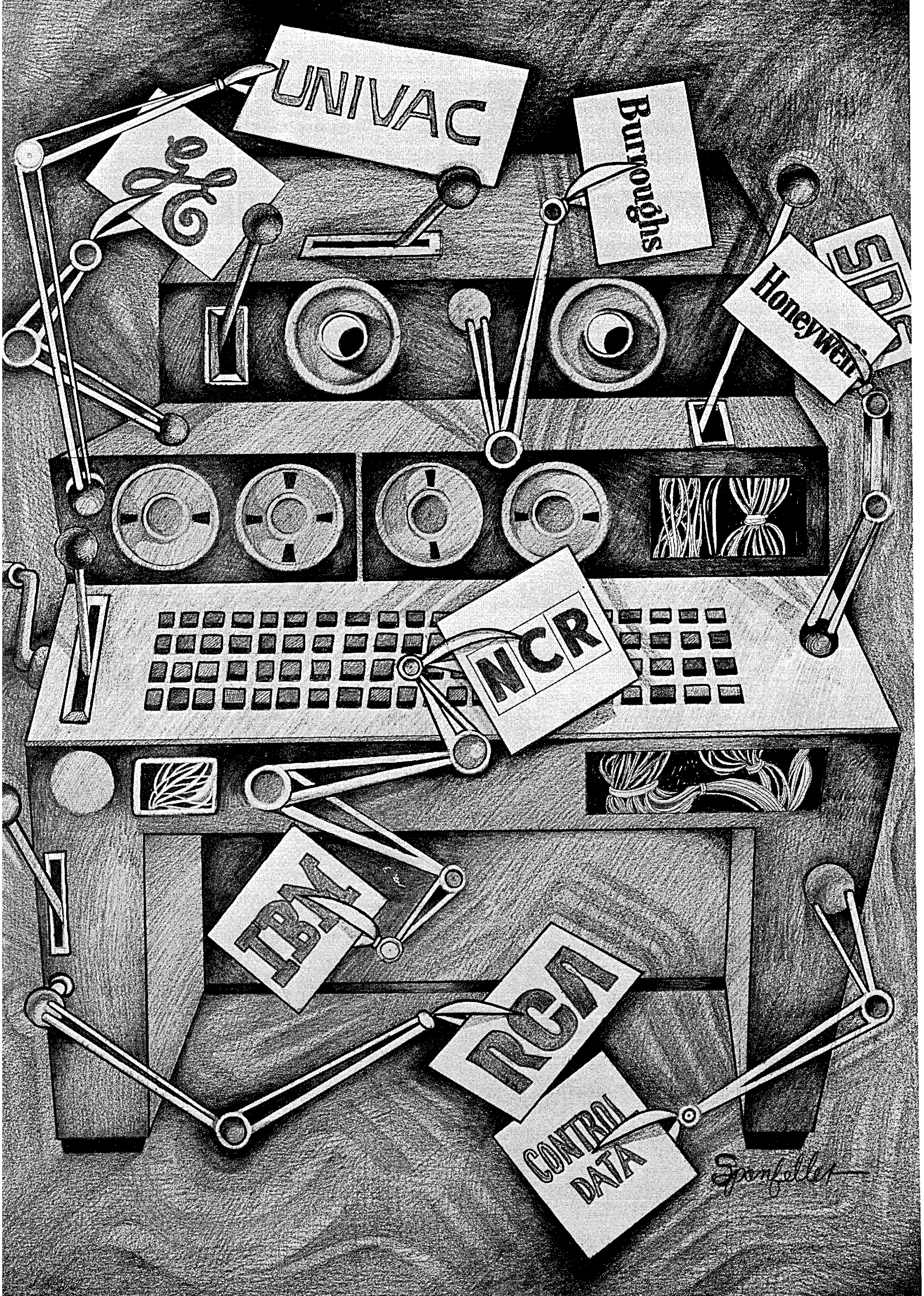
Those who claim that the wrong things are being standardized have a certain logic on their side, especially in the software area. The responsible critics taking this postion do not denigrate physical standards but raise some interesting points most sharply posed in the area of programming languages. Should we have a USAS FORTRAN (as we do) or should we rather have a USAS method for describing programming languages? Superficially the latter is much harder to accomplish, but a strong argument can be made that it is not possible to *effectively* standardize a specific language without a precise description technology. Further, it can be noted that we don't have USAS screws, we have a USAS for describing any reasonable screw.

Additionally, it is argued that *evaluative* standards are needed, such as the old ASA film ratings, permitting the user to select the item that best matches his requirements. Conceptually, this makes a lot of sense for software, but its practicality at the current state of our technology is questionable. In the best of all possible worlds (which ours is most certainly not) pursuing the goal just mentioned would be unexceptionable. That there are political and economic deterrents of a powerful nature opposing this course in the real world is also unexceptionable.

My view of this question is that most of the current objectives of data processing standardization are sound. (But not all; the vocabulary activity is probably foolish in principle and certainly abominable in execution.) In addition there are other objectives not yet attacked, particularly in software. I concur with your editorial view that inadequate management is at fault. However, the particulars of your charges are in error and, in places, unfair. Also, the unstated implication that nobody in standards work has noticed the problem, much less caring about it, is patently false.

Specifically, you are correct about the general character of X3, but often the tenuous links of which you speak are the fault of the external organizations. The representatives of computer manufacturers go to X3 meetings well informed and with their positions well coordinated through their own organizations. The same is true of the U.S. Government. The same cannot be said of other organizations that have a real stake in the matter such as ACM, IEEE and JUG. The blame here lies on the organizations, *not* the individual representatives. It is the old blood and turnip story.

Your observations concerning the technical working committees are simply false to fact. First, "part time" is, in truth, "substantial time," even if, as Bromberg suggests, it is insufficient. Second, the charge of "high-turnover" is refreshing, even if it is in error. The
*(Continued on page 307)*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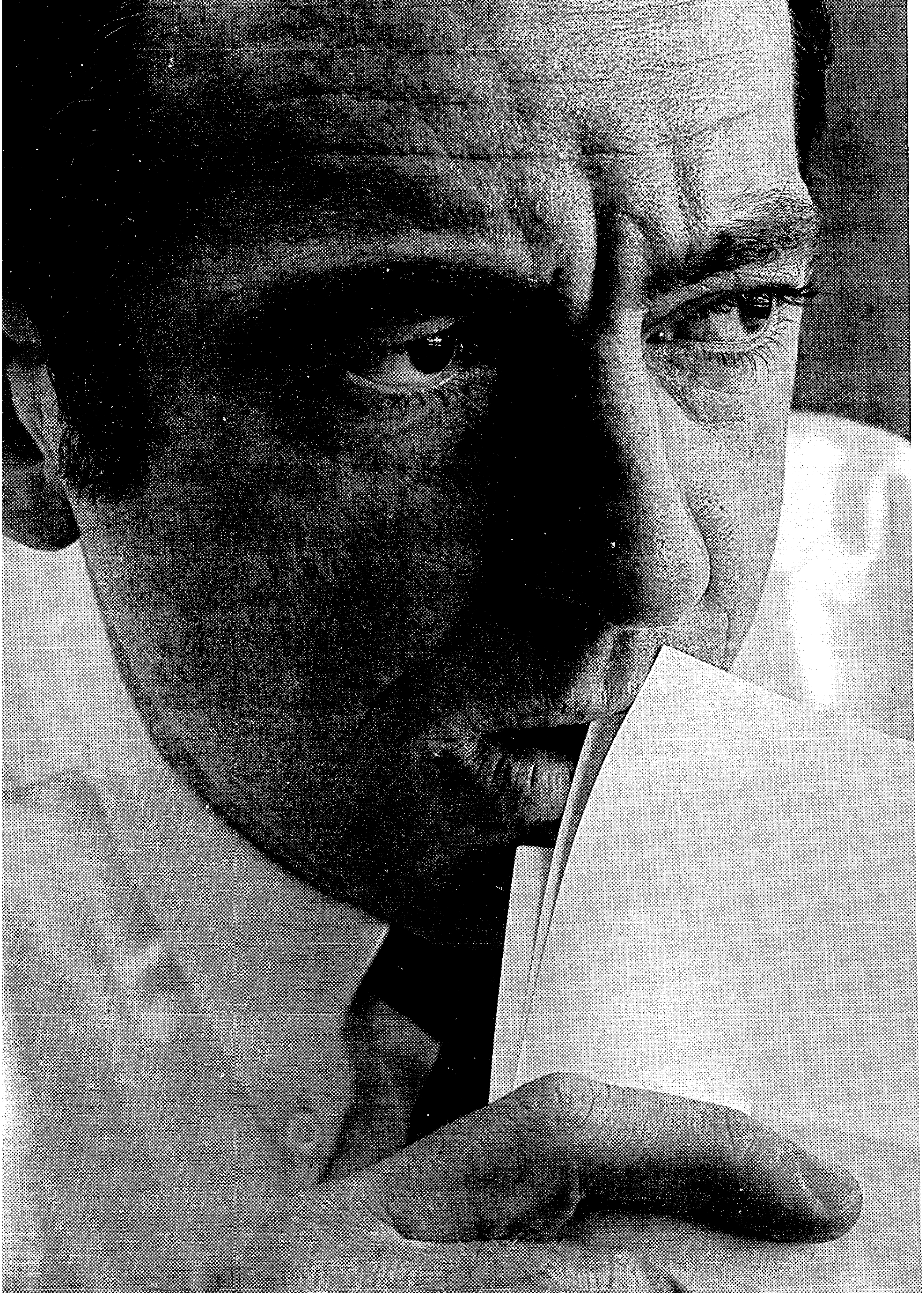
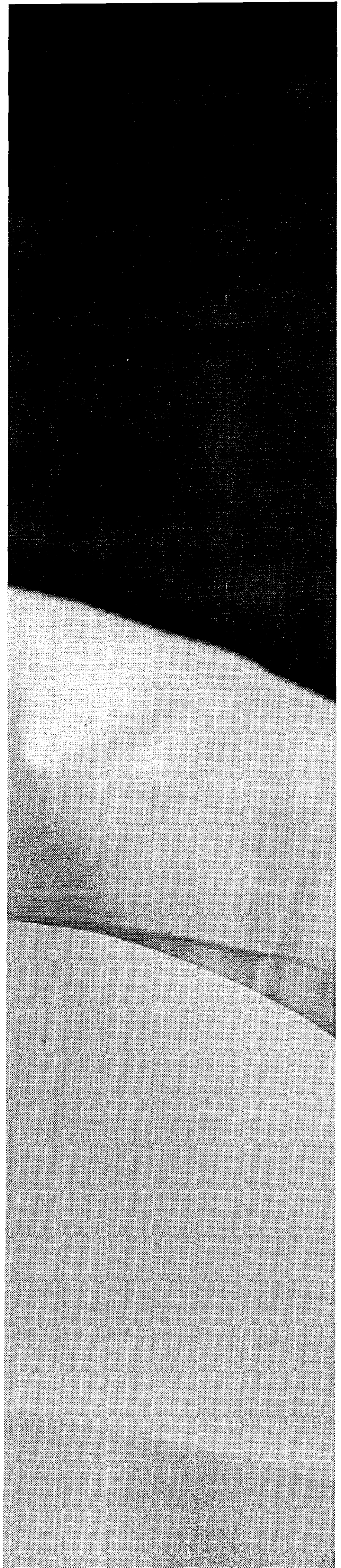
# Time-sharing?

## If so, you can't afford not to consider the extraordinary 2000A System from Hewlett-Packard.

## For three profitable reasons why, read on...





# If your time-share bill runs over $2,300 a month

# you're being had!

Forget about mounting rental bills. You'll save hard cash with *your own* HP 2000A System.

You can have up to 16 terminals going simultaneously. Your users can program the computer in simple conversational BASIC... and unlike most computers it checks every entry step-by-step. No busy signals; no wait messages. And you can even forget about expensive repairs and computer down-time. The 2000A System keeps on working . . . while others are being worked on. *Time and money saved,* that's what you can count on with the extraordinary HP 2000A System.

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***HEWLETT hp PACKARD***

DIGITAL COMPUTERS

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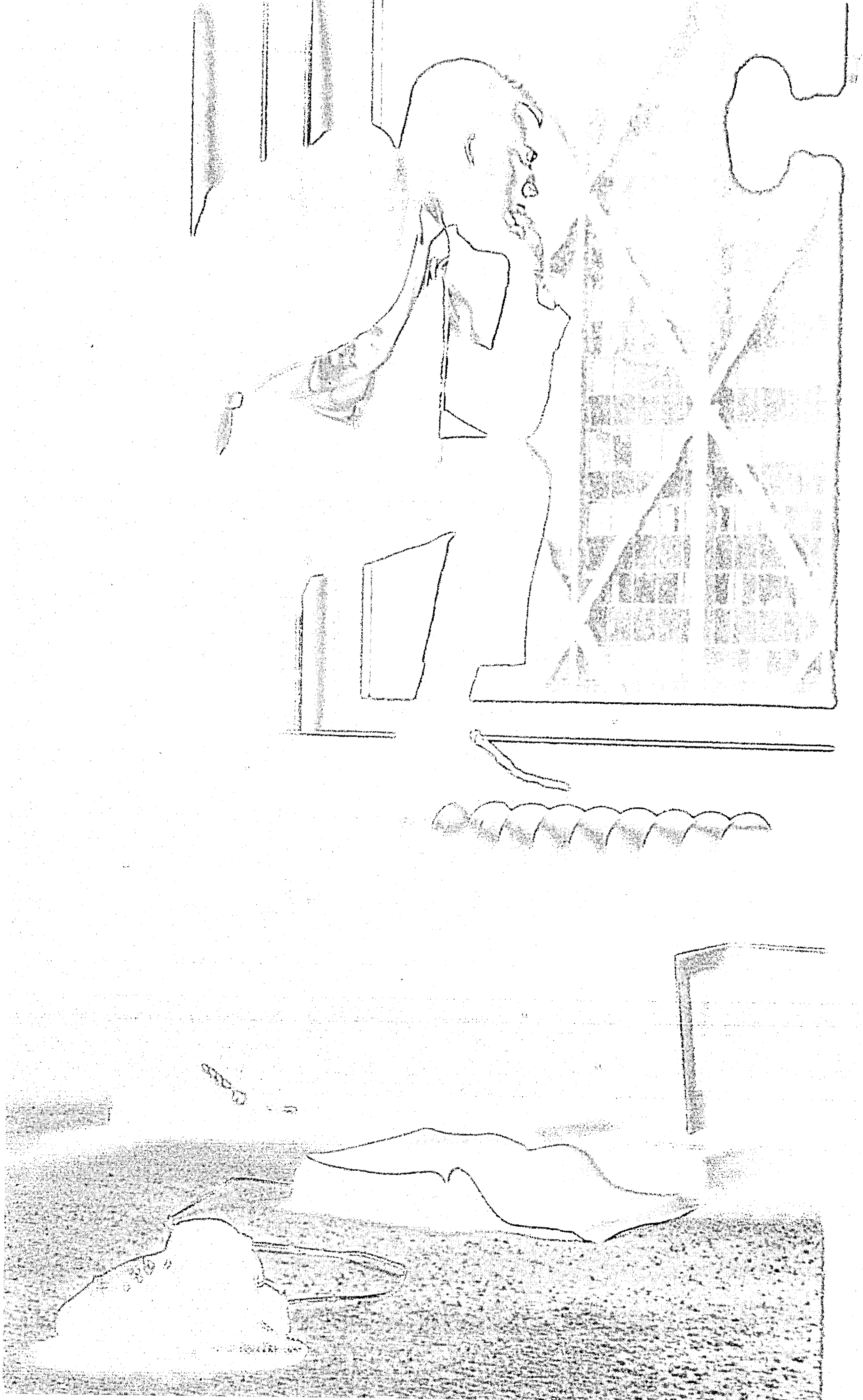
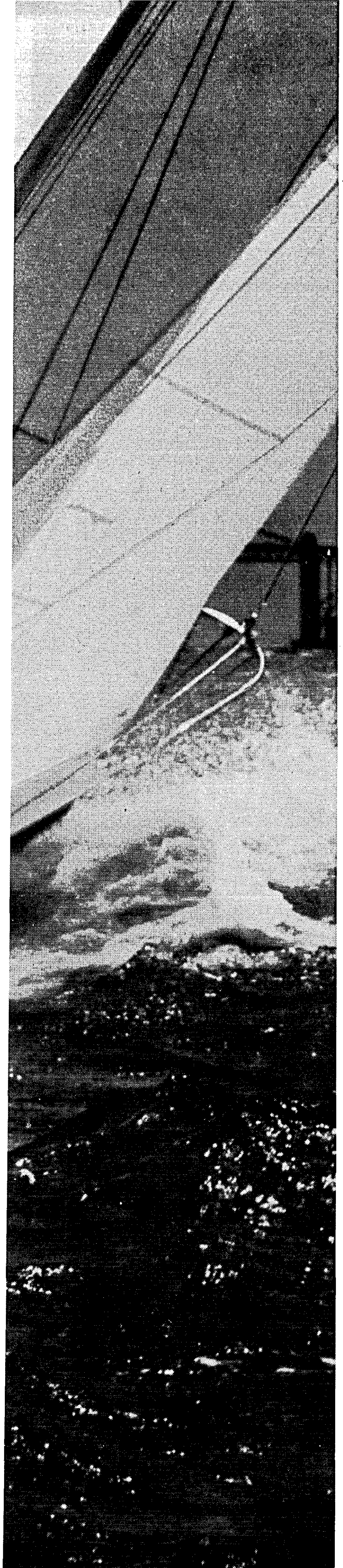
22913





# This man is running his own business... time-share.

Is this any way to run a business? . . . it *is* with the extraordinary HP 2000A Time-Share System. Whether you're running your own Time-Share business, or managing a computer center, the HP 2000A System *makes life worth living.*

HP BASIC is so simple, yet so powerful, engineers and scientists who are non-programmers can use it. It only takes about half a day to learn. And you can have 16 remote terminals going simultaneously.

Another nice thing. This system really works and works and works. No valuable time lost in repairing the computer or debugging the operating systems. And unlike most other systems, it checks every program entry line-by-line . . . *your users will actually see time and money being saved.*

The 2000A Time-Share System, with control terminal and all custom software included, costs just $90,500. Want to get a head start on the good life? Just call your local HP computer specialist. Or write Hewlett-Packard, Palo Alto, California 94304; Europe: 1217 Meyrin-Geneva, Switzerland.

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# DEMONSTRATING 11 NEW DATA

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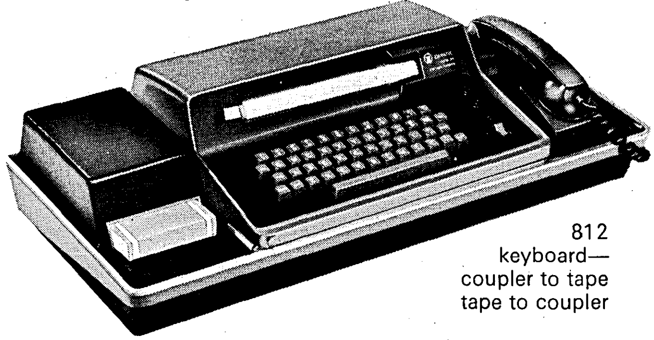
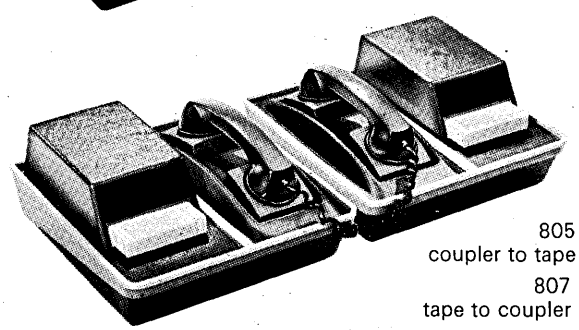
Offering choice of data recording via keyboard or telephone line. Complete subsystem product line consisting of units for writing, reading and converting ¼" tape into standard ½" tape IBM compatible. Use in time sharing, carry in, carry out or polling applications.

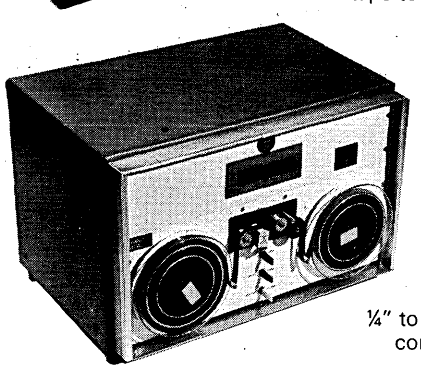
811
keyboard
to tape



812
keyboard—
coupler to tape
tape to coupler



805
coupler to tape
807
tape to coupler



806
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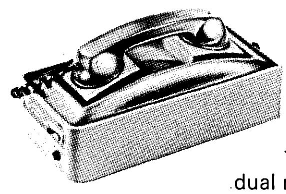
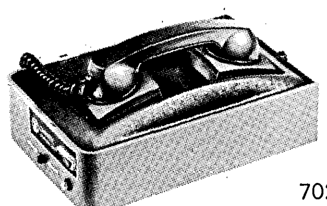
conversion

## complete line of telephone couplers

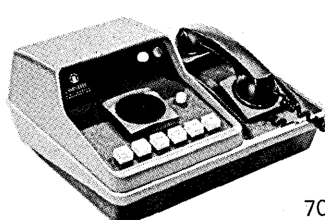
There must be a reason more OMNITEC couplers are used today than all other makes combined. Actually, there are three: performance, flexibility and economy. Noise immunity is high, price is as low as $365 for multi-users. Directly compatible with 33/35 & 37 TTY, EIA, RS-232, etc. Expand your system capabilities with new ORIGINATE and ANSWER model, enabling terminal-to-terminal communications, interfacing voice-grade transmission with computer center. New replacement for 103A now eliminates requirement for hard-wired installation. Mounting banks for multiple use can be provided. New series available with dual mode, simultaneous input from teleprinter and plotter (or other EIA device). Specially designed models to meet all European electrical and physical requirements directly.



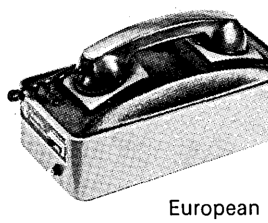
701A
dual mode



702
originate/answer



703
automatic answer



750
European model

CIRCLE 102 ON READER CARD

CIRCLE 103 ON READER CARD

# COMMUNICATIONS PRODUCTS

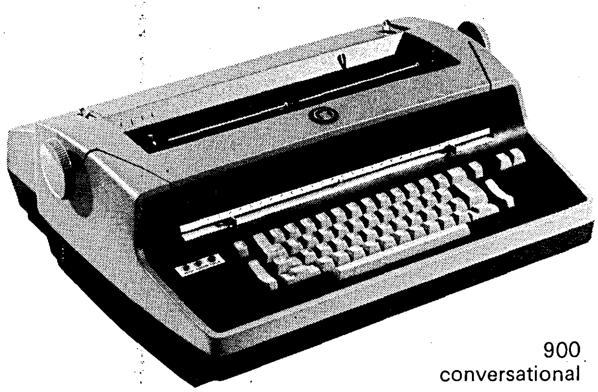
## ready for immediate delivery with volume discounts for OEM

## complete line of data terminals

OMNITEC portable terminals speak in a whisper and are ready to follow you anywhere. Any place you need time sharing or remote batch. Any time you want to communicate data in and out of a remote computer via phone lines, using a 63-character keyboard. ASCII-10 cps or Correspondence-15 cps. Strip printer output, with less clickity-clack at the terminal environment. Best of all, OMNITEC portables travel 25 pounds light and satisfy airline regs for cabin carry-ons. So they'll follow you anywhere, from bedroom to board room, plant, warehouse, or out of town on business. The OMNITEC conversational terminal prints full 8½" page and requires no special desk or console mounting.

800 ASC II
800A
2741 IBM compatible

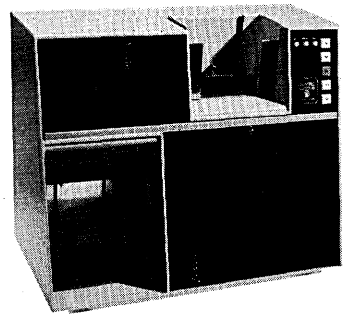
804
numeric



900
conversational

## new applications opened by unique reader features

OMNITEC ruggedized card readers are designed to combine volume processing capability with source data gathering input needs. Beautiful for time sharing or remote batch. The unique automatic RE-READ feature can serve as "scratch pad" memory; and to re-circulate and transmit data from one card as often as called for by stored program. The only reader that can be programmed to offset selected cards in a deck. This exclusive feature can be used for data master identification or as an automatic sorter. Read hundreds of thousands of cards without a single error. The ultra-dependable picker-knife design pampers each card, adds longevity to your card decks. For bulk processing or source data gathering applications, the 300 zeroes in on the source of most problems—eliminating read errors, costly maintenance and down time. It also offers flexible reading rates for more efficient time sharing. Operates in a DEMAND-READ mode at speeds between 80 and 300 CPM. Or reads continuously at top speed.



325
ruggedized
card reader

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If you're thinking about time sharing, you should be talking to OMNITEC...the one-stop shop with 25 advanced communications products—offering a complete line of terminals, couplers, card readers and related input-output devices.

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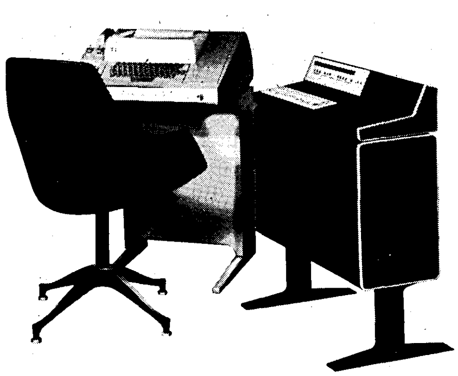
CIRCLE 105 ON READER CARD



## TEMPO I-A

Basic Monitor
Macro Assembler
Real Time Fortran IV
Debug
Utilities

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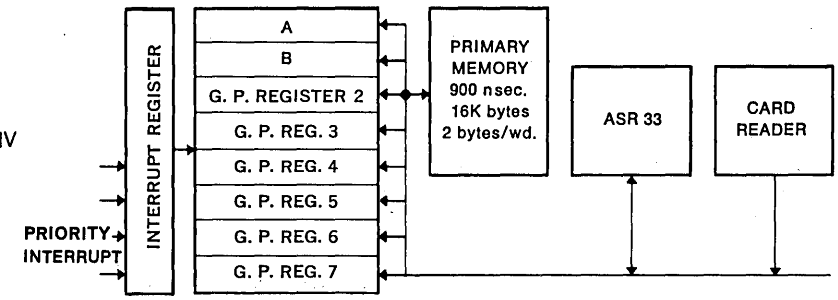
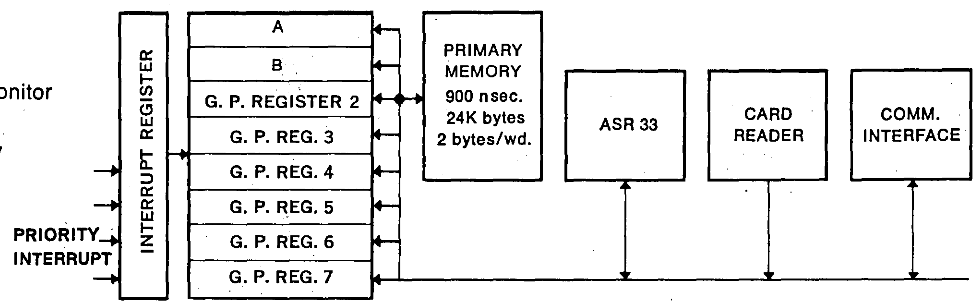



## TEMPO I-B

Communications Monitor
Macro Assembler
Real Time Fortran IV
Debug
Utilities

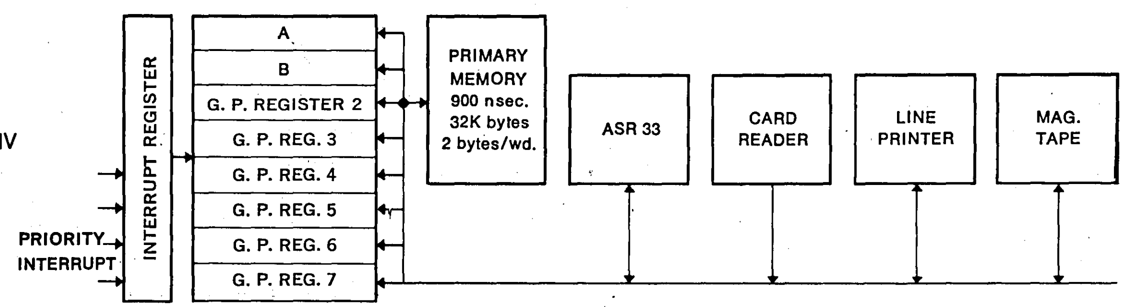
**$35,000**




## TEMPO I-C

Real Time Monitor
Macro Assembler
Real Time Fortran IV
Debug
Utilities

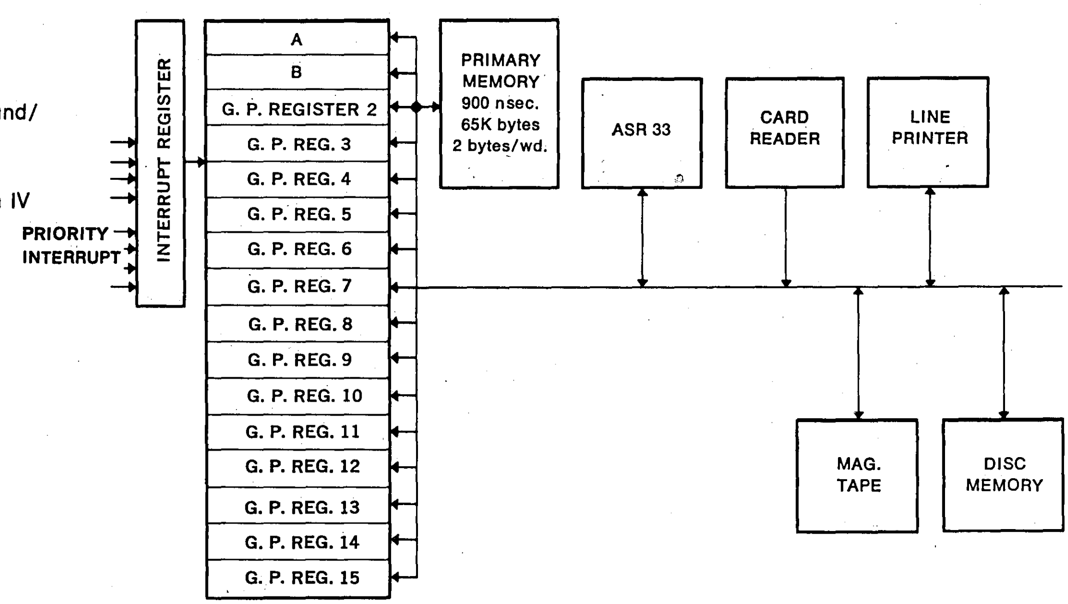
**$60,000**



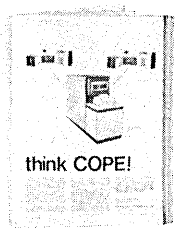

## TEMPO I-D

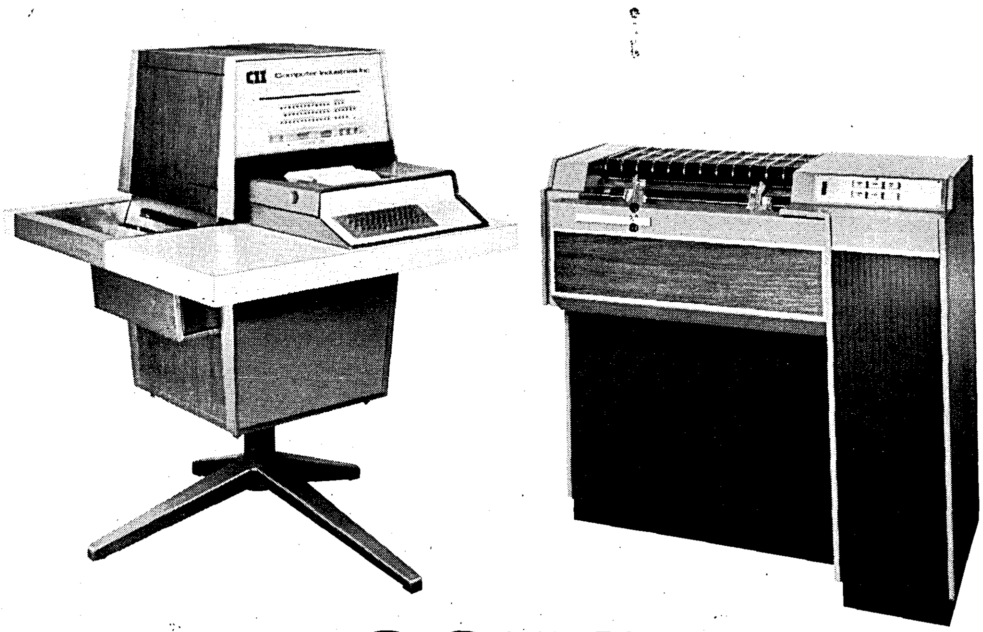
Real Time Disc Monitor- Foreground/ Background
Macro Assembler
Real Time Fortran IV
Debug
Utilities

**$99,000**



## You've been "Thinking COPE"...



# now think COPE .30 series!

If you've been thinking about remote terminals, you've probably already considered the COPE .45 system developed and manufactured by Computer Industries Inc. (This system, as advertised above, was demonstrated at the Fall Joint Computer Conference.)

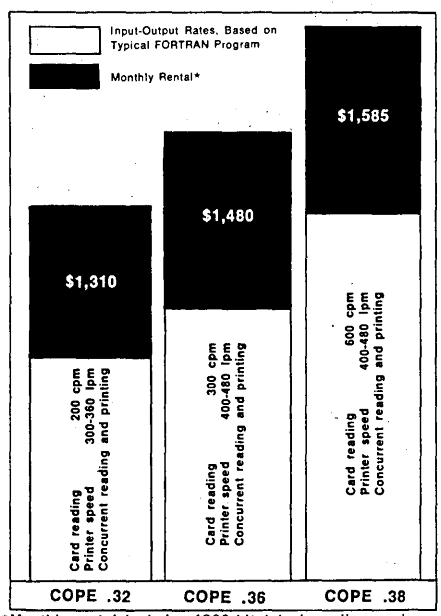
Now you can think some more.

Our Series .30 COPEs are in production, with deliveries scheduled for this summer. Starting with the newest and most inexpensive member of the series, the .32, you can field upgrade to the .36 or .38 to get the processing capability you need at the price you want to pay. These compatible small brothers of the COPE .45 share the characteristics that have made the .45 a success, yet start in the $1300 per month price range.

Check the chart at the right. You'll find the COPE family provides industry's lowest throughput cost ratio. Any of our COPEs give you the speed and processing power of a big computer in your own office or plant at a fraction of the big system's cost. And our COPEs are adaptable for use with systems such as the IBM 360, Univac 494, GE 635 and CDC 6000 in addition to the Univac 1108.

After thinking about our COPE .30 Series, you may still need the maximum speeds provided by the .45. Fine! You'll be joining a growing family of users in this country and Europe who won't settle for anything less.

For more information on the new COPE systems and the rest of the COPE family, write or call Marketing Coordinator, Data Communication Systems Division, 2659 Nova Drive, Dallas, Texas 75229, (214) 241-3501. Or plan to see us at Spring Joint Computer Conference.




*Monthly rental includes 4800-bit telephone-line modems.

CII

**COMPUTER INDUSTRIES INC**

DATA COMMUNICATION SYSTEMS DIVISION

A Subsidiary of University Computing Company

Started by president Errol Payne, a physicist, in July of last year, the firm now has patent protection, a working prototype, and a half dozen models of the display in the works. The prototype has a 2' by 2' flat screen, made of a honeycomb thermoplastic material. A scanner bar moves across this surface, taking about 10 seconds for a round trip. In one direction it erases the numbers, words or pictures on the screen; in the other it deposits thousands of tiny particles to form the images. The information to be displayed is stored digitally in computer core and transferred over standard telephone lines. Speed is limited by line rates—and this appears to be the main drawback, since it takes up to two minutes to change the display. With wideband service, this time would be much less.

The unit doesn't generate heat and needs no high voltage; 5-volt logic is used. And unlike other display methods now in use, the cost only goes up linearly. This opens up such markets as outdoor advertising, airline terminal displays, and so forth, plus the possibility of home use since only a phone is needed.

An added note on the low cost: the company has set up a subsidiary to produce a toy called Graph-A-Magic using the same principle and selling retail for about $5.

## IBM's ROUND HOLE PUNCH CARDS PEGGED FOR JULY

Guess what? IBM's little 3.7 computer system with the round-hole punch cards is now due out in July, presumably after any separate pricing announcements. We hear IBM will try to avoid the mammoth systems engineering effort always needed for small, small-system users by providing "model" applications packages for quick implementation. Language: RPG. Going to the other extreme, the 360/85 I, or whatever the 85 successor will be called, is reported to have a freon cooling system as opposed to the water cooling systems of the 85 and the 90 series. Maintenance charges for the latter systems are so high, explains one quipster, because it involves "six plumbers and a CE." One of three super computer projects at IBM is somewhere within Federal Systems Division, where a parallel processor is being designed.

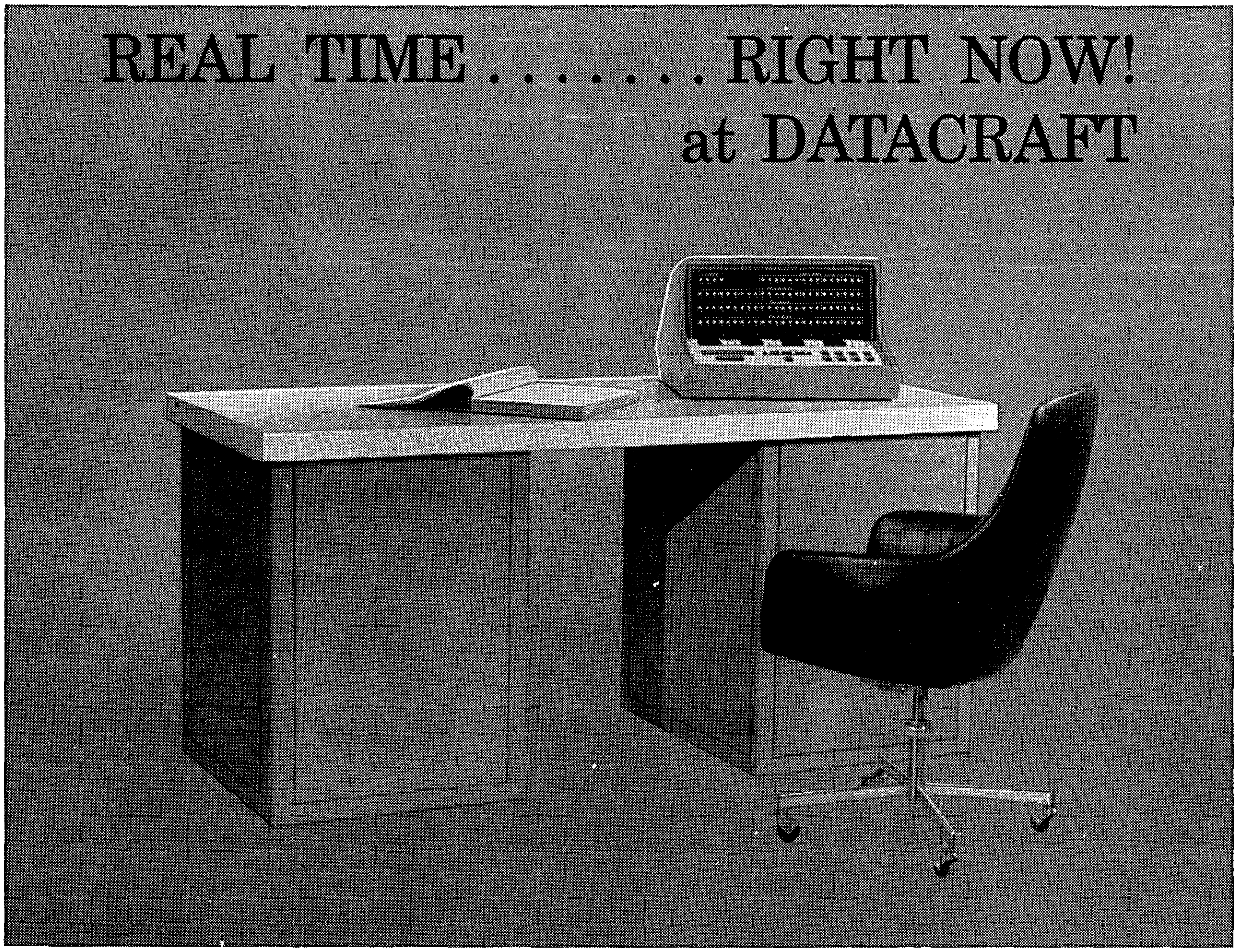
## GROUP TO EVALUATE ATTACHMENT TALKS

The FCC reportedly has asked the Computer Science & Engineering Board of the National Academy of Science—headed by ACM ex-president Tony Oettinger—to evaluate upcoming discussions concerning foreign attachments. The Board is reportedly interested in acting as interpreter at discussions, which would include AT&T, the commission's common carrier bureau, and communications users.

The talks may get under way this month, after the bureau issues a public notice specifying ground rules; several working groups will be set up, and different foreign attachment problems will be assigned to each. Bureau officials are said to be "sympathetic" to BEMA's suggestions that the bureau issue a progress report after the talks have been under way for awhile, that written records of the deliberations should be maintained, and distributed to all participants, and that any participants should be able to sit in on any group's discussion.

Members of BEMA's DPG/telecommunications committee, who hammered out the association's basic

*(Continued on page 281)*




The DATACRAFT DC 6024 General Purpose Digital Computer offers unparalleled speed and power with its 600 nanosecond 24-bit full-word cycle time and over 500 instructions in the basic 8K configuration. The DC 6024 easily replaces larger, more costly computers or back-to-back multiprocessors in real time control applications.

Full-word fixed-point execution times in the basic machine are:

| | |
|---|---|
| Full Cycle | 0.6 uSec |
| Add/Subtract | 1.2 uSec |
| Multiply | 4.8 uSec |
| Divide | 9.0 uSec |
| Hardware Square Root | 8.4 uSec |

Even with these features the DATACRAFT DC 6024 is less costly than other computers capable of performing similar functions.

Prices start at $53,900 which includes 8192 word storage (expandable to 65,536 words in 8192 increments); Hardware/Multiply/Divide/Square Root; four true levels of priority interrupt; five 24 bit general purpose registers and ASR-33 Typewriter. Desk or rack mountable.

The basic DATACRAFT DC 6024 software includes a Resident Operating System with modular interrupt-oriented I/O handlers, link loader, two-pass assembler, utility routines, math library and floating-point routines. Optional software includes a one-pass ASA standard FORTRAN IV package and a Real Time Supervisor having foreground/background operations applicable to process and manufacturing control requirements.

For detailed specifications, call (305) 565-9441 or write:

Raymond L. Marlatt
Sales Manager
Datacraft Corporation
P.O. Box 23550
Fort Lauderdale, Florida 33307

**SEE US AT THE SPRING JOINT COMPUTER CONFERENCE MAY 14-16 BOOTH #802.**

*Datacraft Corporation*

*776 N.E. 40th Court    P.O. Box 23550    Ft. Lauderdale, Fla. 33307    Phone (305) 565-9441*

CIRCLE 163 ON READER CARD

# look ahead

## IBM SAYS PL/I IS BASIC

When IBM announced the availability of CALL/360: BASIC to users on a "take it as it is basis," most assumed this included the operating system and the BASIC compiler. When IBM transferred CALL/360 services to SBC, most assumed that future software developments for the system beyond BASIC would be done by and belong to SBC, which would provide them only through its centers. Right? Wrong.

It is now apparent that IBM will continue to improve and add to CALL/360 software for its users. This month, under what is called the "CALL/360: BASIC Program," customers will receive not only a "new and extended BASIC compiler" but also a PL/I compiler. And this PL/I is probably very similar to SBC's, since SBC's was developed at IBM before the transferral. Now, if IBM customers include service bureaus with the right mod 50 configuration for CALL/360, won't the new offerings strengthen them in their battle against SBC? If that is so, surely none can claim that IBM developed CALL/360 in order to capture the time-sharing market, but merely to capture more of the T-S equipment market.

And we're told the 50 with CALL/360 could be an efficient, profitable machine for SB's, since its Executive Control Program supports 101 lines simultaneously. The T-S system requires at least a 512K/50, 2703 for TTY and 2741's, and a 2314 disc and certain nonstandard features (RPQ's).

Features of the PL/I subset include automatic storage allocation facilities, user-controlled interrupt processing, array facilities, stream-oriented I/O facilities, and ability to handle a variety of data types.

## COMPUTER OPERATORS GUILTY UNTIL PROVEN INNOCENT?

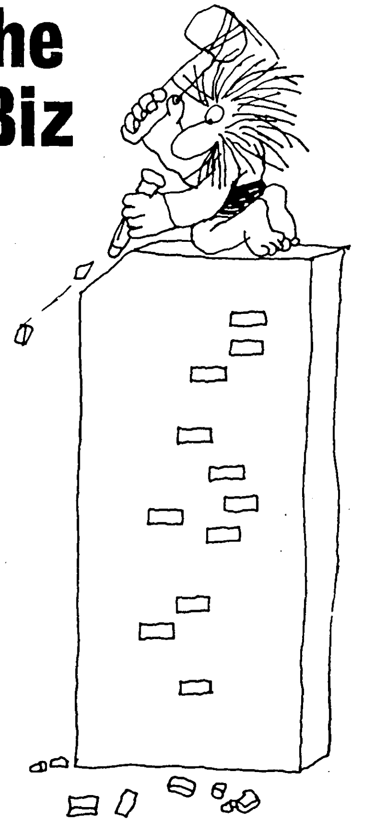
The State of Minnesota now has bills in the House and Senate hoppers which say in effect that anyone damaged "in person or property" by a computer error can sue the persons maintaining or using the computer "for all damages sustained and shall recover therefor unless the person who caused the injury establishes that he was not negligent." The bill, if passed in this form, seems to pass the burden of proof to the defendant—and could be an excellent case for the Supreme Court. Senate and House committees now are studying the bill (number 433 in Senate, 104 in the House).

## SLOW...BUT OH SO CHEAP

How about a neat display to go with your time-sharing terminal for $9.50 a month?

That's what Peripheral Data Machines plans to offer this fall. And the small Newport Beach, Calif., company may have come up with a really new idea in display technology that could have widespread effects on this and other industries.

# BC 1400 and the Data Service Biz



Back in the dark ages of the service bureau business, a guy gathered together some key punches, a few pieces of EAM gear and a couple of operators—voila! Instant service bureau. The capabilities of the equipment were limited, so everybody did things pretty much the same way. The only setup involved consisted of a few hours of board wiring, and from there it was just a matter of cramming cards through the old hopper.

The 1401—remember him?—changed that forever. It was really the first computer low enough in price and high enough in efficiency to make the computerized independent service bureau possible. So, gleefully, the service bureau operators jumped on board. And a lot of them promptly lost their shirts.

It wasn't just a matter of a few hours of board wiring any more. Everybody knew computers were flexible and powerful enough to do just about anything. There was only one small hitch. You needed high-priced people called Programmers, and you also needed lots of their valuable time to do what everybody knew could be done.

That fact put the service bureau business into a new classification. No longer could a successful service bureau be a one-man band, operating out of a store front on a side street. A good service bureau today is a substantial organization with major investments in hardware, software, and people. And a substantial requirement for good management, good technology, and that strong service orientation that makes a good business go.

Getting service bureau operators to acknowledge these facts of life took some doing. A lot of blood was shed along the way, and some of it hasn't washed out yet. When you say you're in the service bureau business, you get more than one raised eyebrow and a lot of why did you want to do a thing like that?

Well, to succeed, you either have to come up with something new or cure something that's really sick. We did both. The sick part was the service: slow, catch-as-catch-can, late, and full of errors. And the customer coordination left a lot to be desired. We installed enough computer power to cure the slow service problem. And, with our people (about 700 of them, all over the place), we can get more involved in the problem. Tailor programs to needs. And handle any size effort.

As for the new, customers can take advantage of our exclusive MARK IV General Purpose File Management software products. We'll be developing customer services packages, like our bill of materials processing program for manufacturers, payroll packages, insurance agency accounting. That type of thing.

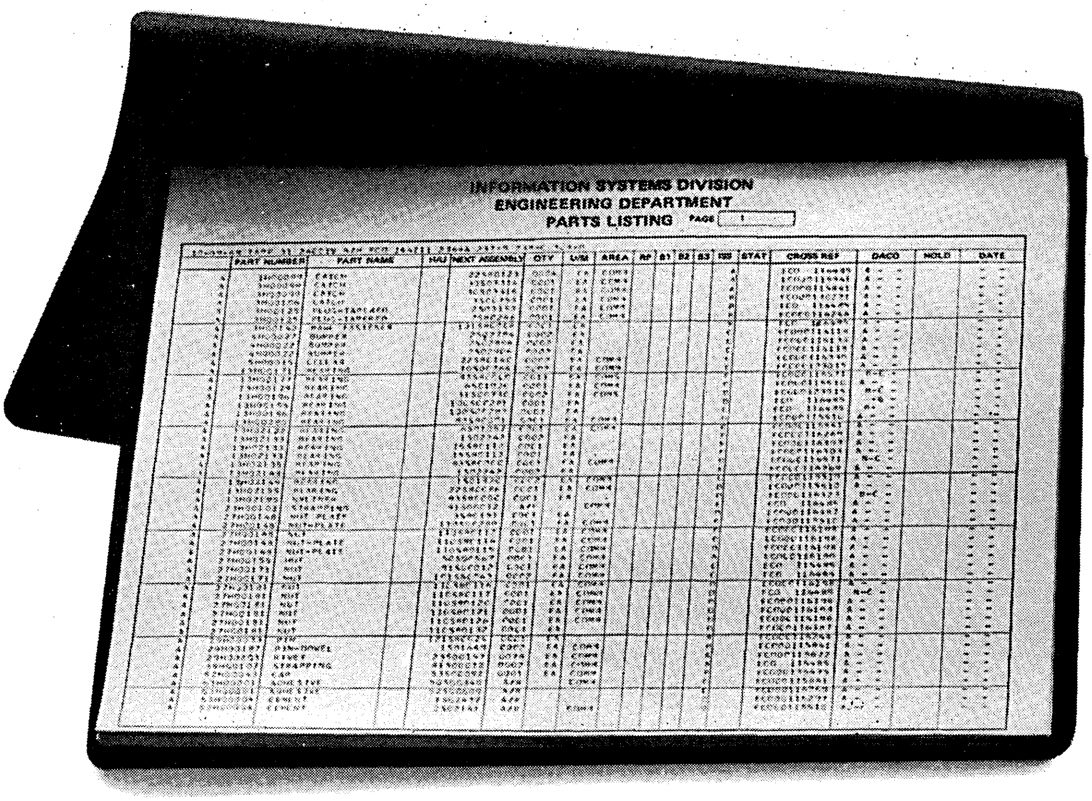
So you can see, service businesses as most people know them have cobwebs on them. It's a whole new technology. And it's deserving of a whole new image to match. A good one. And that's where we come in. We mean business.

**informatics inc.®**
5430 Van Nuys Boulevard
Sherman Oaks, California 91401
Telephone: (213) 783-7500

CIRCLE 162 ON READER CARD

CIRCLE 164 ON READER CARD

# Profit.




**(Easy for you.)**

Your computer was installed because prompt decisions based on current facts can make a difference between your company's profit and loss.

That's just where bulky computer printout can cost your company plenty.

It's hard to route and handle.

Hard to work with.

Copies are limited unless you tie up expensive computer time with additional passes.

Result: People on a decision-making level don't make full use of computer information...and often don't even get it until it's too late to be useful.

The Xerox Computer Forms Printer (CFP) converts printout to individual 11″ x 8½″ reports, all clean and clearly printed.

They are easy to organize and easy to handle.

Headings and guidelines can be superimposed to make the figures easier to understand.

Everyone who needs a copy gets one, all at the same time.

So decisions get made on the basis of up-to-date information.

And the computer spends less time printing...more time tackling new problems.

Telephone your nearest Xerox Information Systems Representative today.

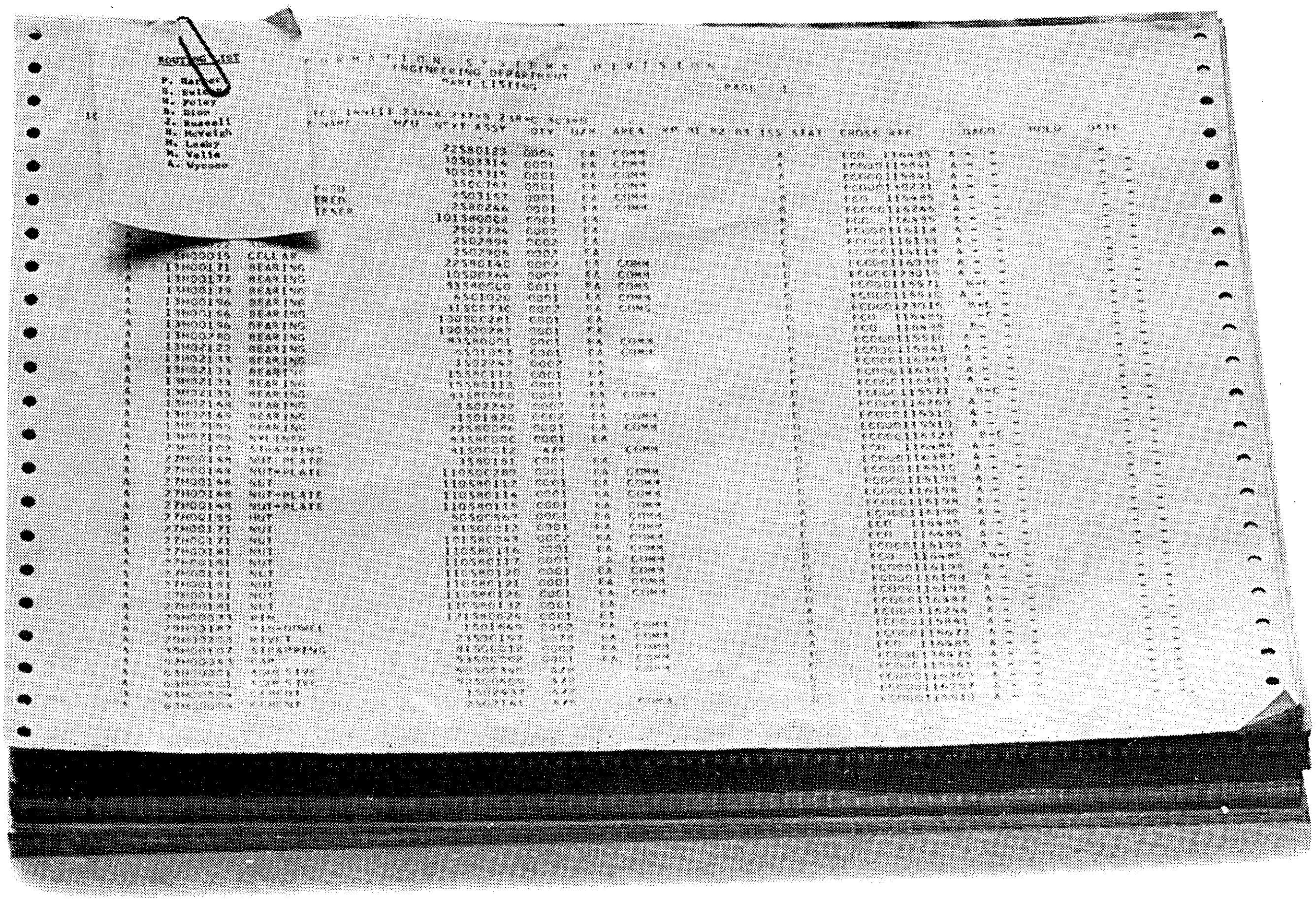
That's a profit-making decision right there.

**XEROX**

COMPUTER FORMS PRINTER

XEROX CORPORATION, ROCHESTER, NEW YORK 14603. IN CANADA: XEROX OF CANADA LIMITED. OVERSEAS: SUBSIDIARIES THROUGHOUT LATIN AMERICA; AND IN ASSOCIATION WITH RANK

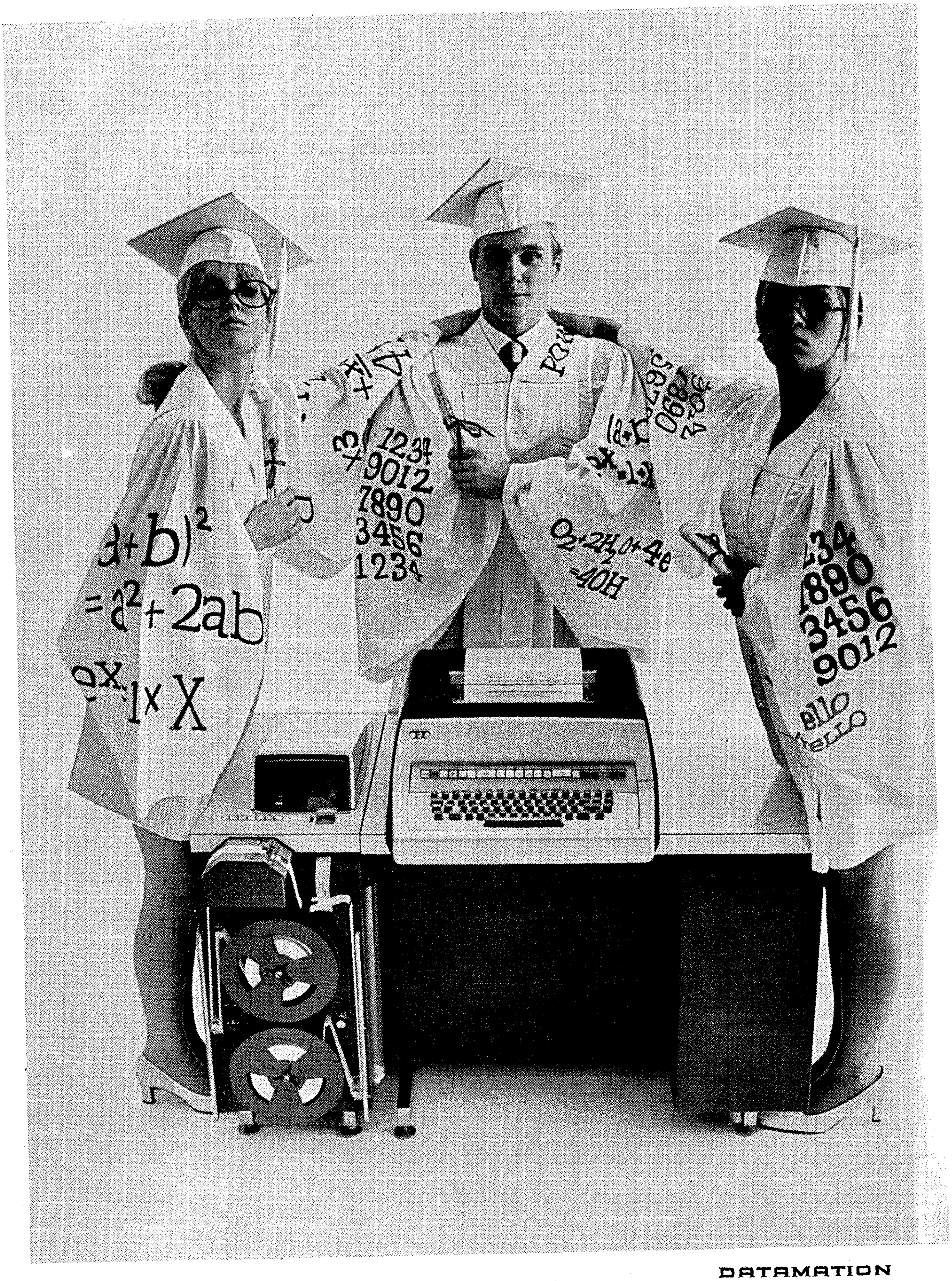
# Loss.



(Easy for the computer.)

ORGANISATION LTD., RANK XEROX LTD., LONDON; AND THROUGH RANK XEROX LTD., FUJI-XEROX CO., LTD., TOKYO. XEROX IS A REGISTERED TRADEMARK OF XEROX CORPORATION.

CIRCLE 165 ON READER CARD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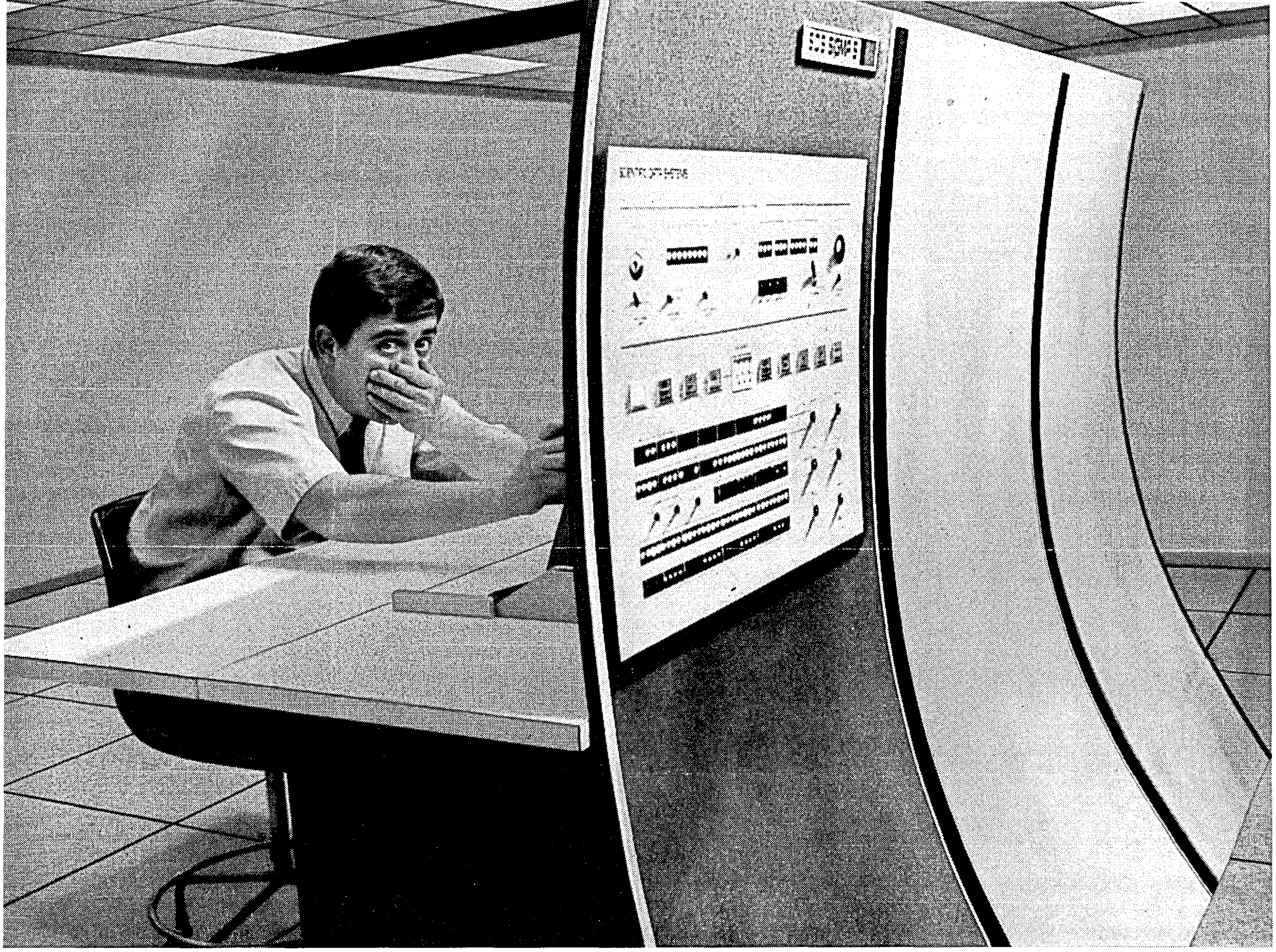
9012



# editor's readout

## WHITHER IBM?

*(Last month's Readout discussing the IBM suits concluded with a request for readers' comments on the implications for the computer industry. Many have been received and we have chosen one for this month's guest editorial. Others will appear in the Forum section later.)*

It is difficult to imagine a data processing industry without IBM, and yet there are those attempting to use the judicial process to accomplish this. It is obvious that IBM has made massive contributions to the industry; a breakup of this collective effort would be dangerous if not disastrous.

Many of us have been exposed to negative practices by IBM—an almost inevitable result of dominance, or absolute power, said to corrupt absolutely. If legal action is used to curb such practices it is clearly beneficial. However, like any corrective action ("fine-tuning," the money managers call it) it can overcompensate, and people can get hurt. My position is therefore clear: legal action to correct, compensate or control the balance of power is fine—if it succeeds in breaking up IBM, or in drastically changing its corporate objectives, I am unalterably opposed to it for the sake of the industry.

It is apparently inevitable that some "unbundling" will occur. This is a natural outgrowth of the industry's development and its potential acceleration by legal action is good. It should be noted, however, that this will be by no means as dramatic as is generally forecast by many of my colleagues. Several factors will reduce the impact:

1. *Buyer Psychology*—The typical buyer tends to buy a complete package—and is nervous about buying subassemblies. The automotive industry is an obvious example. Who would think of buying floormats or a tape player from a separate vendor? Thus IBM will retain continuing control over the sale—regardless of separation.
2. *Competitive Strength of IBM*—IBM is a strong competitor with a well established marketing organization. It will provide very strong competition for any organization in other comparable areas. Despite the optimism of software houses, precariously maintaining high stock multiples, it should be noted that basic operating software cannot really be separated economically. Only in the area of application packages and general utility systems is any competition possible, and there IBM has a natural lead. Education, documentation, systems support and maintenance are areas for separation and yet—who has the largest number of instructors? And who has a Federal Systems Division providing systems support at $30,000 per man-year which is five times larger than the nearest competitor?
3. *Increasing Competition from other Areas*—A totally open industry will attract competition from many other sources. Large firms with lots of capital, already attracted by high multiples of the glamor stocks, will find it even more attractive to enter the field. The smaller software houses, needing additional capital for expansion, will conglomerate to ward off competition, and to strengthen their position vis-a-vis giant IBM.

Thus, changes are coming, because change is inevitable in a dynamic society. However, rapid revolutionary change, dictated by legal action, will be damaging. A gradual evolutionary change, accompanied by much buyer education and increasing sophistication, is the only one our economy and our economic system should allow.

—Dick H. Brandon

less hand wringing

# ON-TIME SYSTEMS MANAGEMENT

by J. E. CONNOR

A concern of rapidly rising interest in using computer systems is estimating and project management. This article suggests that projects can be controlled successfully. To understand what "successfully" means requires a preamble.

A large computer project is always a one-time job. We can expect to manage it about as well as other one-time jobs are managed (a construction project, for example). It is idle to expect such projects to have the predictability of repetitive work. Asked, anyone would agree this is true; much of the hand wringing and many expressions of guilt ignore it though.

Secondly—again for any kind of work, not just computer projects—as we range nearer technological frontiers performance predictions are less reliable. Disc jobs are harder to estimate than tape jobs. Batch is easier than on-line. Programmers who really have done it before make better estimates than those who have only talked about doing it or read about it. One way or another the reliability of an estimate of any kind of project is a function of how close it is to the technological frontier of the participants.

It is not quite so easy to get assent to this second proposition as to the first, because we all want to be part of the newest and the best. The issue is further clouded by computer literature which often overstates what is happening, or describes as existing already our hopes for next year. Think about the proposition as if it were for a project to launch rockets rather than for a computer project. Assent will come.

Finally, the reliability of an estimate is a function of the time devoted to making it. We often aren't willing to spend the time required or aren't allowed to. In such circumstances the estimate cannot be reliable.

It is here suggested that if a proper effort is made to estimate the time and cost required for a computer project and if the project employs a technology well understood by the estimators, then the estimate will be about as good as estimates of construction projects or engineering designs, or other one-time jobs.

With this definition of successful, this article discusses a way to frame the estimate so that control of the project is facilitated. It is either on schedule or everyone has ample notice that it is not and knows precisely why not. The method is in use at several companies.

We will be concerned with four documents—a project evaluation, a project outline, a project schedule, and a project synopsis. Three of these forms are illustrated as we have used them although it is not my expectation that in another company they would be used in exactly this way. The purpose of the article is to sell an approach to systems project management, not the forms.

Three of the forms—the evaluation, the outline, and the schedule—are to be used as the basic agreement with the client department. The fourth—the project synopsis—is an internal detailed "schedule" supporting the broader project schedule forwarded to the client. It lists tasks of a technical nature not likely to be informative to the client, and may contain dates for tasks intermediate to those on the project schedule.

The four documents are intended to serve three purposes:

1. They enable us to allocate our limited manpower resources rationally.
2. They help our client departments to continue to understand what we are doing and, of greater import, to change what we are doing if it is not what they want done.
3. They give us a constant idea of what we set out to do

*Mr. Connor is with the technical services division of the Equitable Life Assurance Society. He has been in the computer field since 1955 and is a past chairman of the SET committee of GUIDE. He has an MBA in economics from New York Univ.*

and how long we expect it to take—eliminating the drift so often observed in systems work, and inhibiting change.

As soon as any manpower is assigned to a project we require that a project synopsis be prepared. On a large project there could be a series of synopses. The first one might only indicate the date on which a feasibility study was to be completed. A feasibility study is completed when we have made available a project evaluation, a project outline, and a project schedule. In the real world there are often a series of feasibility studies, each more detailed than the last. This problem is easier to discuss after we have described the procedure we use for management of the design period.

## project outline

The project outline is used to ensure that everyone concerned with the project has the same understanding of it. It is usually prepared on one page. We discourage multi-page presentations although we have not been able to eliminate them entirely. The project outline is not a systems specification. Usually a systems specification is available only after a large fraction, often a third to a half, of the design time is already expended. The project outline, on the other hand, is prepared at the very beginning of the project and is intended to describe the destination; it is not a road map.

We begin with a single paragraph, labeled "objective," in which the problem that engendered the study is specified. We try not to generalize. A concise statement of the problem is essential. When the objective is to overcome the perceived deficiencies in a going system, we state these deficiencies (see Fig. 1).

Following in a paragraph or two is a brief discussion of the specific limits of the proposal under the label "scope." We do not seek to change the entire world and are anxious to delineate, carefully, that part of it we do hope to improve. It is often useful in this section to state explicitly the things we plan *not* to do. For instance, the project in the example is the first step of several. The steps we are not undertaking are listed.

We are particularly keen to phrase the entire outline in the terminology of the client's business—not in our own jargon. To illustrate that, two sentences in the scope section of the example are deliberately miswritten:

"The project will require the conversion to magnetic tape of name and address data received on information forms. Five computer programs will be written for the maintenance of the magnetic tape file and the printing of the mailing labels."

These sentences are better written this way:

"This project will not convert the existing plates to computer format. Rather it envisions collecting currently correct data on information forms which will be converted to computer format. In addition to replacing the printing of mailing labels, the new system will emphasize correct updating of data collected."

In this second version the emphasis is on the system as the advertising department will see it. The "magnetic tape," "number of computer programs" and "maintenance of the file" are of concern to data processing but not its client.

The third section of the project outline, entitled "departmental responsibilities," is still another attempt to clarify for the client, early in the effort, how the project will work. Here we have a general statement of the area of responsibility for each of the participating departments. We do not list here all the tasks which each of the departments will undertake; we use the project schedule for such a list.

To be noted is the early allocation of the responsibility for implementation to the client department. The last sentence has this intent. More will be made of this in the project schedule.

## project schedule

The heart of this proposal is the project schedule. It serves to coordinate the activities of those involved in the development of a project. It shows the date when those concerned are to produce the parts of the work for which they are responsible.

PROJECT OUTLINE

| PROJECT NO. | PROJECT TITLE | DATE | PREPARED BY: |
|---|---|---|---|
| 327 | Advertising Mailing | 7/1/69 | G. G. Allen |

OBJECTIVE

Replace the address plates used to mail advertising literature to customers with computer generated labels. Add to the file profile data on each of the customers so that literature directed to them will be more pertinent to their needs.

In replacing the address plates verify the accuracy of their information. The new system must be able to maintain addresses and other data much more currently and correctly than the present system does.

SCOPE

This project will require the conversion to magnetic tape of name and address data received on information forms. Five computer programs will be written for the maintenance of the magnetic tape file and the printing of mailing labels. Procedures and forms will be created for the movement of data from Advertising to Data Processing and return. The existing Addressograph file of names and addresses will be eliminated.

This project will make available for use profile information which can serve as a basis for selected mailing lists. At first the profile data will be limited. More elaborate and useful profiles can be provided later, but are not included in this project. However, the programs provided in this project will facilitate this subsequent expansion.

DEPARTMENTAL RESPONSIBILITIES

Advertising is responsible for all aspects of mailing, receiving, and editing of information forms. Office Services will process Information Forms against existing Addressograph plates. Systems will design and write the programs for implementing the system and perform the liaison with Data Processing who is doing the conversion work. With the help of Systems, Advertising will design and develop procedures for changing names and addresses in the file and will be responsible to implement the new system.

Fig. 1

The most important part of the project schedule is to select tasks whose completeness is easily checked. Further, the statement of them should be "ends" oriented: described as a function that will change in the client-department's business, not as the computer-means to accomplish that function.

The illustrated project schedule (see Fig. 2) lists such tasks. Before reviewing them, consider several sample tasks whose completeness is not very easily checked.

1. Complete the block diagram for program A.
2. Complete the conversion of all address plates to magnetic tape.
3. Suggest a final design for the new mailing label.

Tasks like these do need to be completed, but listing them on the project schedule does not help. No one ever knows whether his *own* block diagram is complete. To ask someone else to ascertain whether it is (especially a client not computer-oriented) is hopeless.

The fifth task on the project schedule is: "Demonstrate that address plates are converted to computer and will produce new labels."

To check the completeness of this task, one compares a list made with the address plates against a list made by the computer system. If the lists compare well the computer program which produces them works, the conversion (listed as No. 2 above) to magnetic tape is completed, and the final design for the new labels (listed as No. 3 above) must be satisfactory because the labels themselves have been printed.

On the other hand, anyone who has tried to decide that a forms design is "final" knows how much time it takes and how often one is mistaken. If tasks are chosen like this whose completeness is not easily determined, the determination is not made when the time comes. Early checkpoints are, in fact, missed—although everyone thinks they are complete. This is a feature of central importance to tasks on the list: they are selected and stated so that, when the time comes, their completeness is readily and correctly determined.

The reader should recognize that many tasks whose completeness is easily checked can be listed for the early stages of a project. The task list is of little use if it only lists a few tasks done near the completion of the project. The purpose is to keep track of the project all the way through. Toward this end it is useful, in a project that takes many months, to plan on listing a task for completion about every six calendar weeks.

Let us assume that you require a brief description of each program to be included in the documentation. It is not unreasonable to ask for this description before programming begins, right after we have agreed on a systems specification. In a few cases we will have to rewrite these program descriptions, but since they are brief not much is lost. A great deal is gained if this kind of work is done early rather than left to the crushing final weeks of project implementation.

Also, especially if there is a standard format in which program descriptions appear,[1] such descriptions are concrete tasks which can be finished early.

As still another example of early tasks, much of the work involved in conversion from clerical to computer format can be done early and checked easily for completeness. In the example we have been using, Task 5 requires the completion of a large amount of clerical work and can be scheduled early.

Looking at the tasks listed on the project schedule you will notice that we have suggested that the advertising department prepare the clerical procedures in their final format and that the systems people review them. This is deliberately contrary to the usual practice, and is intended to make completion of the task somewhat easier to check. The real task here is to be sure that the advertising department understands the procedures. This is much more likely if they have written them (with a review by systems) than if the systems people write them and advertising says they understand. As a sign that you understand a procedure, what could be better than having written it?

I believe that the best test of the seniority of a systems designer is the thoroughness of his task list. Unanticipated major tasks just don't occur often on a project scheduled by an experienced computer systems designer who is being careful. In several presentations to corporate executives I have suggested that they make this a test of the competence of their systems staff. They can hardly make a judgment about the organization of your disc files or your choice of a programming language. There can be reasons, beyond the control of any systems designer, for a project being late. But the occurrence of unanticipated, major tasks should be rare if computer people are competent (and not operating too close to their own technological frontiers).

Few of the technical tasks required in implementing a large system are listed on the project schedule. The purpose of the schedule is to coordinate the activities of several participants, only one of them the systems designer/programmer.

**PROJECT SCHEDULE**

| PROJECT NO. | PROJECT TITLE | DATE | PREPARED BY: |
|---|---|---|---|
| 327 | Advertising Mailing | 7/1/69 | G.G. Allen |

| ACTION TO BE TAKEN | RESPONSIBILITY | STARTING DATE | COMPLETION DATE |
|---|---|---|---|
| 1. Decide on feasibility of project | Advertising Executive | 7/1/69 | 7/15/69 |
| 2. Mail all customer info forms | Advertising | 4/15/69 | 7/30/69 |
| 3. Supply a systems specification | Systems | 6/1/69 | 7/30/69 |
| 4. Decide on mailing label | Advertising | 7/15/69 | 7/30/69 |
| 5. Demonstrate that address plates are converted to computer and will produce new labels | Systems | 6/15/69 | 9/1/69 |
| 6. Accept systems specification | Advertising | 7/30/69 | 8/15/69 |
| 7. Complete zip - coding of multi-route cities | Advertising | 4/15/69 | 8/15/69 |
| 8. Deliver computer printed address file | Systems | 8/15/69 | 9/15/69 |
| 9. Deliver clerical forms and procedures | Advertising | 8/1/69 | 9/1/69 |
| 10. Approve address file | Advertising | 9/15/69 | 10/1/69 |
| 11. Approve clerical forms and procedures | Systems | 9/1/69 | 9/15/69 |
| 12. Supply, from test, all systems output | Systems | 10/1/69 | 11/1/69 |
| 13. Agree that output meets specifications | Advertising | 11/1/69 | 11/15/69 |
| 14. System fully operative | Systems | 11/1/69 | 12/1/69 |

Fig. 2

## project synopsis

The project synopsis, which supports the project schedule, is the place for a list of technical tasks to be done. (The project schedule lists tasks which need to be co-ordinated among different departments, although we may wish to add tasks in order to list a checkpoint every six weeks or so). Here too it is important to list tasks easily checked for completeness. For example:

Good choice of task—Complete first listing of Program A, which has no errors preventing compilation.

Poor choice of task—Complete testing of Program A.

The project synopsis is used internally by the systems department to monitor its own work. Some supervisors favor repeating on the project synopsis all the tasks from the project schedule but with earlier dates, but there will be many additional technical tasks of no interest to the client-department. To a considerable extent these technical tasks are repeated for each project. Project synopses rapidly become quite complete as experience is gained with several projects.

Furthermore, because the same tasks are repeated for each project one can seize upon a particularly precise and demanding phrasing and list it in exactly the same words each time. Since the synopsis gets no external circulation no damage is done by the repetitious wording. Private notes which emphasize some part of the objective of particular

[1] Many companies have such standards.

interest or concern to systems may also be added.

Systems work is not considered a capital project, but it has many aspects of a capital project. There is a long period during which the system is being "built." It is finally ready for use and during the period that it is used it has some economic effect on the business. Furthermore, all during its use it deteriorates. Maintenance is required and, despite maintenance, it gradually depreciates.

The form illustrated for project evaluation is very similar to what might be used to appraise a capital outlay. In showing the effect on annual operating expenses, we list personnel changes and changes in equipment rental. Almost everyone who makes an evaluation does this, but we also list the cost that will be required to maintain the programs written. Our estimate of this cost is based on the belief that maintenance requires about 10% as much effort each year as was involved in the initial outlay. It will require about one man working full time to maintain a project which costs us 10 man-years to implement.

Guidelines can be supplied for calculating many of the data required on the form. The systems designer uses these if he has no way to make a better estimate. He is encouraged to make a specific estimate—rather than our generalized one—if he has any basis to do so.

Initial outlay includes the work done by client organizations as well as the systems design, programs, and procedures work which we do ourselves. We estimate the computer cost both for testing and for conversion. One should make a clear distinction between "design" and "implementation." Making this distinction may help as much as any other single practice to improve the quality of our estimates.

Many projects have a very large training cost. This is especially true where a project will be used by many different installations in a business spread across the country or a large geographical section of it; training costs can be large and can be a particularly unpleasant surprise if unanticipated. Lack of training can sharply increase other costs of implementation.

Projects will often be undertaken which do not have a quantitative economic payout. We have deliberately chosen such a project as our example (see Fig. 3) to demonstrate that even when the main reasons for undertaking a project are intangible it is worthwhile doing a project evaluation. We can't quantify the benefits but we can quantify the cost. Knowing one side of the equation is considerably better than not knowing either side.

**PROJECT EVALUATION**

| PROJECT NO. | PROJECT TITLE | DATE | PREPARED BY |
|---|---|---|---|
| 327 | Advertising Mailing | 7/1/69 | G. G. Allen |

TOTAL EXPENSE DECREASE $ 223

TOTAL INITIAL OUTLAY $21,460

**EFFECT ON ANNUAL OPERATING EXPENSES**

| | PRESENT SYSTEM | PROPOSED SYSTEM | EXPENSE DECREASE |
|---|---|---|---|
| A. PERSONNEL (FRINGE BENEFITS 25%) | $ 6,832 | $ | $ 6,832 |
| B. PROGRAM MAINTENANCE ($30X F-2 DEVELOP) | | 300 | (300) |
| C. EQUIPMENT RENTAL | 10,000 | 6,900 | 3,100 |
| D. OTHER EXPENSE CHANGES (SPECIFY) | | | |
| 1. | | 2,300 | (2,300) |
| 2. | | 1,000 | (1,000) |
| 3. | | 200 | (200) |
| 4. | 316 | | 316 |
| 5. | | 6,225 | (6,225) |
| E. TOTAL EXPENSE DECREASE (A-B-C-D) | | | $ 223 |

**INITIAL OUTLAY**

| F. LABOR EXPENSE | MAN WEEKS DEVELOP | IMPLT | TOTAL | | DOLLARS TOTAL |
|---|---|---|---|---|---|
| 1. SYSTEMS DESIGN | 4.0 | 2.0 | 6.0 | X 280 | $ 1,680 |
| 2. PROGRAMS & PROCEDURES | 10.0 | 5.0 | 15.0 | X 280 | 4,030 |
| 3. CLIENT ORGANIZATIONS | | 15.0 | 15.0 | X | 1,500 |
| 4. TOTAL LABOR EXPENSE | | | | | $ |

| | DOLLARS DEVELOP. | IMPLEMENT | |
|---|---|---|---|
| G. COMPUTER EXPENSE | 500 | 1,700 | 2,200 |
| H. MATERIAL EXPENSE | | 50 | 50 |
| I. TRAINING | | | |
| J. OTHER (conversion of old plates) | | 12,000 | 12,000 |
| K. TOTAL INITIAL OUTLAY (F-G-H-I-J) | | | $21,460 |

**INTANGIBLE BENEFITS**

£

1. Ability to perform analysis of market penetration and special mailings which would require a minimum of $10,000 to perform on a manual basis.
2. Ability to purge an existing file of names of addresses which if occurring under the present system would require additional part-time personnel estimated at $666 per year.

Fig. 3

## repetitive project synopses

Earlier we mentioned feasibility studies of large projects. Some projects cannot be comprehended at all in the first few weeks and assembling the paperwork discussed here is out of the question as an initial target.

Remember the purposes we have for this paperwork. Eventually the synopsis lists a date for completion of the paperwork. If it will be several months before that can be done the synopsis can list other concrete tasks of which the completion may be checked easily. As an example, this task: "Supply a date when a feasibility study will be available" can itself be dated. It allows the systems designer several weeks (from now till the date set) just to decide how long the feasibility study will take.

The point is not to allow waste of time early in the project by having no fixed objectives and no schedule. For the most amorphous projects, a few tasks can be selected and dated with just a few days thought.

## conclusion

From the beginning, systems projects should be aimed at the completion of concrete tasks in a few weeks. One of the early tasks is the completion of project paperwork describing the project.

The project outline is a written statement of the objective of a project. It has as its first purpose preventing the drift which characterizes so many large projects. During the course of the project the outline is re-read from time to time. If it no longer describes the current project, a conscious—as opposed to the usual practice—change can be made in the outline. If the drift from the original outline is not in order, the project can be brought back on course.

The heart of the project schedule is a task list. Each task must be selected and phrased so that the completion of it is easily checked and not subject to dispute. With such a task list, projects can fall behind schedule—but no one will be surprised. ■

not so easy

# HARD COPIES FROM CRT TERMINALS

by ROBERT RINDER

Despite the predictions of a paperless society, some companies are working determinedly in exactly the opposite direction. Their activities center around the production of hard copy prints from crt terminals.

The crt terminal offers users a substantial improvement over electromechanical teleprinters in the form of higher speed, quieter operation and greatly increased flexibility in the formating and editing of data. However, the inability to obtain a hard copy from such a terminal has been a major drawback in some applications; thus a number of firms are turning their attention towards solving the problem.

Ideally, the crt printer is envisioned as functioning somewhat as follows: the user, searching a data base for example, calls up by means of entries on a keyboard a number of displays on his crt screen. When he finds a display containing the pertinent information he depresses a PRINT function key, and out rolls a printed copy of the display.

It is somewhat ironic that crt terminals are precisely the devices which were originally expected to make the paperless society possible. The crt terminal connected to a powerful computer was expected to replace the filing cabinet; since all information could be instantly accessed and displayed, the need for storing information on paper would no longer exist.

In fact, if an economical crt copier can be developed there may be a proliferation of paper rather than a diminution. To see why, consider only the tremendous impetus such a device would give to the transmission of both textual and nontextual data. By the use of TV techniques, not only alphanumerics but pictures and graphs can be transmitted and duplicated at high speed. In addition, when crt units can provide a convenient means for the recording of data from remote locations there will be a substantial increase in the dissemination of data over communication systems, and the storage of that data on paper.

Although a case can be made for storing all data in a computer it is expected that for some time it will be cheaper and more convenient to store many categories of informa-

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tion on paper rather than in a computer. In any case, present requirements demand hard copy prints for various forms of data.

### application areas

The following are some of the broad areas in which the use of hard copy printout from crt terminals is indicated:

1. Results, and intermediate results, of computations on a time-shared system.
2. Customer receipts in retailing.
3. Legal documentation in banking and finance.
4. Ticket systems using remote ticket terminals.
5. When access to data would be difficult due to indexing problems.
6. When future access to the received data is required at places removed from the crt terminal location.
7. When storage and indexing of computer generated data is uneconomical.

There are many possible approaches to hard copy printout, corresponding to the large number of copying or reprographic methods available. Given the apparent need for a crt printer, why are they not prevalent? What are the problems of implementation, and what can be expected in the near future?

Such printers will generally require the application of two technologies, optics and reprographics. The field of reprographics is a highly diverse and rapidly expanding technology. Since the 1950's, activity in reprographics has mushroomed to the point where there are now 21 copying processes and some 33 manufacturers producing and marketing copying equipment. And research in reprographics continues to be intense, making it impossible to predict exactly what methods may be eventually adapted for crt copying over the next several years.

Despite an extensive technology of reprographics, the development of a low cost crt copier which can deliver acceptable quality copies has proven elusive. Given the prevalence of office copiers the difficulties of implementation are not readily apparent to the uninitiated. Upon first approaching this subject the solution appears to be deceptively simple. Since the crt display produces a luminous image, it might be thought that it would only be necessary to expose the image to a photosensitive paper.

However, even when paper is in contact with the crt face plate, the thickness of the glass is sufficient to allow dispersion of the light rays. Thus one immediately encounters the need for an optical system. With a lens system the crt image can be focused, but typically only 1-2% of the emitted light will reach the photosensitive paper. (About 2% of the emitted light will be in the cone intercepted by the lens.) Also, prevention of distortion due to the curvature of the crt image surface is difficult to implement economically.

Some crt's are available in which bundles of optic fibers are imbedded in the glass face plate. The optic fibers can pipe the light to the paper with a much higher light output and less distortion than a lens system.

Whether a lens system or fiber optic system is used, the cost immediately becomes large for any display of reasonable size.

Another difficulty which faces the designer is the mechanical configuration of the copying equipment in the visual display. If a reprographic method is used which employs a light-sensitive paper, this paper must be stored in a light-tight compartment. The problem then is to transfer the direction of the image light rays from one that is convenient for observation by the user to one which can focus on the light-sensitive paper.

Two approaches have been used to solve this problem. In one case, mirrors are positioned to intercept and reflect the image on the crt from the viewer to the copy paper. The other approach is to use a completely separate crt for imaging on the paper from that used for viewing by the operator. This has the advantage that the crt used for printing can be designed specifically for the characteristics required of the printing operation without compromising the characteristics required of the viewing crt. For example, techniques are available for reducing optical requirements by imaging only one line of print; or even one crt scan line. Then, by moving the paper, the copy is imaged line by line. Here, a reduction in the cost of the optical system has been traded off for increased mechanical complexity and slower reproduction times. In any of these systems it is clear that the complexity and, therefore, the cost of the printer must be increased over what would be expected from a simple placing of the paper against the face plate of the viewing tube.

### more problems

An added complication arises in many commercial applications requiring the formating of information and the documentation of transactions. Most office copiers are designed to reproduce images on an 8½ by 11 sheet of paper without regard to formating. However, for crt applications, in which it is desired to reproduce such items as legal documents, tickets, customer receipts, etc., it is highly desirable to be able to print on preprinted forms. The preprinted form provides an authenticity, legitimacy and capability for font variation that is impossible to obtain from a crt printout directly. But the requirement for the use of preprinted forms immediately puts strict requirements on the reprographic process. Most reprographic processes, especially those that are most attractive for use with crt copiers, require specially coated paper. The xerography process avoids this limitation, having the capability to reproduce on ordinary paper, and is thus suitable for use with preprinted forms. However, this process is relatively costly and complex, requiring as it does the five following separate steps to image and develop the copy:

1. Charge photosensitive drum or plate.
2. Project image onto charged surface freeing electrons in proportion to light received.
3. Dust powder on drum. Powder adheres selectively to charged areas.
4. Place copy paper in contact with drum to transfer powder to paper.
5. Apply heat to fuse the powder to the paper.

The complexity of the xerography process and requirements for drum maintenance precludes wide-scale adoption in its present form for crt terminal copying.

When the use of preprinted forms is not a requirement, processes other than xerography appear more feasible. The dry silver process is particularly attractive because it requires only two steps for printing. Dry silver utilizes specially prepared paper coated with light-sensitive chemicals. The paper is exposed to the crt image, and then developed simply by the application of heat.

Another reprographic process which appears attractive for use when preprinted forms are not required is the electrofax process. Electrofax is widely used in office copiers. Like xerography, it uses an electrostatic charge to form the image. However, in place of a selenium drum, a paper coated with zinc oxide is used. The coated paper is first charged in the dark. Light from the crt reaching the zinc oxide frees electrons, producing an electrostatic image. The image is developed by either brushing with a charged powder, or using a powder suspended in a hydrocarbon liquid. Dry powder is fused to the paper by heat. Thus, the electrofax process is a three- or four-step process.

Most of the many other copying processes available are eliminated for application to crt copiers because they are either unsuitable for imaging from a crt phosphor source, or because they require the use of liquids, producing wet copies which must be rated unacceptable to most users. In the former case is included thermographic processes which rely on temperature differences in the source data. One wet process which might be acceptable is the electrolytic, since only slight moisture is required for development. The electrolytic process is widely used in microfilm reader-printers, an environment that is somewhat similar to that of crt terminals.

Table I summarizes the characteristics of the most promising reprographic methods for adaptation to crt terminal printing.

### other methods

Other approaches have been considered that are derived from the high speed, nonimpact printers developed for large-volume computer output or facsimile reproduction. These are generally electrostatic devices which use special crt's to charge a paper. The paper is then coated with powder and fixed. In one form, the crt is made with a very thin face plate. The paper in contact with the outside of the face plate receives charges deposited by the electron beam on the inside. The small thickness of the face plate prevents excessive divergence of the charge pattern between surfaces.

Another adaptation of the crt for printing is the use of a wire face plate. In this arrangement fine wires are used instead of optic fibers to pipe the image from the interior of the crt to the surface of the paper. An image is formed on the paper, then developed by electrostatic methods. These approaches using electrostatic read-out appear to offer the potentially highest speed printing equipment. The problem is to get cost and size down to what is acceptable for use in a crt terminal environment.

Other requirements which a crt printer should meet in order to adequately serve as part of a terminal are as follows:

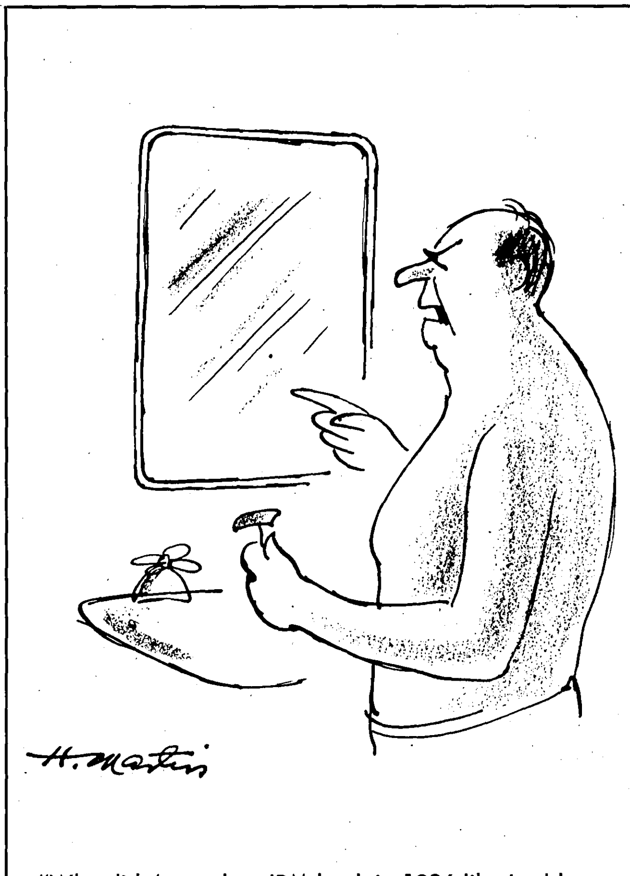
1. *Speed.* Crt printers which are intended for use in an on-line environment must be able to match the response times that are expected of on-line terminals. This would make the desirable speed for the printing of one full crt display approximately 3 seconds, and anything over 5 or 6 seconds would be considered excessive.
2. *Size of Equipment.* In most working areas where crt terminals are used, space is at a premium. In these applications even most desk-top copiers must be considered too large.
3. *Permanence.* In some applications archival quality will be required. Many reprographic processes are not archival due to a gradual fading of the image. Unfortunately, this is the case for the dry silver process. However, it is possible to obtain an archival copy from a dry silver original by means of the xerographic process.
4. *Size of Copies.* A general-purpose copier should be able to produce copies up to at least 8½ by 11 and if possible up to a legal size paper. However, cost of fiber optic tubes and lens systems go up rapidly with the size of the image. Therefore, users may be willing to settle for smaller copies in order to obtain lower cost equipment.

At present there is, unfortunately, no one reprographic method that meets the functional and cost requirements for crt printers. In the near future users can expect crt terminal copiers offered as separate units that will sell for around $3,000 to $10,000, depending on copy size and speed. The size of the copier will be about that of office desk-top copiers. Copiers integrated into a crt terminal are not expected to be available in first-generation units. Again, first-generation copiers are expected to require specially coated papers, and not be amenable to use with preprinted forms, except perhaps in very special applications.

Hopefully, a new reprographic method will eventually be developed which can provide a truly general-purpose, low-cost and compact crt copier unit. ■

| | Complexity: Number of Processing Stages | Relative Equipment Cost (Appr.) | Relative Speed (Appr.) | Appr. Cost per copy | Lines or Fiber Optics Required | Special CRT Required | Special Paper Required | Continuous tone Quality | Resolution | Copies Curl | Permanence is Archival | Positive Copies from Negative (Normal) CRT Display |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Xerography | 5 | High | Fast | 1¢ | Yes | No | No | Poor | Excellent | Low | Yes | Yes |
| 2. Dry silver | 2 | Low | Slow | 2¢ | Yes | No | Yes | Fair | Excellent | Slight | No | Yes |
| 3. Electrofax | 3 or 4 | Interm. | Fast | 2½¢ | Yes | No | Yes | Fair | Excellent | Slight | Yes | No |
| 4. Electrolytic | 2 | Low | Fast | 9¢ | Yes | No | Yes | Fair | Excellent | High | Yes | Yes |
| 5. Wire or thin crt face plates | 4 | High | Very Fast | NA | No | Yes | Yes | NA | NA | NA | Yes | Yes |

Table 1 — Characteristics of reprographic methods adaptable to crt terminals



"Why didn't you buy IBM back in 1936 like I told you to?"

# TESTING FOR PROGRAMMING APTITUDE

better than tea leaves

by JACK M. WOLFE

The testing of programming aptitude cannot be 100% accurate as an instrument of prediction of a person's future performance in programming. Even if the test were a most superior one, the person being tested is highly variable. A person's attitude and purpose in taking the test can affect his performance on the test. And there are many factors that can cause a person's powers of concentration on work of intricate logic and protracted detail to vary from one time to another. Whereas it is customary to take a number of samples in measuring characteristics that are not in a fixed state and interpret the resulting measurements by consideration of average and dispersion, a programming aptitude test is usually administered only once.

While employers generally compare aptitude test results with the evaluation of the training class instructor, the on-the-job performance of the person is actually the more important criterion in evaluating the predictive effectiveness of a programming aptitude test. The training instructor may tend to underestimate the slower worker, not only because he scored lower on the timed tests but also because he was slower in seeming to understand the work presented. Our experience with the *Aptitude Assessment Battery: Programming* shows that a substantial number of slow workers are capable of superior work if they are allowed to proceed at their own normal pace. Whereas an aptitude test in which speed is an important factor more closely simulates the training class situation, a test that is "open end" with regard to time is a better simulation of the on-the-job work situation. More than 90% of the persons taking the test, which does not have a fixed time limit, finish it in four hours or less.

## what is tested

The test measures the following characteristics: accuracy, deductive ability, reading comprehension of a complicated and extended explanation of a kind found in programming reference manuals, ability to grasp new and difficult concepts from a written explanation, and ability to reason with symbols. Some persons are highly accurate, show good reading comprehension and do only moderately well on the logically intricate problems. On the other hand, a person highly capable with regard to the logical aspects of the work may be a somewhat careless worker who does not check his work before turning it in. Yet these two entirely different kinds of workers may end up with the same numerical score, for assigning a numerical score for the test as a whole is like trying to characterize a multi-dimensional composite as a one-dimensional entity. The evaluation therefore includes not only a total score and a percentile ranking but also a description of the person's strengths and weaknesses as revealed by his performance on the test. When the applicant is tested by the user company, the test is sent to the publisher for evaluation. Results are usually sent out within 48 hours.

Table 1 shows the relationship observed between test score and time. The tabulation was based on norms obtained from the results of 727 programmers and programming trainees tested in approximately 185 companies and

Table 1 Relation of score and time
(Norm group: programmers and programming trainees)

| | SPEED | | | |
|---|---|---|---|---|
| SCORES | Slowest Quartile | 2nd Quartile | 3rd Quartile | Fastest Quartile |
| Highest Quartile | 21% | 20% | 25% | 34% |
| 3rd Quartile | 22% | 24% | 26% | 28% |
| 2nd Quartile | 24% | 29% | 27% | 20% |
| Lowest Quartile | 34% | 27% | 21% | 17% |

government agencies. These results were calibrated to apply to an equal number of programmers and trainees. The lowest 10% of this group has been omitted from the tabulation because of the fact that they not only showed poor performance on the test but also tended to omit problems that they did not understand. Thus their "fast" time was often the result of their not completing the job.

As can be seen from the table, the relationship between

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score and speed of working is not a pronounced one. Over 20% of the persons who scored in the highest quartile actually worked at a pace that placed them in the slowest quartile. The coefficient of correlation between score and time was —.186.

Thus, while there is some tendency for speed to be related with test score, the use of speed to eliminate some persons from consideration for employment will generally mean that less capable persons will be employed instead. Although an installation does need some programmers who can work quickly and under pressure, some slower workers who are highly capable may be assets in a programming department.

Slowness, moreover, does not apply to all aspects of a person's work. In a study by E. F. Bairdain of the IBM Corp., as reported on page 16 of the 1967 Proceedings of the Computer Personnel Research Conference, less than one third of a typical programmer's time was spent in reading or writing. Since accuracy is far more important in programming than speed, a speed test has the effect of underestimating the programming aptitude of the slower worker who is very precise and likes to check his work as he goes along. Applicants who could become superior programmers may be rejected as trainees because of a slower-than-average rate of work despite a superior degree of accuracy and comprehension. The highly accurate worker, moreover, although perhaps seemingly slower, may actually prove to be the faster programmer in that he will tend to require fewer debugging tests. In this regard he will be the less costly programmer as well, for he will require less machine time to check out his programs.

Chart 1 shows that of the 869 persons who took the test and indicated their present occupation as other than programmer or programming trainee only 5% did as well on the test as the top 10% of the norm group, that is, the group of 727 persons who were programmers or programming trainees. It is significant to note also that 30% of the non-programming group scored in the lowest decile of the norm population. The fact that as many as 29% of the non-programmers scored better than the median of the programming group tends to verify that the test does not measure programming knowledge, experience or techniques. The characteristics that it does measure are possessed by programmers as a group to a higher degree than by the non-programming group. But these results show that there is a very substantial number of non-programmers who are superior to the average programmer in those characteristics. It is from among this non-programming group that new trainees must be found, for industry obviously cannot meet all of its programming needs by the bootstrap method of hiring away each other's programmers—even with a salary boost at each turn.

It should be stated at this time that this report is in the nature of a progress report. The test has not yet been validated statistically against a reliably controlled criterion of programming aptitude. Such a validation study is now being made by a government agency. We believe that this agency will make its report available for publication when its study is completed. There are at the present time, however, many indications that the test is proving of value to companies that have conducted their own in-house validation studies.

## results by occupation

Charts 2 through 14 show the distributions by various occupations. These distributions are shown in terms of deciles based on the scores of the norm group of 727 programmers and programming trainees. The intervals shown are the top and bottom deciles and the four intermediate intervals of two deciles each.

Chart 2 shows the test results of the 32 systems analysts who had not had programming experience. Although 9% scored in the top decile of the norm population, this group had 19%, or proportionately almost double the normal number, scoring in the bottom decile of the norm group. Persons who score in the bottom two deciles, as well as some who score higher, are not recommended for employment in programming. Not quite half of the systems analysts, 44%, scored in the upper half of the norm distribution.

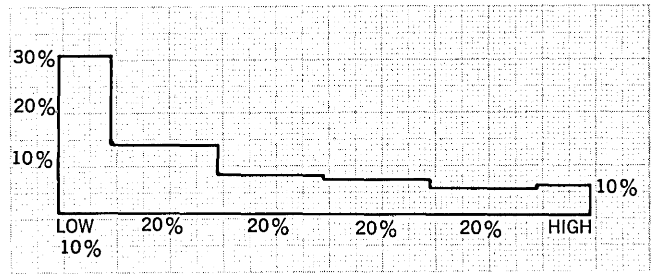


**Chart 1—Total of all specified occupations other than programming trainee (869)**

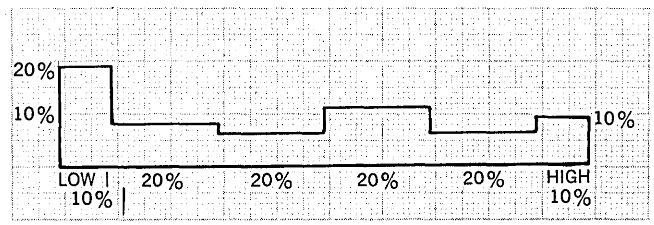


**Chart 2—Systems Analysts (without programming experience) (32)**

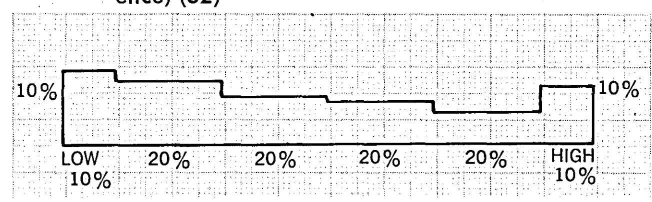


**Chart 3—4-Year College students (or very recent graduates) (84)**

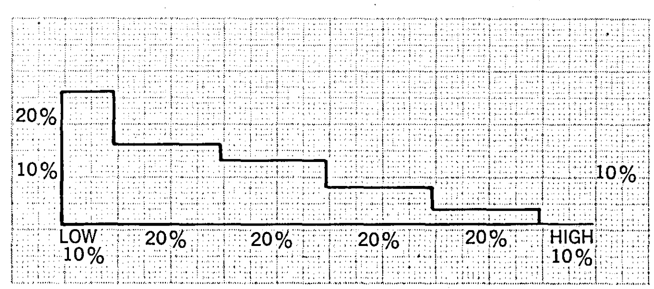


**Chart 4—2-Year College students (or very recent graduates) (20)**

Chart 3 shows that almost 12% of the 84 four-year students scored in the top decile of the norm group. This college group, however, also had more than the norm group in the bottom decile, 14%. Forty-four per cent of the college group, which also includes recent graduates seeking full-time employment in programming, scored in the upper half of the norm group. This is the same percentage as was found for the systems analysts who had had no previous programming experience.

Chart 4 shows the results of the 20 two-year college students. None of this group scored in the top decile of the norm group while 25% were in the bottom decile. This is of particular interest because many of these persons had studied data processing, programming and systems work in the course of study at the two-year institutes. Only 20% of this group scored in the upper half of the norm group.

Chart 5 shows the test results of 12 professional mathematicians who had no programming experience. These persons were employed as mathematicians and not as teachers. Although this group is small and the results may not be statistically valid, these observations are of some interest. Twenty-five percent of this group scored in the top decile of the norm distribution and no person in this group scored in the bottom decile. It should be noted, however, that 42% of the mathematician group scored below the median of the norm group. This occurrence of almost half of the mathema-

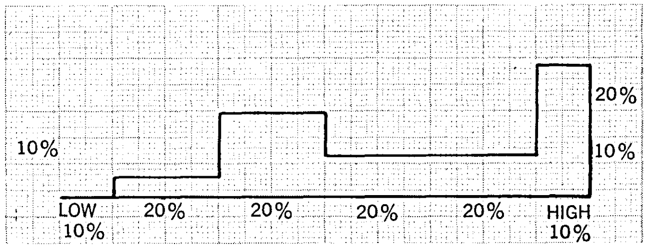


Chart 5—Professional Mathematicians (without programming experience (12)

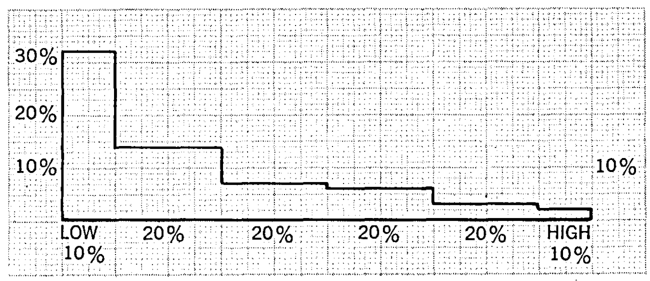


Chart 6—Computer operators (137)

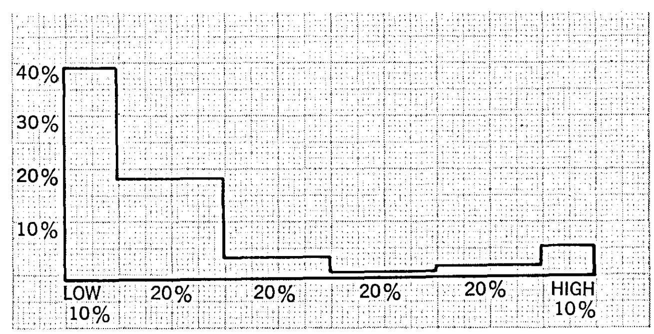


Chart 7—Tab operators (47)

tician group scoring below the median of the programmer/trainee group is evidence that the test is not merely a test of mathematical knowledge and ability.

Chart 6 shows the test results of 137 computer operators. Apparently many companies seek among their computer operators for promotion to programming. Only 3% of these computer operators scored in the top decile of the norm group, while 32% scored in the bottom decile. Although computer operators have a background of computer concepts and programming concepts as well as computer operations, only 25% of the group scored in the upper half of the norm group. Thus the test does not favor persons with a computer background on the basis of their knowledge alone.

Chart 7 shows the test results of 47 tab operators. It is of interest to note that this group had 6% in the top decile whereas the computer operator group had only 3%. This is probably due to the fact that the tab operator group included a number of tab supervisors who were being considered for programmer trainee jobs. In the other observations the tab operator group showed up as less capable for programming than the computer operator group. The tab op-

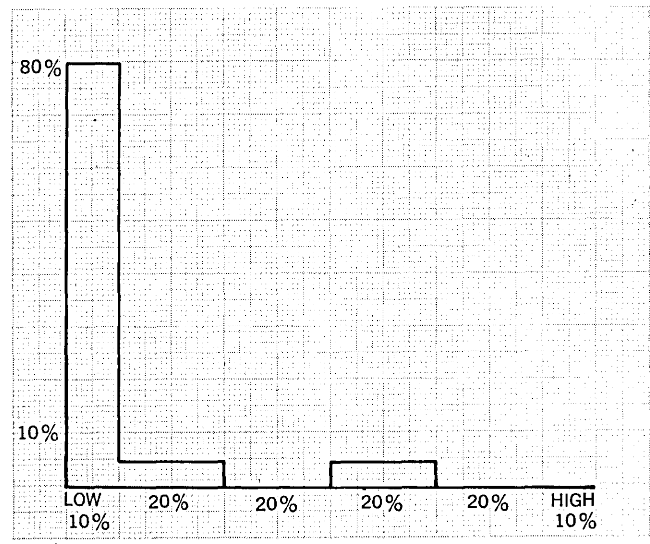


Chart 8—Keypunch operators (10)

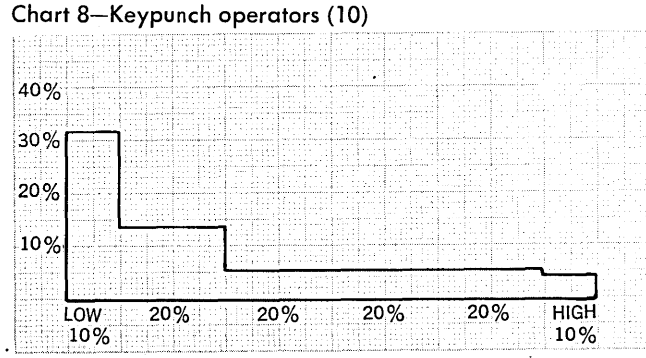


Chart 9—Technicians (77)

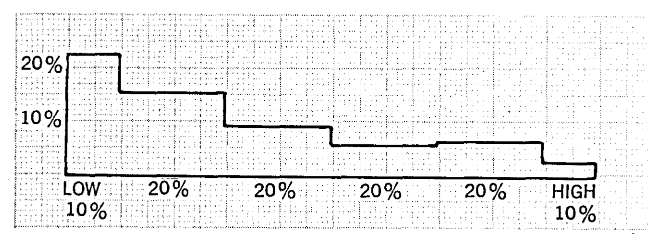


Chart 10—Accounting (67)

erator group had 40% scoring in the bottom decile and only 13% scoring in the upper half of the norm group.

Chart 8 shows the results of the 10 keypunch operators who have taken the test. While this is too small a group for statistical validity, the results may be of some significance because of the extreme nature of the distribution. None of these 10 persons actually scored in the top 40% of the norm group while 80% scored in the bottom decile. Only one of the 10 keypunch operators tested scored in the upper half of the norm group.

Chart 9 shows the results of the 77 technicians who have taken the test. While only 5% scored in the top decile of the norm group, there were 32% in the bottom decile. The technician group had 27% who scored better than the median of the norm group.

Chart 10 shows the test results of personnel from the accounting department of their company. Of the 67 such persons tested, 3% scored in the top decile and 22% scored in the bottom decile. The accounting group had 28% scoring in the upper half of the norm distribution.

Chart 11 shows the test results of clerical and secretarial workers. Of the 123 persons in this group no person scored

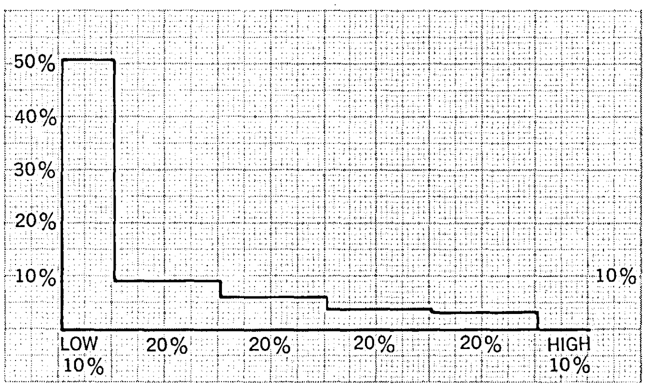


Chart 11—Clerical and Secretarial workers (123)

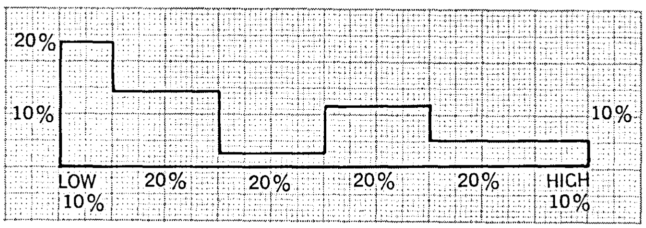


Chart 12—Teachers (17)

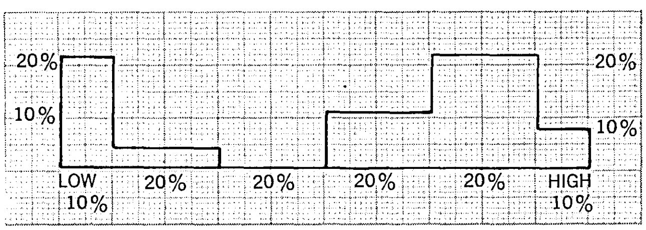


Chart 13—Professional Engineers (14)

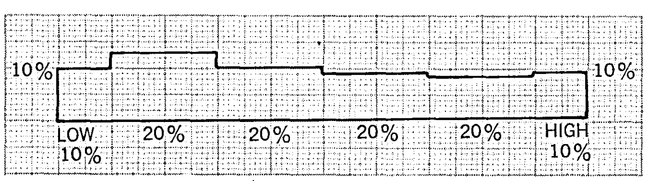


Chart 14—Programming trainees (129)

in the top decile of the norm group while 51% scored in the bottom decile. Eighteen per cent of this group scored in the upper half of the norm distribution.

Chart 12 shows the test results of 17 teachers of elementary school or high school who had applied to various companies for employment as programming trainees. Six per cent of this group scored in the top decile of the norm group while 24% scored in the bottom decile. Forty-one per cent of the teacher group scored in the upper half of the norm group.

Chart 13 shows the results of the 14 professional engineers who took the test. This group had 7% in the top decile of the norm group and 21% in the bottom decile. Seventy-one per cent of the engineers, however, scored in the upper half of the norm group.

Chart 14 shows the results of the 129 trainees, who are themselves included in the norm group. Nine per cent of this group scored in the top decile of the norm distribution while 10% scored in the bottom decile. Forty-three per cent of the trainee group scored in the upper half of the norm group.

### trainee selection

Prevalent selection procedures in the hiring of trainees generally include an interview with consideration of the personality and background experience of the applicant, a general intelligence test and a programming aptitude test. The latter is usually the test supplied by the computer manufacturer. Additional testing of vocational interest is sometimes administered as well. While these procedures are producing a full range of trainees from superior to low, they are not effective in selecting the above average trainees and rejecting those who are at the low end of the programmer scale. This situation may be due to the preference for college graduates in hiring from the outside even when there is no evidence of the special kind of work habits and mental abilities required for successful work in programming.

The many mistakes made in internal promotion to programming from some other department are probably attributable to the prevalent idea that it is easier to teach programming to a person who already knows the business of the company than to teach the business to a newly employed programmer. This is probably true, however, only for those persons in the company who happen to have the necessary aptitude for programming. It is likely to prove unsuccessful for persons who do not have such aptitude regardless of how extensive their knowledge of the company's business may be.

| Occupation Group | Scored Above Median of Norm Group | Scored in Lowest Decile of Norm Group | Scored in Highest Decile of Norm Group |
|---|---|---|---|
| Professional Engineers (14) | 71% | 21% | 7% |
| Professional Mathematicians (12) | 58% | 0% | 25% |
| 4-Year College Students (84) | 44% | 14% | 12% |
| Systems Analysts (with no programming experience) (32) | 44% | 19% | 9% |
| Programming Trainees (129) | 43% | 10% | 8% |
| Teachers (17) | 41% | 24% | 6% |
| Accounting Dept. Personnel (67) | 28% | 22% | 3% |
| Technicians (77) | 27% | 32% | 5% |
| Computer Operators (137) | 25% | 32% | 3% |
| 2-Year College or Institute Students (20) | 20% | 25% | 0% |
| Clerical and Secretarial Personnel (123) | 18% | 51% | 0% |
| Tab Operators (47) | 13% | 40% | 6% |
| Keypunch Operators (10) | 10% | 80% | 0% |

Table 2 Comparative results of various occupation groups relative to the norm group of programmers and programming trainees.

Table 2 shows the results of the various groups arranged in descending order of the percentage scoring above the median of the norm group. The number of persons in each group may reflect to some extent the present practice of personnel managers with regard to the groups from which they seek to obtain new programming trainees, or it may reflect the degree to which persons in those groups apply for programming positions and get as far as the aptitude testing. In some groups the results may not be valid because of the small number of persons tested.

The mathematician group is the only group that was superior to the norm group of programmers and trainees in all three of the following measures: more than 10% in the top decile of the norm distribution, more than 50% in the upper half of the norm distribution, and less than 10% in the bottom decile of the norm distribution. The mathematicians, however, did not uniformly do well on the test of programming aptitude. Programming ability and mathematical ability do not appear to be identical.

none at all. The majority had no prior instruction in programming.

Persons doing internal accounting work, and having no prior experience in programming or data processing, seem to be a better group to tap for above-average programming aptitude than the graduates of the two-year community college or technical institute. As a group, in fact, the accounting people even performed better on the test than did the computer operators.

Chart 15 shows for each group the norm percentile ranking of the lowest score for that group, the norm percentile of the 10th percentile of the group, of the median, of the 90th percentile and of the highest score of the group. The numbers on the top bar are the norm percentiles. The left

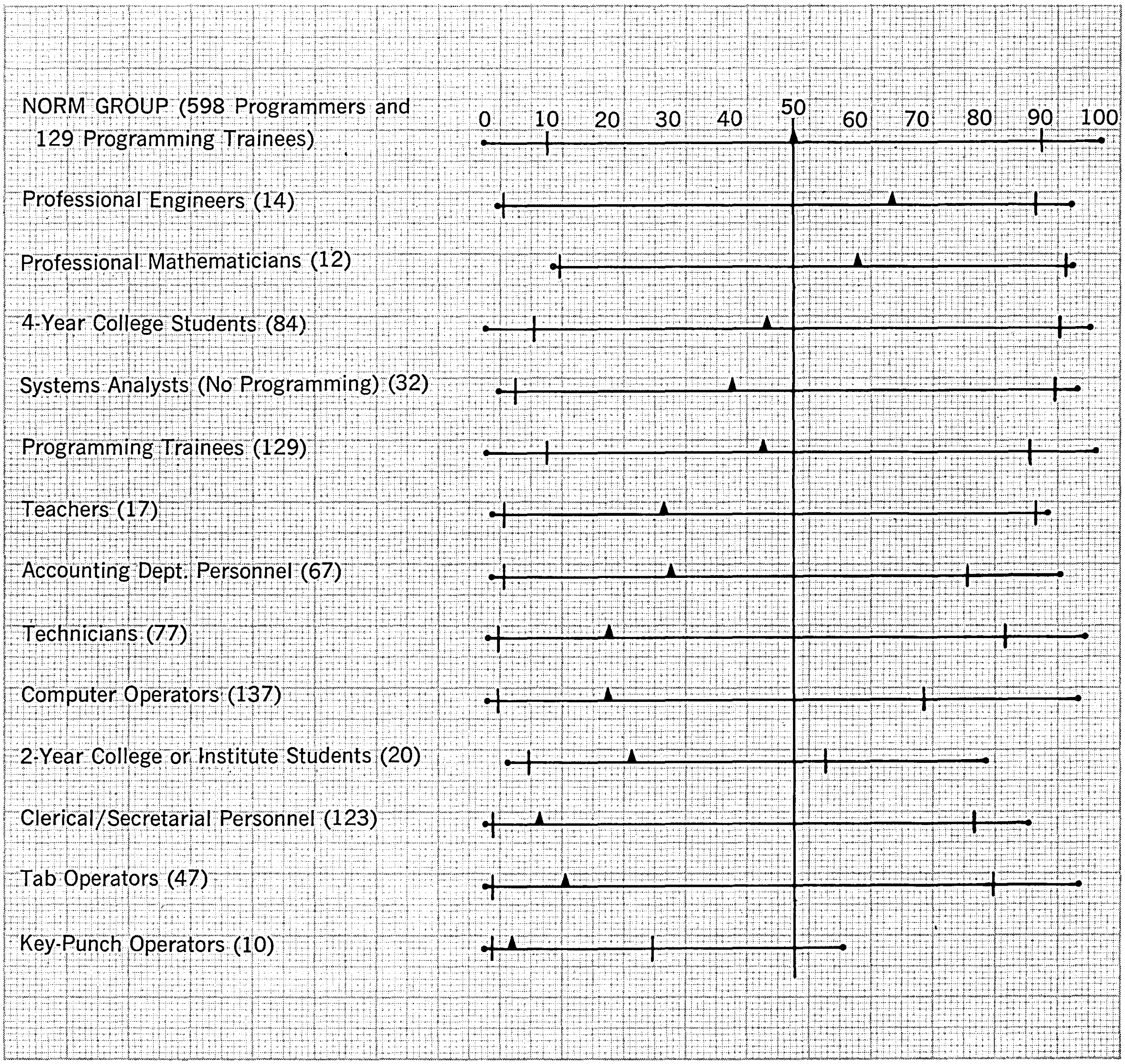


Chart 15—Group distributions in terms of norm percentiles

The applicant from the four-year college appears to be significantly superior to the applicant from the two-year college or institute although the latter group contains persons who had specialized in data processing and had one or more courses in programming. In the four-year college group most persons had a single course in programming or

end of the bar for any group, when read according to the scale on the norm bar, indicates the norm percentile of the lowest score in that group. Thus the lowest score of the group of professional mathematicians fell at the 21st percentile of the norm distribution. The vertical stroke on the bar, near the left end, indicates the percentile of the norm population at which the 10th percentile of the group population fell. Thus the 10th percentile of the systems analysts' scores fell at the 5th percentile of the norm population.

The middle mark, the arrowhead, indicates the median of the group. Thus the median score of the accounting group corresponds to the 30th percentile of the norm population. The vertical stroke near the right end of the bar indicates the 90th percentile of the group. Thus the 90th percentile of the scores of the computer operators fell at the 71st percentile of the norm population. The right end of the bar indicates the norm percentile of the highest score of the group. Thus the highest score of the keypunch operators corresponds to the norm percentile rank of 57.5.

It is interesting to observe that every group had some representation in the upper half of the norm distribution. Except for three groups—two-year college or institute students, clerical and secretarial personnel, and keypunch operators—every group had some representation in the top decile of the norm population.

### where to look

It is not likely that very large numbers of new programmers can be obtained from the groups of professional engineers or mathematicians. The members of those groups who are interested in programming careers, moreover, will probably be interested in scientific programming rather than business applications. While the college graduate group appears to be attractive, the cream of the crop will probably take the most attractive offers. Many of these persons will be working in scientific applications or for the very large corporations. To seek programming personnel in the lower levels of the college graduate group, with regard to their programming potential, rather than in the upper levels of other groups, may be a costly mistake. Persons should be evaluated as individuals and not cloaked with "group attributes."

While it will generally be necessary to consider significantly more applicants from a lower group to find the persons with high potential for programming, the search might well be done in one's own company. Such persons, when identified and trained by their own company, are also likely to remain as long-term employees of the company. They will also be coming to the programming department with a practical background of experience in the company's business. They can be valuable liaison contacts between the programming department and other departments, probably more so than a person brought into the programming department from outside the company. Although the percentage of successful applicants will probably be less than for the college graduate group as a whole, a company will probably find a significant number of persons with high potential for programming in the various departments of its own organization. The fact that the total base from which to draw is so much larger than the college graduate group may well result in a substantial number of new trainees selected from within the company itself.

It is important, however, that supervisors' recommendations about highly accurate workers should not be the chief basis of selection. Many persons who do their regular work with high accuracy and even with good judgment in that work will prove inadequate for the special kind of logical demands of the work in programming. It would be desirable to administer some test or tests of logical ability with special reference to programming before starting a person in a programming training program.

This study is being continued and updated and supplementary reports will be prepared on an on-going basis. ■

a checklist

# HOW NOT TO CHOOSE AN EDP SYSTEM

by TOM GILB SCHARF

*"All men are liable to error; and most men are, in many points, by passion or interest, under temptation to it." (John Locke, 1632-1704, Essay on the Human Understanding)*

Certainly some attempts have been made to publish the results of users' experience in edp-system selection.[1] But certainly far too few have chosen to publicly admit their errors of judgment.

The following checklists are written with a view to making some dp salesmen feel uneasy and some buyers to be more wary.

Not everybody is guilty of all the points below: but all are guilty of some (including the author).

### typical errors in changing systems

1. Failure to consider the *motivation* (or lack of it) of the organization to use a new tool.[2]
2. Failure to change the organizational structure in order to utilize the true potential of a new system. Failure also to recognize that this change process may require longer lead time than the machine installation.[3]
3. Failure to attack and to give priority to the *real* problems of an organization. New solutions are often available but not even seriously considered in the rush to "improve" the old solutions to the problems which were solvable the last time around.
4. Failure to educate the organization's edp specialists and other personnel sufficiently well to avoid bad solutions, or to avoid good solutions to the wrong problems. The failure is in broad training and in updating knowledge up to, and ahead of, current needs.
5. Failure to perceive the edp system and all associated costs as a capital investment and to calculate its rate of return, as well as its marginal rate of return.[4]
6. Failure to place the edp organization in a sufficiently high organizational position so that it is responsible for serving the *whole* organization, not just a single department.
7. Failure of top management to:
   a. Explain their problems (their big problems)
   b. Clarify their goals and their policies
   c. Demand (continual) rate-of-return calculations as the basis for the existence and installation of edp systems.
8. Failure to integrate technical and commercial problems into common-base solutions. Examples: inventory control, production planning and product design.
9. Failure to think in terms of *split solutions*. Examples: hiring a smaller dp machine inhouse; using a larger one outside; having some inhouse dp staff; using outside consultants systematically (as opposed to "in emergencies only").

### typical errors in evaluating suppliers

1. Tendency to consider only one manufacturer seriously —for example, your present dp supplier.
2. Tendency to look at what a manufacturer offers you, not what he *has* to offer. He often doesn't himself know

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1. Computer evaluation method developed by the author. Published in English in the proceedings of NORDDATA-68, Helsinki (not generally available). To be published as the proceedings of the Sandefjord Computer Evaluation Conference 1968: to be edited by the author and published in English by Universitetsforlaget, Oslo.
2. For an excellent short book on the motivational problem see "Beyond Management by Objectives" by J. D. Batten, American Management Association, 1966.
3. Charles A. Meyers (ed.). The Impact of Computers on Management, M.I.T. Press, 1967.
4. See IBM manual entitled "Capital Investments."

what his best offer really is.

3. Failure to define your own needs clearly and in sufficient detail for the manufacturer.
4. Lack of real will (in proportion to the economic benefits) to co-operate with other potential partners in the fields of machine use, application development and specialized staff.
5. Tendency to grossly underestimate *total* costs. Especially system development, programming and data preparation and checking.
6. Failure to evaluate the manufacturer as he *really* is and *will be* in your special situation (machine type, application area, etc.) as opposed to his general "reputation."
7. Lack of will to make extensive and systematically searching first-hand contacts in order to evaluate user experience with corresponding machines and manufacturers.
8. Lack of *relevant* experience on the part of those participating in the dp selection decision, especially as opposed to the manufacturer team which is both trained and experienced in this particular situation.
9. Failure of a business to recognize that their own personnel may bring irrational thinking into the evaluation for personal reasons. Failure to guard against this by using outside consultants on the evaluation team.
10. Failure to recognize that the manufacturer and certain of your own personnel will have the *same vested interest* in empire building (and maintenance!).
11. Failure to analyze the half-truths served by dp salesmen. Tendency to *act* on these half-truths.
12. Lack of will on the part of the manufacturer to really learn about your real problems: his tendency to stereotype you as customer type "X" because he won't spend the time to find out what is really the situation.
13. Tendency of manufacturer sales teams to be specialized, in spite of the fact that your organization may need interdisciplinary knowledge. Example: distribution and production, payroll and technical edp.
14. Failure to realize that the dp salesman has extremely strong (if you only knew!) short-term motivation and weak long-term motivation. Question: how *can* supplier management motivate the salesman to be more interested in your long-term satisfaction than in his short-term quota?

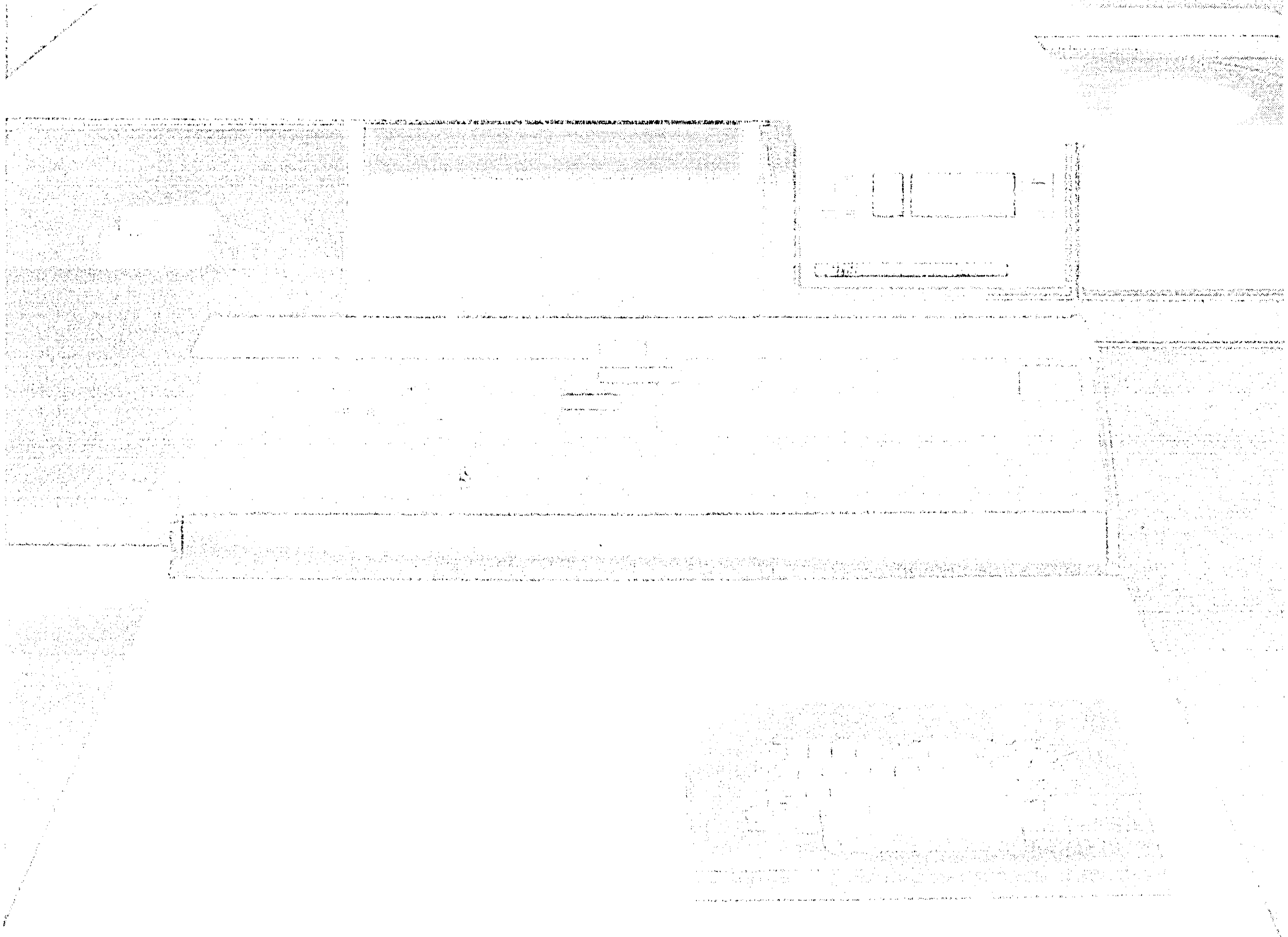
### typical errors in hardware evaluation

1. Failure to go into depth regarding different forms of parallel operations (overlap, data channels, spooling, multiprogramming).
2. Failure to run *actual tests* (the *salesman* probably never has either).
3. Failure to take into account the effect of *software organization and selection* (during "system generation" for example) on hardware performance.
4. Failure to find out if hardware is presently *supported*, sufficiently supported or supported under a particular software system so that it can be utilized without "do it yourself" software support.
5. Failure to calculate the *marginal utility* of adding certain hardware. Small additions can make an unexpectedly big difference. Some additions are useless in practice because of lack of balance in other hardware or software.
6. Failure to evaluate hardware costs in terms of *other* alternatives: "value analysis." Examples: people vs. hardware; 24-hour operation vs. more hardware.
7. Tendency to evaluate in terms of *old myths*. Example: "fast cpu is not important for commercial users," "commercial users need four tape files."
8. Failure to design an efficient system *before* calculating needed hardware capacity. Example: designing really compact files and records before calculating file needs for direct-access files.
9. Failure to anticipate *Parkinson's Law:* the tendency of users to expand needs so as to fill (and exceed) the capacity of a new edp facility within unexpectedly short time. There seems to be a threshold effect whereby increase beyond a certain usage gives drastically reduced service from the computer facility.[5]
10. Tendency to confuse *traditional* needs for hardware with *real* needs simply because we have been unable to satisfy real needs economically before. Example: consider use of cathode-ray display-terminals and other newer data communication devices instead of more customary print-out methods.
11. Failure to give serious consideration to *independent peripheral* suppliers, thus forcing yourself to take the economic consequences of the package deal even on the hardware side.

### typical errors in software evaluation

1. Failure to run *actual tests* on actual machines and to ensure that the evaluation team is trained and given time to do this.
2. Failure to measure *real performance*. Example: by including job control time and linkage editor time in a compiler speed evaluation.
3. Tendency to think in *traditional ways*. Example: COBOL is better than FORTRAN for commercial problems, without regard for other possibly more significant factors such as the concrete software offered for a machine, where FORTRAN might likely be superior in efficiency or perhaps the only one of the two to be offered.
4. Failure to comprehend all the *complex factors* which affect software performance on a given machine. Example: amount of core storage available; number of disc access arms; location of key system files in relation to one another.
5. Failure to use experienced *experts* for independent software evaluation.
6. Failure to recognize and calculate the amount of *man effort* on your own part which is necessary in order to actually use certain software. Example: the system-programmer requirements to use a modern operating system[6], man-years of effort needed to use certain application packages.
7. Failure to use the *same* standards for comparative evaluation of different manufacturers' machines. Example of a solution: "Weighted Ranking by Levels" evaluation method!
8. Tendency to evaluate on the basis of *past needs,* not future needs. Lack of prognosis attempts on percent usage of different components over a future time period.
9. Failure to evaluate the concept of *security* in software.
10. Failure to evaluate the complexity of using software efficiently on a day-to-day basis.
11. Failure to evaluate single software parts in terms of the effect on the *total economics* of the software system. Example: generating a "bells and whistles" resident monitor system at the expense of core storage space which, if available, could, among other things, effectively increase compiler speed, or total job throughput in a multiprogrammed system. ■

5. See Trond Vahl's paper in reference 1 (Sandefjord conference).
6. Tom Scharf, Management and the New Software, Datamation, April '68, p. 52.



yes and no

# WERE EARLY GIANT COMPUTERS A SUCCESS?

by HERMAN LUKOFF

A question frequently raised in technical articles is whether the early giant computers developed in the late 1950's and early 1960's were actually worth the time and effort that went into their construction. The author offers an answer to this question. He was intimately connected with the development of the Univac LARC®—the first of these high performance giants—at the Univac engineering facilities in Philadelphia from 1955-1960 and can state that there was no question of LARC's success; it was considered an unquestioned technical success despite the fact that the costs far exceeded expectations. In fact, LARC was so far ahead of the state of the art that many of its design features are just now beginning to re-emerge . . . in third and fourth generation systems.

To appreciate this more fully, consider "the technology" back in 1955. The first solid-state, or second-generation, computer had not been delivered to the Cambridge Air Research Center by Univac. Transistors were available, but they were expensive and their capabilities did not even approach those of today's transistors. The "best-available" memories were only beginning to approach an 8-usec cycle time and the propagation time for state-of-the-art circuits was ½ usec.

These were the conditions in September 1955, when the Lawrence Radiation Laboratory, Livermore, Calif., awarded Univac the LARC (*L*ivermore *A*utomatic *R*esearch *C*omputer) development contract . . . a contract which called for developing the world's first giant computer system, with a much higher operating speed than existing computers and a guaranteed "uptime" of 90% or higher.

Yet, in 1960, when LARC was delivered to the Lawrence Laboratory, it met every element of the design specification which had been laid down five years earlier. (This fact is amazing in itself considering the number of technological breakthroughs required to simultaneously enter the second generation and the giant computer field.) Despite its technical success, however, only one additional LARC was built. This second system was delivered to the David Taylor Model Basin, now known as the Naval Ship Research Development Center (NSRDC) at Carderock, Maryland, in 1961.

After their installation, the two systems remained in continuous use until December 1968, when the Lawrence Radiation Laboratory retired its LARC system which had been operated on a 7-day-per-week, 24-hour-per-day schedule. The NSRDC system is still in active use on a full 2-shift-per-day basis, and is being used to solve many sophisticated problems.

One of the problems being run on the NSRDC LARC, for example, is Dawson's three-dimensional potential flow program.[1] A 500 X 500 full matrix times a vector of order 500 can be performed in less than 10 seconds using Dawson's routines. LARC also has been successfully applied to solve large scale reactor simulation problems. The coefficient ma-

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[1] Dawson, Charles W., "The LARC Potential Flow Program", AML Tech. Note AML-22-68, Naval Ship Research and Development Center, Washington, D. C., June 1968.

trices generated by the FLAME program[2] contained 100,000 X 100,000 or $10^{10}$ entries.

Throughout their many years of highly successful operation, both systems averaged consistently better than 90% uptime and, in fact, to date there has been only one occasion that required maintenance assistance from Univac. This is a tribute to the capabilities of the customer's maintenance personnel as well as the excellence of the engineering design of LARC. In retrospect, one may conclude that there should have been more maintenance problems and perhaps that the system was over-designed. Of course, this is a manufacturer's viewpoint and the customers undoubtedly would disagree. Both laboratories agree on one point, however: LARC met its design specifications in every sense of the word and included many features that are now appearing in third and fourth generation systems.

What were some of these features? To name a few, multiprocessing, as embodied in the Univac 1108-II, is a successful example of one of the concepts initiated by LARC. LARC was also a pioneer in the use of multiple magnetic drums for mass storage which now have been carried forth into the very successful Fastrand subsystem used in today's Univac product line. The operating system for LARC provided for the control of many simultaneous I/O operations. This principle is employed in every modern computing system in use today. The dedication of a stored program control unit (IOC) to exclusive servicing of many I/O devices is another LARC feature that is being included in many new systems.

General-purpose registers pioneered by LARC have now become a standard of the industry. The modular memory, allowing simultaneous operations, is now used in all large-scale systems produced by major manufacturers. These, plus many more features appearing in newly designed systems, are proof of LARC's heritage.

## hardware

The saga of LARC is proof of what can be done with motivation, competence and sufficient money. In 1953, Univac realized that the days of the vacuum tube were numbered. About 90% of all computer maintenance problems were due to the vacuum tube and it simply had to be replaced. But with what? Univac pioneered in the development of solid state elements and one of these was the magnetic amplifier. It found its way into the Univac Solid State Computer and was characterized by moderate speed and high clock power. Transistors were commercially available in the early/mid fifties but only in the moderate speed range. The first breakthrough in high speed transistors occurred with the development of the Surface Barrier Transistor (SBT). Univac knew that the time for use of transistors in computers was fast arriving and that it had to develop the technology.

The opportunity came in the spring of 1955 when the University of California Radiation Laboratory at Livermore, Calif., now Lawrence Radiation Laboratory, decided it needed a super computer to handle its ever-increasing workload. The request for proposal called for a hundredfold increase in speed over any existing computer. Because of the large number of logic elements to be employed, the computer would have to be made of solid state elements to provide 90% or better uptime. This was the oportunity for developing a good solid state approach to computers that Univac was looking for.

Univac bid on the Livermore Automatic Research Computer (LARC) and won the award in September 1955. By March 1956, the specifications were frozen. While the system architecture was quickly resolved, the battle with the hardware started. The breakthroughs required were formidable. The state of the art encompassed ½ usec propagation time circuits and 8 usec memories; LARC needed 40 nanosecond circuits and 4 usec memory. There wasn't much choice on the logic element. The Surface Barrier Transistor was the only high speed transistor in production and it was a matter of finding out how to get the most out of the device. High speed diodes were chosen to accomplish the logic function and incorporated into a DTL NOR configuration. Meeting the 40 nsec propagation time was a struggle all the way. Every bit of performance was eked out of the circuit by an "optimization to the hilt" process.

It became clear relatively early in the program that packaging was a key factor. Estimates showed that approximately 60,000 transistor circuits were required in the system with 25,000 in each major cabinet. To meet the propagation time requirements, lead lengths had to be kept short. This called for significantly higher packing densities than had been heretofore achieved. Backboard wiring areas had to be significantly reduced, which could only be done by increasing the terminal density on the printed circuit (PC) card connector. The development of the connector was an accomplishment itself; 84 low capacity taper pin terminals were provided within a ½" x 3½" moulded connector. Even by today's standard, over 10 years later, the backboard wiring density is high. Special techniques and tools had to be developed to work with the two-inch pile-up of wiring on the backboard. The laboratory looked more like a hospital operating room with its surgical instruments than an electronics laboratory. Prior to fabrication, several engineers resigned because they believed that it would be impossible to wire the backboard and they didn't want to be associated with a failure. Fortunately, the wire men weren't aware of the fact that it couldn't be done, so they went right ahead and completed the work.

Another key factor in the success of LARC was the complete understanding of noise factors. With 25,000 transistors all within the same cabinet turning off and on in nearly random fashion, there had to be such understanding. Noise factors were studied, measured and computed. Anti-noise measures were engineered into the design. Noise reduction after design would have spelled disaster. Twisted pair transmission lines were used for all leads greater than 18". Ground straps were interlaced through the backboard to provide a ground plane and return path for the open wiring. Ground impedances were carefully designed to be inconsequential. Gold plating was abundantly used to keep structural and other conductive members at a constant low impedance and impervious to time and atmospheric conditions.

The logistics involved in interconnecting 60,000 logic elements were more than manual means could provide in the time allowed. Therefore, a number of computer routines were constructed to assist the designers. These routines assigned logical components to cards, determined the card complement, assigned cards to physical locations (subject to designer intervention) and generated the backboard wire interconnections. The routines that generated the wiring, as well as attempting to minimize wire length, balanced the loading on multiple branches of high current sources and used an algorithm based on "electrical length" to determine when a twisted pair was necessary to minimize noise pickup. Additional routines were provided to analyze circuit loading, min-max delay spreads, clock loading and other factors that were important in the successful completion of the LARC system. These programs were the forerunner of today's highly automated backboard wiring procedures,

[2] Cuthill, E. H. et al, "Specifications for FLAME 1 — A Three Dimensional Reactor Depletion Code for UNIVAC — LARC, NSRDC", Report 1477, June 1965.

layout optimization process and logic simulation.

The development of a 4 usec memory was a great technical challenge (otherwise known as a headache). The biggest problem without apparent solution was that there wasn't a transistor available that was capable of driving heavy currents that could switch fast enough. If only the memory could have been designed two years later, the problem would have disappeared. The problem was resolved but in a brute force, expensive manner. High-current slow transistors were used as X-Y drivers that were turned on and off rapidly by pulsed power supplies. Designing power supplies that put out more than a kilowatt of pulsed power with a rise time of .25 usec was no simple task but it did produce a working 4 usec memory. Even X-Y drive diodes that operate at high currents and high back voltages weren't available and had to be developed in pilot facilities within the Sperry Rand Corp. Ferrite cores that operated with a 4 usec cycle time were not available. Univac had to develop its own 30 x 50 mil core for the purpose.

A new mass storage development was required to exploit high speed throughput while relegating the traditional tape handlers to that of loading and unloading the mass storage. Many new concepts were evolved which form part of today's technology in mass storage. Magnetic plating and finishing techniques of large surfaces (24" diameter drum) were perfected. A six-channel magnetic head flying on its own air stream was one of the first such developments in the industry. Phase modulation recording was used for the first time to provide higher pulse densities with lower error rates. A reliable head accessing means was developed as well as all else necessary to evolve one of the first truly successful large mass storage systems.

The other technical problems that had to be solved are too numerous to mention and could well fill a book. Needless to say, all problems were solved, but at great expense and delay to the program. LARC is an example of the price that must be paid for pushing the state of the art before it wants to be pushed. The familiar law of paying for progress at a nonlinear rate sets in if operating on the steep part of the technology curve.

Consider the ease with which LARC could be built today. Instead of paying $5 for a transistor that will just barely operate in a circuit at 40 nsec propagation time with fan-out of 2 to 3, transistors are commonly available today at 17¢ or less that will easily provide a fan-out of 10 in a 10 nsec circuit. The factor improvement in transistors since LARC was designed is a fantastic 40 for gain-bandwidth and 30 for price reduction, or a total factor of 1200 in performance per dollar. Clearly, LARC was too far ahead of the state of the art as far as hardware was concerned. But LARC won't be remembered for its hardware features because the hardware technology has rapidly passed it by.

## systems architecture

The LARC will be noted as an achievement of the first order for its contributions to systems concepts. The systems design for LARC is as exciting today as it was 13 years ago. For those unfamiliar with LARC, a block diagram is shown in Fig. 1. It basically consists of (in today's terminology) a central processing unit (cpu), option of a second cpu, an Input/Output Controller (IOC), and peripheral control units, all of which have direct access to multiple core storage units. The advanced features which are LARC's claim to fame are as follows:

1. *IOC.* A cpu program will decide on an I-O operation and construct an I-O packet which is recorded in memory. The cpu then communicates to the IOC the location of the I-O packet. The IOC program examines the I-O packet to determine the type of operation. It then sends it to the proper I-O handler routine. The handler routine will queue the I-O packet if necessary, interpret the packet into absolute instructions, perform the I-O operation, examine for any error condition, attempt a recovery if possible and interrupt the cpu upon successful completion.

The program that ran in the IOC can be recognized as a prototype of that part of the modern executive or operating system which handles the I-O operations. The advantage of the IOC program over modern executives is that the large amount of overhead in running time is not apparent since the IOC program runs in parallel with the cpu program. The IOC program was constructed so as to allow great flexibility and simplicity in the construction of I-O packets by a cpu program. For example, one I-O packet stated in effect "Get Next Record," another "Get Record with this Key," and yet another "Get Record at this Location."

Another part of the IOC program was the microprogram control of I-O operations. By means of this control, it was possible to handle data transfer of variable size, to perform scatter-gather type of data transfers and to run several I-O operations continuously without stopping or interrupting in the time interval between them.

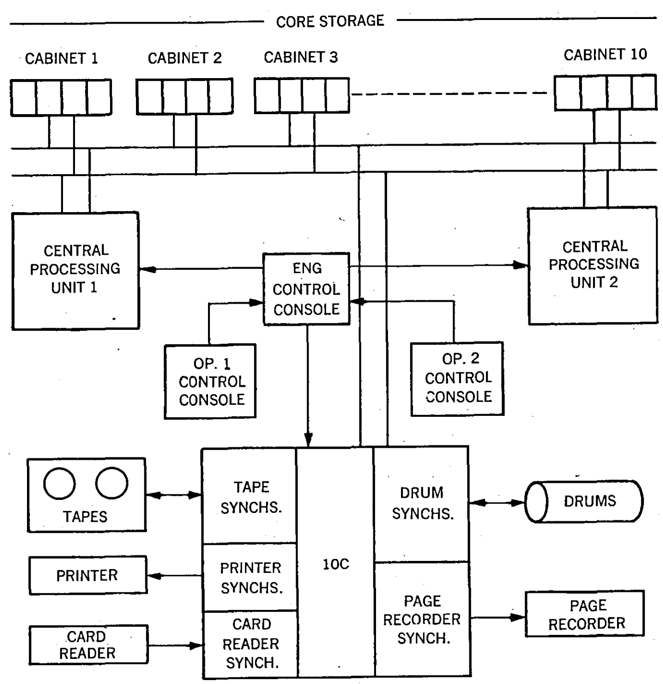


Fig. 1—Block Diagram of a LARC System

2. *Core Storage.* Core storage is divided into independent modular units, each of which has a capacity of 2500 words of 12 decimal digits (60 bits/word). Eight storage units are used in a minimum system. Up to 39 units are permitted in a fully expanded system. Each core storage unit contains its own switching, timing and amplifying circuits so that it can be operated independently and overlapped with other units. The division of the core storage into independent units permits simultaneous reference to storage: by the cpu for obtaining instructions and operands, and by the IOC for its instructions and for transferring data to or from the I-O control units. Although the individual unit core storage access time is 4 usec, the effective system access time approaches ½ usec because of overlapped operation of independent units.

3. *Intra-Unit Communications.* To allow for simultaneous communication between the IOC, cpu's and the many core storage units, a time slot (multiplexed) system is used. Interconnections between all units are accomplished by a transfer bus which is time-shared between units. The bus is shared on the basis of a repetitive 4 usec time cycle which is broken down into eight ½ usec time slots. During any time slot one word of data or instruction can be transmitted to or

# PDP-10 can handle 63 users simultaneously.

from the core storage in parallel. Time slots are pre-assigned to the cpu's, IOC and control units. A core storage unit can initiate its 4 usec cycle at any one of the time slot periods. Once a storage cycle is initiated, interlocks prevent any other calling unit from gaining access to the storage unit. Because control units must transfer data within a definite period of time in order to maintain a continual flow of input-output data, each storage unit is provided with priority circuits that guarantee access by the control units within 4 usec after it addresses the storage unit.

Time slotting is a very efficient method of providing communications in a multi-processor multi-memory system and is worthy of fourth-generation consideration.

4. *Levels of Storage.* There are four levels of storage in the LARC system that differ in speed, capacity and cost per character. The first level of storage operates on a 1 usec cycle. It consists of a number of registers that may be used interchangeably as accumulator registers (A) for storing operands and results or as index (B) registers for storing constants used in addressing operations. Up to 99 1 usec registers may be used in each cpu. Similar registers are used as buffers in each control unit. The second level of storage is the ferrite core units which have already been described. The third level consists of mass storage drum units and will be described next.

5. *Mass Storage.* Up to 24 drum storage units may be included in a LARC system. Each drum is capable of storing 250,000 words of 12 decimal digits. Up to three read control units and two write control units can be utilized to provide concurrent reading and writing. The IOC program can connect any drum to any control unit. Two drums operating alternately through a single control unit transfer data at a continuous rate of 330,000 decimal digits per second. The six-channel magnetic head flies on an air film over the surface of the drum and is "stepped" into any one of 100 positions. Continuous stepping time is 50 milliseconds from one position to the next. The microprogram control in the IOC program allows a data transfer to start in the middle of the data if that is the present position of the drum under the read-write head. This means that latency time is reduced to practically zero in some cases. In addition, the head on one drum can be stepping to the next position while the head on another drum is transferring data.

6. *CPU Instruction Overlap.* The cpu is designed to process several instructions simultaneously. While one instruction is being executed, the operand of the second instruction is being transferred to or from storage, the operand address of the third instruction is being generated and a fourth instruction is being obtained from storage. The average effect during continuous operation, therefore, is to execute one instruction each 4 usec even though each instruction is in the control section of the CPU for a longer time period.

7. *Modularity.* LARC set new records for modularity. Fig. 2 indicates the expansibility and diversity of the system.

8. *Electronic Page Recorder.* Thirteen years ago, the need for reducing the tremendous volume of high speed printer paper output was recognized. An answer was provided with a cathode ray tube display and microfilm. Output data may be presented by the Page Recorder in the form of a curve plot, grid pattern, alphanumeric characters or a combination of all three. The output is displayed on the face of the cathode ray tube and recorded on a 35-mm camera under IOC program control. The recorder operates at an average character rate per film frame of 15,000 characters per second or graphically at 2000 points per second or 1000 grid lines per second. An alternate self developing camera is used for quick monitoring checks.

9. *Miscellaneous.* The list of outstanding features in LARC could go on and on but there simply isn't the space and time to provide it all. Sophisticated error and operator switches-lights routines, tracing modes, interrupt facilities, operator and engineer control console features, checking circuits and dozens of others are all part of the LARC.

**summary**

The pioneering work that went into LARC blazed a trail for a whole series of new computers that followed. It contributed as much to the state of the art as its predecessors, ENIAC, BINAC and Univac I. Its completion was a tribute to the competency of the engineers in the project, who completed the task despite the overwhelming obstacles involved in following uncharted paths.

The LARC system was a definite success from the technical point of view. But it also brought home two important lessons. One is the requirement, when embarking on a project of this dimension, to develop the advanced techniques first with a small pilot model of the actual system, so that an intelligent cost estimate can be made. The second is the need to follow one of the fundamental laws of modern technology—"Don't push the state of the art before it is ready to be pushed or else be prepared to pay a price you don't expect." ■

| EQUIPMENT NAME | TYPICAL | EXPANDED |
|---|---|---|
| Magnetic Core Storage Units (2500 words each) | 8 | 39 |
| CPU | 1 | 2 |
| Multipurpose Fast Registers (per CPU) | 26 | 99 |
| IOC | 1 | 1 |
| Drum-read Synchronizers | 2 | 3 |
| Drum-write Synchronizers | 1 | 2 |
| Tape Read-Write Synchronizers | 2 | 4 |
| Electronic Page Recorder Synchronizer | 0 | 1 |
| High Speed Printer Synchronizer | 1 | 2 |
| Card Reader Synchronizer | 0 | 1 |
| Console Printer Synchronizer | 1 | 1 |
| Tape Positioning Checker | 1 | 1 |
| Magnetic Drum Storage Units (250,000 words each) | 6 | 24 |
| Uniservo II Magnetic Tape Units | 12 | 40 |
| Electronic Page Recorders | 0 | 2 |
| High Speed Printers | 1 | 2 |
| High Speed Card Readers | 0 | 1 |
| Control Consoles | 1 | 2 |
| Numeric Keyboards (one per Console) | 1 | 2 |
| Alphanumeric Console Printers (one per Console) | 1 | 2 |

Fig. 2—Modular units of a typical and completely expanded Univac LARC system.

hazards and dilemmas

# THE COMPUTER ART OF SCHEDULE-MAKING

by MURRAY SPITZER

If you were present at the launching of a computer system in the field of scheduling ("Transit Authority Will Use New Computer for Trolley Routes and Motormen's Assignments") and were also there when it was quietly cancelled (without a press conference), this paper will touch familiar topics. Others have shared your disaster, if that is any consolation to you. More helpfully, it is the intent of this paper, by recreating your experience and misadventures step by step, to try to throw some light on what went wrong, and in what order. The computer art of schedule-making, as developed here, needs little new in computing capability, but it does need some novel strategies for its successful implementation.

Schedule-making is the systematic assignment of certain resources of an organization. These resources can be vehicles, personnel, machinery, or workload—whatever is basic to the organization. Schedule-making can be complex, with each trial element needing a laborious computation. Or it must be done under inexorable deadlines—e.g., airline timetable changes. These common aspects of a scheduling operation, and its underlying mathematical structure, strongly suggest that under proper conditions a computer system to help do the job can be a feasible and profitable application.

The development of new methods to solve problems related to schedule-making has been a favorite preoccupation of mathematicians in recent years. The literature of operations research is already voluminous in the new fields of discrete programming and combinatorial mathematics. The assignment problem, the traveling salesman problem, the truck dispatching problem, are now familiar phrases in this literature.

Yet in terms of actual accomplishment very little seems to have been achieved. No records are kept for projects an-

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nounced and never finished, but the gap between proposals and fully implemented systems must be very wide indeed. Even in technologically sophisticated industries, schedule-making is still the art of a century ago, a trial-and-error exercise in combinations and permutations and paper.

### computational and other hazards

If computerized schedule-making is in fact a promising application, the astute reader can wonder whether anyone has ever done it, or has reported doing it, which are two different things. Is it possible that a few companies which have cracked the application are keeping a good thing to themselves? A few successful pioneers may be doing just that. But it is such a deceptively difficult, baffling, and frustrating application, that a large number of secret, guarded success stories is very unlikely. There are in fact several good reasons for believing there are as yet few success stories at all. For strewn along the developmental path is a series of no less than three insidious computational hazards, each more subtle than its predecessor. The researcher, grappling with the first, second, or third of these, if he is that persistent, will tend to agree with my conclusions in not too long a time. (Each of these hazards will be identified and dealt with shortly.)

There is a fourth hazard which can be far more embarrassing to the researcher than the other three, and that is to discover part-way through the job that he has been wasting his company's time. Not every scheduling situation can benefit from computerization. If there is very little difference between one schedule and another, things may be better left the way they are. The would-be schedule-maker can reach the proper decision by looking for favorable omens for computer solution, including the following:

1. The operation is substantial; for example, it could involve the routing of vehicles for a trucking firm; railroad or ship movements; assignment of airline flight crews, etc.
2. The problem is sufficiently complex so that not only is a good solution not immediately evident, but the solution is also continuously improved with additional time for trial-and-error analysis.
3. Each element of a possible solution can be quantitatively evaluated in terms of profit, cost, service, etc. The difference in profitability between the average solution level, and the best believed to exist, could be substantial.
4. There are secondary uses for computer solution; for example, as a research tool for evaluating operation under other conditions.
5. There is management interest in the development of the computer system.

### the vehicle scheduling problem

To illustrate the concepts of computer schedule-making, consider a common industrial scheduling activity—the operation of a fleet of vehicles based at a central point, and servicing a number of customers on a repetitive cycle. On each working day each vehicle follows a prescribed route, services several customers, and returns. It is apparent that there exist numerous alternative ways of routing or scheduling the vehicles. Which is best?

In the trial-and-error method, the scheduler somewhat arbitrarily puts together tentative vehicle paths until he reaches the point at which he has customers left that cannot be serviced by feasible additional routes. He then breaks up the tentative solution until he has fitted in the leftover points. Then, depending on time available and the value of a better solution, the scheduler will continue to juggle, cut and try, until his deadline.

The generalized computer method for scheduling problems of this type varies from the manual procedure by first creating a data base of all possible vehicle paths that might appear in a solution. This is done by an enumerative tracing program that contains within it all the rules of the game. For example, our rules might state that all acceptable routes contain two, three, or four stops, with travel between 100 and 200 miles. With stops numbered 1, 2, 3, 4, . . . , N, we might generate consecutive routes that look as follows:

| Route Number | Number of Stops | Mileage | Stops 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|
| 1 | 2 | 140 | 1 | 2 | | |
| 2 | 3 | 150 | 1 | 2 | 3 | |
| 3 | 4 | 170 | 1 | 2 | 3 | 4 |
| 4 | 2 | 120 | 1 | 3 | | |
| 5 | 3 | 155 | 1 | 3 | 2 | |
| 6 | 4 | 175 | 1 | 3 | 2 | 4 |
| 7 | 3 | 165 | 1 | 3 | 4 | |
| 8 | 3 | 185 | 1 | 3 | 5 | |
| etc. | | | | | | |

It is vitally important that the operational rules of the system be carefully spelled out in Step 1, since any route in the data base could conceivably appear in a schedule.

Step 2 of the generalized schedule-making process is a mathematical solution procedure that finds one or more subsets of routes from the data base so that each customer stop appears once and only once, and so that a solution characteristic (e.g., mileage) is optimized.

We can symbolize the required mathematical solution procedure as follows:

Optimize $\Sigma\, c_j x_j$, subject to

$\Sigma\, a_{ij} x_j = 1$ $(i = 1, 2, 3, \ldots m;\ j = 1, 2, 3, \ldots, n)$

$a_{ij} = 0, 1;\ x_j = 0, 1.$

In this notation we have m customers and n possible routes. Associated with each route $x_j$ is a coefficient $c_j$ representing the characteristic to be optimized. There is an equation for each customer stop of the form, $\Sigma\, a_{ij} x_j = 1$. If a variable $x_j$ contains that particular stop, its coefficient $a_{ij}$ is one; otherwise, it is zero.

This linear system looks very much like familiar systems for linear programming problems. There is one critical difference. Linear programming variables may assume any positive values; variables in the scheduling model are limited to values of only one or zero. (If the path appears in a solution, it is used exactly once, for a solution value of one; if it is not part of a given solution its value is zero.) The standard methods of solving linear programming problems do not control for integer values of variables, particularly "zero-one" values. Specialized techniques have had to be developed, with limited success. More about these problems later.

The first of the three insidious computational hazards is encountered early in Step 1. The researcher will find to his dismay that the number of variables will proliferate very rapidly, as the number of customers is increased only slightly. For instance, with two-, three-, and four-customer paths, the number of possible paths in relatively small problems expands as follows:

| No. of Customers | Number of Possible Vehicle Paths: Two-Stop | Three-Stop | Four-Stop | Total |
|---|---|---|---|---|
| 6 | 15 | 20 | 15 | 50 |
| 8 | 28 | 56 | 70 | 154 |
| 10 | 45 | 120 | 210 | 375 |
| 12 | 66 | 220 | 495 | 781 |
| 20 | 380 | 1140 | 4845 | 6365 |

A practical truck dispatching problem can involve hundreds of scheduled stops. How can we limit the problem to a manageable number of variables without severely restricting its flexibility?

We can borrow the corrective techniques from the trial-and-error methods of the schedule analyst. It is physically impossible for him to evaluate by hand very large numbers of variables, and he never attempts to do so. He simplifies the problem at the outset by first clustering or grouping adjacent customers into single locations which are thereafter considered as a unit. Also, the analyst does not bother with the out-in-left-field combinations; he works with straightforward, natural vehicle paths and generally ignores the existence of the others (which make up most of the Step 1 output).

Thus the proliferation of vehicle paths can be controlled at Step 1 of the schedule-making process, and in such fashion that the danger of restricting problem flexibility is small. It is not necessary to completely control problem size at this point, however. The technique of problem partitioning, discussed later, allows a restoration of problem flexibility to a large degree.

## solving the problem

Having succeeded in generating a manageable set of possible vehicle paths in Step 1, we now look for a mathematical method of finding the optimum solution (Step 2) among the set of paths. We discover that there are a number of methods which have been proposed for the solution of our "zero-one" problem. These methods include enumeration, integer linear programming, dynamic programming, branch-and-bound techniques, Balas' algorithm, etc. We find, however, that guarantees of computational performance are hard to pin down. Much of the mathematical literature that discusses computational experience is concerned with problems of a few dozen variables. Typical of the uncertainty in the field is a comment by Giglio and Wagner.[1]:

"The integer programming approach has the obvious advantage that when it succeeds we indeed obtain an optimal solution to the problem. The drawback at present is that it does not seem to converge fast enough to make it practical."

Now, practical schedule-making problems will be of the order of several hundred to several thousand variables. There is very little published in the mathematical literature to encourage the large-scale problem solver. This is the second of the predicted computational hazards: having gotten to this point, where is the mathematical method that we need?

The way around this dilemma is to recognize that much of the published material on zero-one problems is being produced by mathematicians who are at the moment concentrating more on formalism than on getting answers. In my opinion, today's most useful solution methods are therefore the heuristic, or approximation, methods which, incidentally, are also recognized in the literature. By ignoring the condition that the zero-one solution method must find, identify, and prove the optimum solution, it is relatively easy to develop an approximation method which can handle the large-scale problems satisfactorily.

As long ago as 1961 I reported[2] using a heuristic method to solve problems of the order of 1,000 variables. In 1968, Geoffrion reported encouraging developments in a mathematical method for zero-one problems[3], and suggested that the method could be capable of finding the optimum solution to problems of 1,000 variables. It is immaterial whether a mathematical or a heuristic method should be used for computer schedule-making. The test of effectiveness is simply this: What is the additional profitability of the best solution found by either method, less the cost of attaining it?

To this point, we have learned how to generate just the proper number of variables to encompass the problem. We have a choice of solution methods that will handle up to, say, 1,000 variables, which just fits our vehicle delivery system. With the computer system finally working, we are one day asked to find a solution for an expanded market of 50 additional customers.

Running the data quickly through Step 1, we find that an additional 1,000 variables have been created. Now, the various types of solution method applicable to zero-one problems—enumerative, mathematical, heuristic—all seem to share the same discouraging characteristic: their computer solution time increases nonlinearly with problem size. This means, for example, that if we had been solving 1,000-variable problems in one hour, 2,000-variable problems won't take two hours—they could require three, four, or 20 hours, depending on the method. No matter that we have after great effort achieved a solution method. With a trivial effort, we can overload it, and it will look like a fourth grader's homework in the New Math.

Fortunately, there is a way around the third dilemma, too. Real-world combinatorial problems have at least one desirable property (for a change!) in that they can be partitioned. The partitioned subproblems can be solved separately, and the answers can be combined as a feasible solution to the total problem. In a large vehicle delivery system it should be possible to make a sensible geographical split of customers. The resulting subproblems are solved independently. Now, the arbitrary partitioning may have precluded several desirable combinations. A new subproblem can be formed which includes routes adjacent to the dividing line, taken from both initial subproblems. Its solution now permits introduction of combinations which may straddle the original dividing line. The system solution is now composed of combinations found by each of the three subproblems.

Using the technique of problem partitioning, it is possible to find economic solutions to schedule-making problems of much larger size than would be possible by one-pass methods. Theoretically, problems of almost any size can be handled this way.

## other applications

Besides vehicle routing, another significant schedule-making application is the airline flight crew scheduling problem. In this operation the airline timetable segments are combined into round-trip crew assignments analogous to the vehicle paths of the truck dispatching problem. The solution method must find an economic set of crew assignments such that each scheduled flight is included once and only once in a crew combination. The structure of the basic crew scheduling problem is mathematically identical to the structure of the basic vehicle delivery problem.

One of the secondary benefits of the computer method of schedule-making is that certain types of management decision can be a free by-product of the process. An example is the choice of basing in multi-base problems. In flight crew scheduling, various flights may appear in combinations generated out of more than one base. The computer solution selecting a variable for a given flight, by the selection also designates the crew base which can then best serve the flight. Similar decision choices are possible in multi-base truck dispatching problems.

To summarize: where the economic incentives exist, one should be able to improve upon the manual art of schedule-making with computer techniques. A successful application might be very worthwhile—but between proposal and accomplishment lie some unexpected problems. Forewarned is forearmed. ■

[1] R.J. Giglio and H.M. Wagner, "Approximate Solutions to the Three-Machine Scheduling Problem," *Operations Research* 12, 305-324 (1964).

[2] M. Spitzer, "Solution to the Crew Scheduling Problem," presented to Airline Group, International Federation of Operations Research Societies (AGIFORS), Spring Valley, N.Y., 1961.

[3] A.M. Geoffrion, "An Improved Implicit Enumeration Approach for Integer Programming," Memorandum RM-5644-PR, June 1968, The RAND Corporation.

# TURNKEY TO PROFITS

by ROBERT B. FOREST

On June 27, 1962 an ex-IBM salesman named Ross Perot celebrated his 32nd birthday by forming the somewhat prosaically named Electronic Data Systems Corporation in Dallas. This required $1000 and the names of three directors. Perot had the K note, but he claims that the only people with enough faith in him to sign on as directors were his wife, mother and sister, who became the first officers of the company. (They've since been retired with honors.)

On Aug. 1 of that same year, Perot got to work in a mundane way. He bought a block of time "on a wholesale basis" from a Dallas life insurance firm, and began to canvass the 150 IBM 7070 users in the U.S. at that time. He ran through the 80 east coast users, and it wasn't until he hit Cedar Rapids, Iowa that he made the sale.

The client was Collins Radio, which also has sizable offices in Dallas. "I could have made the sale without leaving town," recalls Perot, "but I was too smart for that."

Two months after the sale, Perot pocketed his fee, paid his bills, and hired his first two employees, Milledge "Mitch" A. Hart III, an IBM salesman; and Thomas J. Marquez, an IBM sales trainee. Their hiring was presumably delayed by a Perot ground rule which required that EDS have two years' salary in the bank for a new hire before he came aboard.

Perot offered each a job at his current salary, but Hart insisted that it wasn't fair for him to earn more than Marquez. Both started at $650 a month. Today, Perot is fond of pointing out, neither ever has to work again.

Neither does Mr. Perot. On Sept. 12, 1968, he sold 325,000 shares of EDS, the company sold another 325,000—approximately 7% of the company—to raise roughly $10 million, based on an initial stock offering value of $16.50 per share. (The earlier book value of $2.04/share was changed to 20¢ in July of '68.) As of early March, the stock was quoted at 40 bid, 42 asked. You can do your own arithmetic.

But the story is not just another rags-to-riches stock market killing. As of June 30, 1968 (end of fiscal year), EDS has 323 employees—303 professionals—and 23 contracts which brought in gross revenue for the year of $7,706,806. Of that one customer represented 43%, and another two accounted for 21% more. (By now, those percentages have been cut in half.) For the six months ending Dec. 31, 1968, EDS revenues were over $5 million, net income $786,205, healthy increases of 68% and 113% respectively over the same period for the previous year. As of the end of February the company had 30-plus customers, over 400 employees, and offices in Dallas, Atlanta, Kansas City, Washington, D.C., New York, Chicago and Philadelphia. They invade San Francisco next.

## but what do they do?

EDS is in the business of what Perot calls "the intelligent use of computers." What this means is that EDS designs, installs and operates edp systems for large companies for a predetermined fee over a long period, usually five years. In essence, EDS becomes the data processing department for the customer. In the beginning Perot's firm used large blocks of excess time on other companies' computers, but he now owns and operates his own computers . . . 20-odd 360's ranging from /30's to a /65, and worth about $8 million.

How did a pipsqueak time broker achieve such stature so quickly? According to Perot, it's because "we feel strongly that the limiting factor on the intelligent use of computers is the proper management and use of skilled systems engineering resources." An insight into how strongly Perot feels about people as the key element in any business can be glimpsed from a summary of his company's objectives, scrawled in longhand on "yellow eyesaver" paper when the company was started:

1. To become the most respected edp service firm in the U.S.
2. To be the largest edp service firm in the U.S. within 10 years . . . providing that size doesn't interfere with high performance standards.
3. To build EDS without borrowing money or selling stock to outside investors.
4. To have EDS belong to the people who build (continue to build) it . . . create an environment where the personal goals and dreams of the individual can be realized.
5. To have one class of employees—no hiding places or quiet corners into

The EDS Dallas computer center

which people can drift. "We want to be able to measure performance and reward it, to allow each person to develop without restriction to age, seniority, formal education. There are no green stamps for the guy who's been here longest. As long as you're the best man here you get the best job. It's that simple."

6. Last and most important: give the best of the best an opportunity to build businesses within EDS. "This creates opportunity . . . and keeps the business manageable."

Perot created ground rules: to create a climate of complete intolerance to company politics, to provide the finest personal and financial advantages for employees, to make EDS an exciting place to work ("some companies you can color dull gray"). He wanted to promote from within, to deal only with the largest firms on a long-time basis. The financial objectives he set for 1980 will be achieved by 1975 . . . or earlier.

**solving the people problem**

But it's the manner in which EDS has evidently managed (so far, at least) to translate these words into action that seems to distinguish EDS from A(Average)DS.

Perot recognized early that the limiting factor on the growth of EDS was the supply of skilled systems engineers. Moving with typical directness and energy, he established an ambitious recruiting program for both experienced people and trainees . . . now has 23 recruiters beating the bushes. To find trainees, EDS places full-page ads in the Asian issue of *Time*, aimed at young reserve officers on combat duty. Those who respond to the ad's challenge of demonstrated leadership are contacted by mail, then in person, and screened. Those who pass the initial field screening are flown with their wives to Dallas for an intensive oneday recruitment pitch while the little lady is shown Big D by a company wife. A team interview rounds out the day. One out of 30 applicants is chosen . . . nine out of 10 accept. "That's the highest compliment anyone pays EDS, in my opinion," says Perot. The program has netted 55 trainees so far.

Once aboard, the trainees are submitted to an intensive system engineering training program beginning with a 16-hour orientation course emphasizing company philosophy and goals that is required of all professional employees. A company education center upgrades and updates experienced personnel. The company videotapes course lectures, has some 200 hours of them in the permanent library. Courses range from demonstrations of selling techniques to basics of insurance and insurance edp (as well as other industries), to courses for programmers and operators. And there's a computer center development program. (EDS hires no experienced operators, takes six months to train their own.) The SE development program lasts three years, with classes conducted from 7:30 to 9:30 a.m. and 4:30 to 7 p.m. What do the trainees do when not in class? "Work," says Perot. The company says it spends an estimated average of $50,000 (direct physical costs) to train an SE.

The company offers no stock options to new employees. It wants to attract people with the skills and confidence to earn stock ownership ... . not those who want a tidy option package to entice them into EDS. Nor will it pay moving expenses. But it will loan the money, then write it off after a year, if the new hire has done "a good job."

Training doesn't stop at the trainee level. Experienced people are encouraged to continue their training at the education center. A video player and miniature screen are available to eager beavers who want to pursue their studies on their own. "If we put a skilled man to work without continuing to train him, he's technically obsolete in three years," says Perot.

Perot has evidently thought long and hard about motivation, and he sees that his employees continue to be motivated. There's a semi-annual review, for instance, consisting of three pages of questions which are given to the employee before he's asked to answer them orally. The interview tries to assess what the employee has done right, what wrong . . . and how he can improve. His assessment of EDS is sought as well. (One of the questions: "If you were President of EDS, what changes would you make?" "Throw out Ross Perot," we sotto-voced. He grinned. "That comes in a lot," he said.)

And at the end of each project the

Ross Perot and friend


# ROSS PEROT

## the man, the mottoes, the mission

The son of a Texarkana cotton broker, Ross Perot's early jobs were all incentive oriented. He delivered the Saturday Evening Post, built paper routes, sold or traded almost anything—saddles, cattle, hogs. In 1953, he graduated from the U.S. Naval Academy, where, he says, he learned "the basic lessons of leadership." It was always his dream to build his own company.

A slight, short man with a quiet, friendly ebullience, and a slight Texas twang augmented by down-to-earth expressions and analogies, Perot is a motto-man with a mission.

company rewards key contributors to profits in the form of cash and stock options. "Up until then," explains Perot, "he's put the company in his debt. We pay off that debt at the end of the project. We remind him that he's been compensated in full. We want to find out if he's a flash-in-the-pan or a consistent producer. There's no riding on past glory."

**fitting the mold**

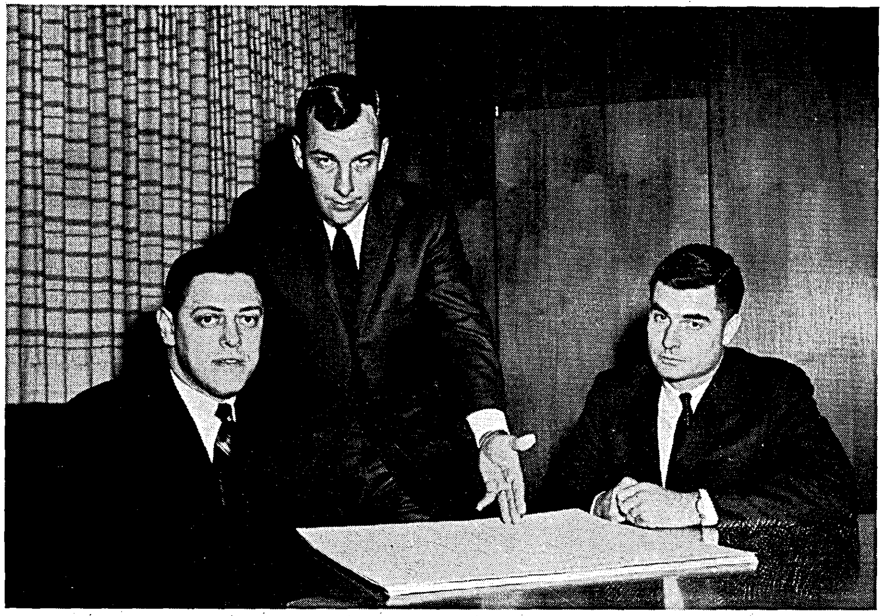
The results of the recruitment, orientation and training is a product that looks suspiciously homogeneous: bright, friendly, aggressive, clean-cut, conservatively dressed young men who smile and gaze directly into your face as they firmly grasp your hand. It's all slightly reminiscent of IBM, but Perot says only about 30% of his people are IBM refugees.

The company and its employees are highly aware of the EDS image, recognize the fact that EDS is a special place for a special kind of person. Speaking in a videotaped lecture on the team interview, Mitch Hart explains that one of its purposes is to find out if the prospective employee will be happy at EDS. One of the saddest things that ever happened, he relates, was the man who came to him and said, "This is a great company if you're the right kind of person, but it's miserable if you're not like everyone else."

But Perot denies that he's turning out stereotype copies of Dale Carnegie course graduates. "If you're asking if we're looking for the clean-cut Super-American kind of guy, you bet. But personalities are quite diverse. If you're asking if there's a narrow range of required conformity, I'll say no. But more significant than that is the low turnover, which proves we're not putting people into a vise." (Or that they like the vise.) "If we ask you to wear a suit . . . if rules are conformity, then we ask people to conform. We're trying to train businessmen, not just technicians. There's a vast difference from how we train people and how IBM trains. IBM has a narrow product line, a rigid price structure, and an unalterable contract," he adds. "In contrast, we ask our people to go into a company, size up the situation . . . then meet the customer's needs."

He had us see a videotape of two men who had been with the company three-four weeks give talks on the EDS philosophy. They spoke clearly, sincerely, recapping in their own words the key points of another videotape in which Perot does the same thing. They looked like Astronauts. Perot's point: these people understand the EDS philosophy, "which gives them a rudder, teaches the essence of the business before the mechanics of the business."

Perot seeks employees who will reflect favorably on the company 24 hours a day, seven days a week . . .



Perot's management team (from l.): Tom Marquez, Mitch Hart, Tom Walter

Large wooden plaques around the corporate offices proclaim the underpinnings of that mission, outlined in the company objectives described in the accompanying article. Outside the offices of Tom Marquez and Tom Walter is one that says:

TO ACCOMPLISH GREAT THINGS
WE MUST NOT ONLY ACT BUT ALSO DREAM

"They're our practical dreamers," says Perot.

In the reception area outside his office:

WHAT IS NOW PROVED
WAS ONCE ONLY IMAGINED

That's Perot's favorite (it refers to the establishment of EDS), although he says the company motto—unplaqued—is "Do what makes sense."

He's proud of his company and its accomplishments, shoves aside the personal fortune angle pushed in a recent *Fortune* profile, wants emphasized instead the company success story. "We were a pay-as-you-go company," he says. "We had to be. We're the only edp company that I'm aware of that went into the business, grew, prospered, expanded, grew successful without borrowing any outside money on selling stock. We had to do it from profits. The story title should be 'How a company learned to make a profit.' Conservatively, 150 people at EDS have learned what a profit is, how a profit is used in business. They've made it happen. You probably can't find 150 people in General Motors who know what a profit is."

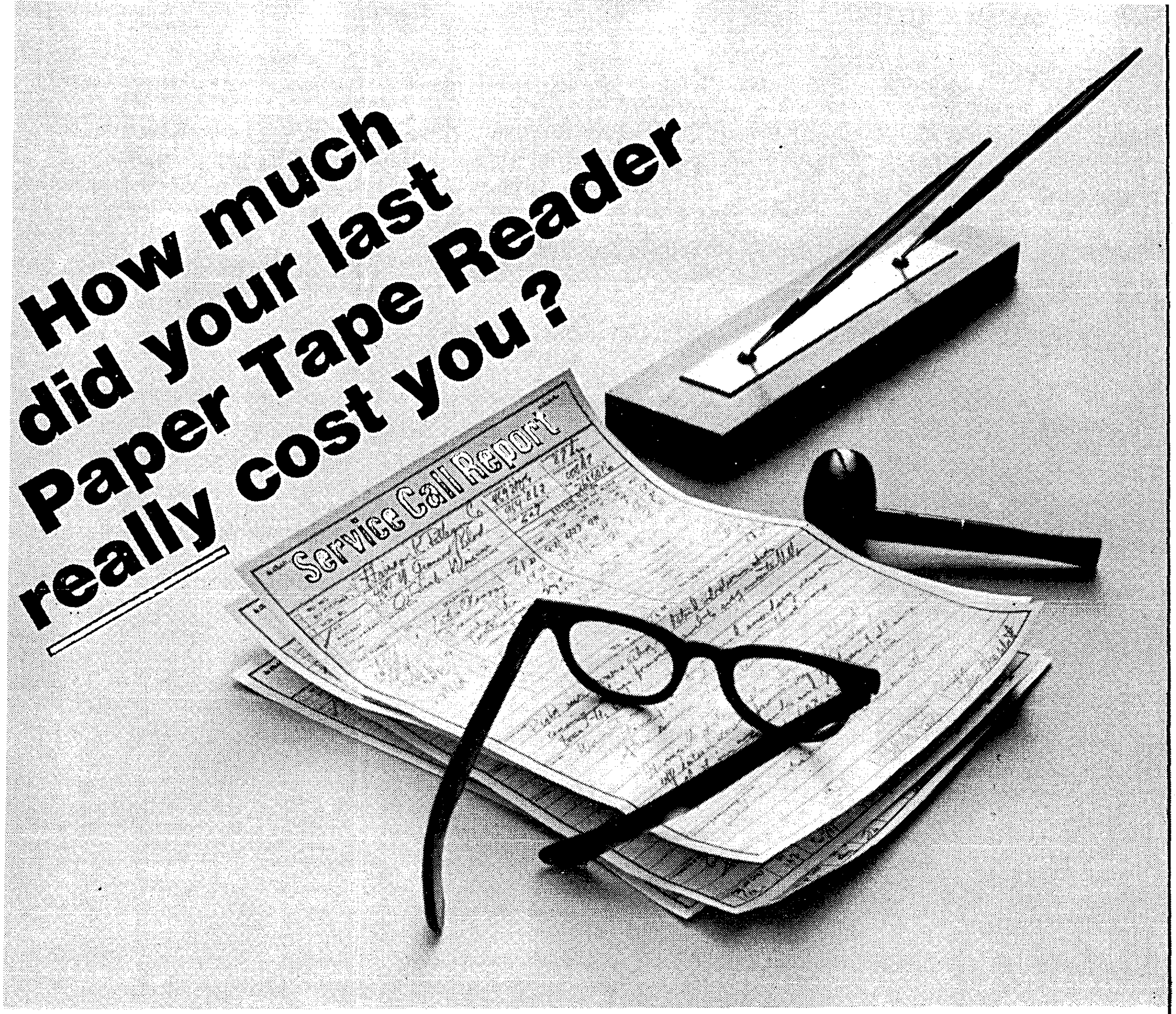
He looks askance at edp service firms which have found it easy to raise money, then created paper profits through accounting, depreciating. "EDS," he says, "generates cash. It's a service company which generates significant amounts of cash as it goes." His comment on edp service firms: "Unless it can generate a true profit, it is inherently weak."

Seated behind the antiqued desk in his large, thickly carpeted office filled with personal and company mementoes on the 13th floor of the Exchange Bank Building in Dallas, Perot muses on why the public has placed such value on his company's stock.

"Because of the care and attention we pay to the selection of people and the development of people, the opportunities we offer for personal growth . . . without acquisitions, but through direct sales. There's a climate for opportunity here.

"Our turnover is very low. We've never lost a key man. Not many can say that. There's an incentive problem for young folks. That's cash. They need it to buy a house. Later the need is for estate building. Now ego satisfaction is the incentive problem. We want to keep an environment in which they get tremendous personal satisfaction in seeing EDS grow . . . without compromising their standards of excellence. So far—knock on wood—all this has happened."

We doubt that Ross Perot will ever have to spend much time knocking on wood. ■

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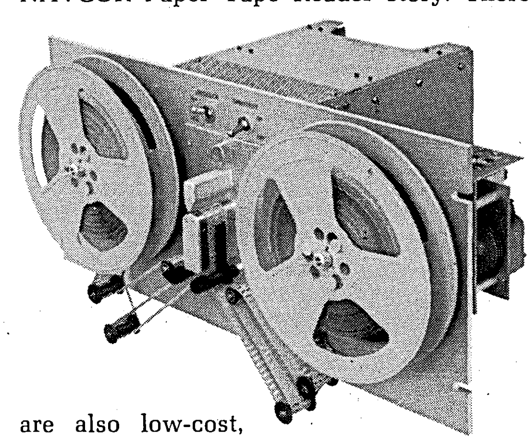

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people of character. How does EDS judge character? "It's hard," admits Perot. "We want to weed out the candidate who is dishonest, or colors the truth . . . or the politician who's willing to sacrifice the company for himself. But if you let a guy talk long enough, he'll come out with his style. You're either comfortable with his style or you're not." Although EDS administers a 4½-hour aptitude and personality test, Perot doesn't believe in blindly following test results, preaches intuitive or instinctive hiring.

Homogenized or not, EDS is on the move, its principle of long-term turnkey services proven on a small scale. What next? "It's a changing business," says Perot. Recognizing this and seeking a way to get even better leverage from his still small professional staff, Perot will move to services based on master systems for individual industries. Separate autonomous centers are being set up, each with its own recruitment, training, sales, accounting, computers . . . and profits. Announced so far are centers for four industries: life insurance, health insurance, distribution, and foods, which last month signed on Affiliated Food Stores, Inc., which has 900 member stores, grossing over $300 million a year. Size of the contract was not revealed.

"A system to serve an industry costs 3-4 times as much as one to serve a single major company," says Perot. "We can build one for the industry for $5 million. Instead of building individual systems for individual companies, we can merely modify the master system, tailoring it to an individual company's needs for 15-20% of the effort normally required." A tipoff to the potential success of the new approach: industry center sales (measured in terms of annual revenue) for the last three months are equal to last year's revenues for EDS.

If the autonomous industry center idea works, it should allow EDS to get a whole lot bigger . . . and still stay manageable.

Perot's aggressive flanking movements around edp management to top management have undoubtedly won him some enemies in those quarters. How does edp management react? "It varies," parries Perot, who moves quickly on to say that EDS has only recently signed a contract which calls for it to take over a 70-man department.

It's too early yet to tell how this will work out, but Perot feels it will be "a fascinating experience. We try to appeal to their pride," he says. "We tell them that yesterday our customer was their employer. Today they are your customer. Here were your operating patterns. Here are your new ones." Perot indicates that the new patterns will rule out "tennis shoes and beards;" people will be expected to go home when they've finished their work, not before. But all will be given an opportunity to live up to the EDS code. He expects some mortalities. "But if we salvage 10 out of 70, think what we go through to hire 10 men."

The company will continue to go after the big orders. In January, EDS broke its all time record for a single order with one for $160,000/month (or $10 million total contract value). A week later they broke it again with an order for $300K ($18 million). Both were five-year contracts. As of this writing they were about to break *that* record.

How do they get the big orders? "Simply by going after them," says Perot. "Others haven't; they think the huge accounts belong to IBM. But it depends on where you hunt."

On the wall behind Perot's desk is a large golden eagle riding on a wooden plaque. On it is painted the EDS recruitment motto, which seems also to describe the company's marketing strategy:

EAGLES DON'T FLOCK
YOU HAVE TO FIND THEM
ONE AT A TIME

■

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# AUSTRALASIA: A SALES PERFORMANCE REVIEW

chasing the pounds and $A

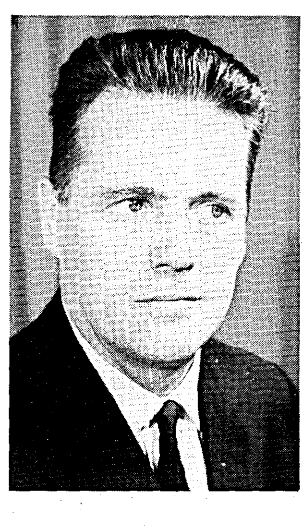
by FREDERICK BLAND

Australasia is a term which has been used in the past to describe an area whose main population and commercial base was in the countries of Australia and New Zealand; perhaps in line with current trends an ugly acronym such as ANZ should be used. In the main this article is about Australia alone, although some figures for New Zealand are included.

The population of the two countries is rapidly approaching 15 million, a total which is divided roughly in the ratio of 5:1 between Australia and New Zealand. Both countries, in the sense that they are English-speaking countries, represent ideal markets for the main computer manufacturers since there is no language barrier to be overcome; in the sense that the population is dispersed over a very wide area the two countries represent a difficult market. Australia, with no duty payable on computers and with the first indigenous manufacturer about to begin production and saying that he will not claim tariff protection, is a wide-open market; New Zealand, however, has import restrictions and at least one order included in the tables accompanying this survey is "subject to government approval."

In Australia the market is in effect represented by two large cities, Sydney and Melbourne, each with populations in excess of two million; three medium-sized cities, Brisbane, Adelaide and Perth; and one small federal capital city, Canberra, included in the state of New South Wales in the accompanying tables, where commercial and industrial installations would not require the digits of one hand for the counting of them. Each of the five cities previously mentioned is also the capital city of a state; there is a sixth island state, Tasmania, but its population, both of people and computers, is comparatively low. Two of the states—New South Wales, capital Sydney, and Victoria, capital Melbourne—have approximately one-third each of the human population, whilst the remaining three states—Queensland, South Australia and Western Australia—share the other third almost equally.

In New Zealand the market is mainly concentrated in one medium-sized commercial and industrial city, Auckland, which is towards the northern tip of the North Island straddling a belt of land a few miles wide between the Tasman Sea and the Pacific Ocean, and two smaller cities—Wellington, the capital city, on Cook Strait and Christ-



*Mr. Bland has been editor of Data Trend, Australia's monthly computer magazine, since March 1968. He was previously with ICL, the British computer manufacturer, in New Zealand, London, and Ireland. He is also a free-lance writer and his play, "The Naming of Murderers' Rock," was performed at the Royal Court Theatre, London, in April 1960.*

church, the main South Island port for the rich Canterbury farming region.

**far apart**

Distances are great. Wellington is 400 miles south of Auckland in New Zealand, whilst Christchurch is a further 200 miles south and separated by water as well. In Australia, Sydney is 500 miles south of Brisbane, Melbourne 500 miles southwest of Sydney, Adelaide 350 miles west of Melbourne, whilst Perth is a mighty 1300 miles west of Adelaide. This area between Perth and Adelaide is named the Nullarbor Desert and provided some of the roughest road in the recent London-to-Sydney car rally.

In Australia the computer companies tend to have their head offices in Sydney, whilst in New Zealand head offices are in Wellington, the capital city. The exceptions to this are Control Data and Hewlett-Packard, which have head offices in Melbourne. There is perhaps some reason for Control Data to be in Melbourne rather than Sydney in that, until recently, its main sales were to government, research bodies and the universities and some government departments are still located in Melbourne rather than the federal capital, Canberra.

One major company, RCA, is not represented as a computer sales organisation here, although, of course, it has links with ICL, the British company, formerly through the 1500 computer and latterly by way of mergers through the English Electric System 4 computers. There has been one sale of a Spectra 70/25 with a Lector reader to a grocery warehousing organisation in Wellington, New Zealand.

In general, the term "computer companies" means the American companies plus ICL, the British company. The Japanese do not yet have computer sales organisations here and, so far as larger computer sales are concerned, might, with the exception of Fujitsu, be inhibited from selling here by their links with American companies. Thus the first Japanese machines to appear in this market could well be visible record computers, although Fujitsu, by its advertising campaign depicting racehorses and the FACOM computer, is obviously aiming for one very large contract—an on-line system for the Totalisator Agency Board (state betting shops) in New South Wales. Competition for this contract is fierce because Control Data has provided the system for the state of Victoria, whilst IBM has provided that for Western Australia.

Punched cards and accounting machines originally provided the background organisation for representation throughout the area for four companies—IBM/ICL and Burroughs/NCR—although the more recent tendency is to divorce computer sales from this "lower order" background. These four companies represent the full competition in New Zealand, although EAI in analogs and Digital Equipment have made some sales from Sydney.

In addition to the four companies which operate in all six states of Australia, Control Data, General Electric, Honeywell and Univac operate from Sydney and Melbourne and between them Control Data and Honeywell have the bulk of the government contracts in the federal capital, Canberra.

**another angle**

Digital Equipment chose a different method of operation by setting up their second office in Perth in Western Australia and this has certainly paid off in the sales of a PDP-6 to the University of Western Australia and a PDP-10/50 to Australian Computing Consultants, who aim to have one of the first independent time-sharing bureaux in Australia. Digital have also sold "large" to the University of Queensland in Brisbane and to Aeronautical Research in Melbourne, these two installations being distant from the head office base.

Hewlett-Packard are more recent arrivals on the Australian scene and can be expected to provide competition at the smaller end of Digital Equipment's range of machines.

In fact, 1968 has seen considerable expansion in the range of "tinies" available. The Elbit has arrived from Israel, Varian now has its own offices here and the Interdata is being sold by Dataprint. Among visible record computers, besides the well-known names of Burroughs, Friden and Litton Industries (through the Monroe 1210), the newcomer is Nixdorf from Germany, which has formed a company on a 50/50 basis with an Australian company and which has already notched up orders for 50 machines.

So far as analogs are concerned the story belongs almost wholly to Electronic Associates, who have captured certain-

APPROXIMATE VALUE OF AUSTRALIAN MARKET (EXCLUDING MANUFACTURERS' OWN MACHINES)

VALUES IN $A TO ¼ MILLION BELOW

| | INSTALLATIONS AT 30TH JUNE, 1968 | | | | | | | | | | | | ORDERS AT 30TH JUNE, 1968 FOR INSTALLATION | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Years to 1964 | | 1965 | | 1966 | | 1967 | | First Half 1968 | | TOTAL | | Second Half 1968 | | 1969 | | TOTAL | |
| | NO | $M | NO | $M | NO | $M | NO | $M | NO | $M | NO | $M | NO | $M | NO | $M | NO | $M |
| BURROUGHS | 4 | ½ | 4 | ¾ | 3 | ¼ | — | — | — | — | 11 | 1½ | 4 | 1 | 1 | — | 5 | 1 |
| CDC | 6 | 5½ | 7 | 3½ | 9 | 6¾ | 5 | 3¼ | 2 | ½ | 29 | 19½ | — | — | 2 | ¼ | 2 | ¼ |
| DIGITAL EQUIPMENT CORP. | 1 | — | 1 | ½ | 5 | — | 29 | ¾ | 15 | 1 | 51 | 2¼ | 6 | 1¼ | 1 | ½ | 7 | 1¾ |
| GE | 4 | 1¾ | 1 | ¼ | 5 | 1 | 8 | 1½ | 6 | ¾ | 24 | 5¼ | 6 | ½ | 1 | — | 7 | ½ |
| HONEYWELL | 8 | 4¼ | 6 | 2¼ | 5 | 2 | 9 | 2½ | 8 | 2 | 36 | 13 | 3 | ½ | 2 | ¼ | 5 | ¾ |
| IBM | 39 | 9½ | 26 | 3¾ | 63 | 20¼ | 67 | 14¼ | 28 | 8½ | 223 | 56¼ | 21 | 7½ | 14 | 4¾ | 35 | 12¼ |
| ICL | 26 | 4¼ | 27 | 2½ | 13 | 1¼ | 22 | 2¾ | 10 | 2¼ | 98 | 13 | 15 | 4 | 10 | 2 | 25 | 6 |
| NCR | 4 | ¾ | 6 | 1 | 8 | ½ | 17 | ¾ | 10 | ½ | 45 | 3½ | 10 | 1¾ | 9 | 1 | 19 | 2¾ |
| UNIVAC | — | — | — | — | 4 | 2¼ | 1 | — | — | — | 5 | 2¼ | 4 | 1½ | — | — | 4 | 1½ |
| MISCELLANEOUS | 11 | 1¼ | 4 | — | 11 | ½ | 4 | ¼ | 3 | — | 33 | 2 | 1 | — | — | — | 1 | — |
| TOTAL | 103 | 27¾ | 82 | 14½ | 126 | 34¾ | 162 | 26 | 82 | 15½ | 555 | 118½ | 70 | 18 | 40 | 8¾ | 110 | 26¾ |

ly 80% of the market and possibly as much as 90%. This is an area where the Japanese have begun to sell and Toshiba is the company involved.

Moving on now to the tables which accompany this article, questionnaires were sent out to all companies in Australia and New Zealand known to have computers installed or on order and there was approximately 70% response. The forms sent out were comprehensive including questions as to capital or rental value of computers. Where forms were not received it was possible to cross-check with all the Australian machine houses mentioned in the tables except one —IBM—whose international policy precludes the Australian company from taking part in the monthly census on computers carried out by the magazine "Data Trend." The information obtained from the manufacturers was type of computer, location, and date of installation. Because of the difficulty in obtaining full figures from New Zealand, a full analysis was not carried out and the majority of tables refer to the Australian position only.

## market groups

So far as grouping computers into different markets is concerned, the following subdivision was made:

A. Capital value less than $99,999 or rental values less than $2,499;

B. Capital values between $100,000 and $299,999 or rentals between $2,500 and $7,999;

C. Capital values between $300,000 and $599,999 or rentals between $8,000 and $16,999; and

D. Capital values greater than $600,000 or rentals greater than $17,000.

The figures given are in Australian dollars (Aus. $1.00 = U.S. $1.12), but might be read as United States dollars, since importation charges will in some cases have been included in values. Where total value of the market has been calculated rentals have been multiplied by a factor of 40.

In tables A and B percentage share of the market has not been included for machines with capital value less than $99,999 since to be meaningful this section should be further sub-divided and the survey area extended to include visible record computers. The main entries in this section are in respect of Digital Equipment's PDP-8 series, IBM 1130 and 1620, ICL's franchise for the Univac 1004, NCR's 500, and the Monrobot XI under the heading of miscellaneous.

In only one area of the Australasian market is IBM the outstanding performer it claims to be in the rest of the world. This is in New Zealand where it has the whole of the market over $600,000 and the greater part of the next valuable portion of the market. In large computers this is by virtue of its sale of 6 360/40's to Databank, the computer bureau organisation formed to provide a nationwide service for several New Zealand banks.

With regard to the type of business analysis for Australia, perhaps the most important factor hidden in these figures is that to a large extent federal government computing is in the hands of CDC and Honeywell. CDC have the largest single contract with 13 computers in the bureau of Census and Statistics ranging from CDC 3200's in the smaller state capitals to a CDC 3600 and two CDC 3300's in the federal state capital. Honeywell has the larger share in the defence departments with twin computers in Defence itself and in Army, Navy and Air Force.

## on the move

In addition, CDC has moved out of the government, education and research area and captured the largest commercial order for 4 CDC 3300's from BHP, which is the largest Australian company and which has been constantly in the news recently for its oil exploration partnership with

*(Continued on page 108)*

COMPUTERS INSTALLED AT 30th JUNE BY CAPITAL VALUE

| | TOTAL | A | B | % | C | % | D | % |
|---|---|---|---|---|---|---|---|---|
| BURROUGHS | 11 | 1 | 9 | 5 | 1 | 1 | | |
| CDC | 29 | 2 | 4 | 2 | 6 | 7 | 17 | 32 |
| DIGITAL | 51 | 49 | | | 1 | 1 | 1 | 2 |
| GE | 24 | 2 | 12 | 6 | 9 | 10 | 1 | 2 |
| HONEYWELL | 36 | | 20 | 10 | 9 | 10 | 7 | 13 |
| IBM | 223 | 49 | 105 | 54 | 50 | 60 | 19 | 35 |
| ICL | 98 | 63 | 24 | 13 | 6 | 7 | 5 | 9 |
| NCR | 45 | 35 | 7 | 4 | 3 | 4 | | |
| UNIVAC | 5 | 1 | | | | | 4 | 7 |
| MISC. | 33 | 22 | 11 | 6 | | | | |
| TOTAL | 555 | 224 | 192 | 100 | 85 | 100 | 54 | 100 |

COMPUTERS ON ORDER AT 30th JUNE

| | TOTAL | A | B | % | C | % | D | % |
|---|---|---|---|---|---|---|---|---|
| BURROUGHS | 5 | | 3 | 6 | 2 | 9 | | |
| CDC | 2 | | 2 | 4 | | | | |
| DIGITAL | 7 | 4 | | | 1 | 5 | 2 | 17 |
| GE | 7 | | 7 | 13 | | | | |
| HONEYWELL | 5 | | 5 | 10 | | | | |
| IBM | 35 | 4 | 13 | 25 | 13 | 59 | 5 | 41 |
| ICL | 25 | 4 | 14 | 27 | 4 | 18 | 3 | 25 |
| NCR | 19 | 9 | 8 | 15 | 2 | 9 | | 17 |
| UNIVAC | 4 | 2 | | | | | 2 | |
| MISC. | 1 | 1 | | | | | | |
| TOTAL | 110 | 24 | 52 | 100 | 22 | 100 | 12 | 100 |

COMPUTERS INSTALLED BY STATE

| | NSW | VIC | QLD | SA | WA | TAS | AUST TOTAL | NZ TOTAL |
|---|---|---|---|---|---|---|---|---|
| BURROUGHS | 6 | 4 | | 1 | | | 11 | 7 |
| CDC | 9 | 11 | 1 | 6 | 1 | 1 | 29 | 1 |
| DIGITAL | 24 | 17 | 4 | 1 | 5 | | 51 | |
| GE | 13 | 10 | 1 | | | | 24 | |
| HONEYWELL | 28 | 7 | | 1 | | | 36 | |
| IBM | 118 | 62 | 14 | 19 | 8 | 2 | 223 | 54 |
| ICL | 36 | 35 | 16 | 3 | 2 | 6 | 98 | 28 |
| NCR | 21 | 13 | 4 | 5 | 1 | 1 | 45 | 13 |
| UNIVAC | 3 | | | | 2 | | 5 | |
| MISC. | 15 | 13 | | 2 | 1 | 2 | 33 | 1 |
| TOTAL | 273 | 172 | 40 | 38 | 20 | 12 | 555 | 104 |

COMPUTERS ON ORDER

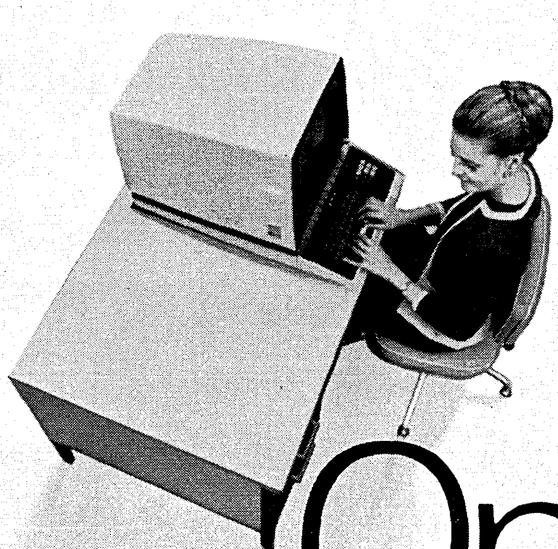
| | NSW | VIC | QLD | SA | WA | TAS | AUST TOTAL | NZ TOTAL |
|---|---|---|---|---|---|---|---|---|
| BURROUGHS | 1 | 3 | | 1 | | | 5 | |
| CDC | | | | 2 | | | 2 | |
| DIGITAL | | 2 | 3 | | 2 | | 7 | |
| GE | 3 | 4 | | | | | 7 | |
| HONEYWELL | 3 | 2 | | | | | 5 | |
| IBM | 18 | 14 | | 2 | 1 | | 35 | 18 |
| ICL | 7 | 13 | 2 | 2 | | 1 | 25 | 7 |
| NCR | 11 | 3 | 3 | | 1 | 1 | 19 | 2 |
| UNIVAC | 3 | 1 | | | | | 4 | |
| MISC. | 1 | | | | | | 1 | |
| TOTAL | 47 | 42 | 8 | 7 | 4 | 2 | 110 | 27 |

ANALYSIS OF COMPUTERS INSTALLED BY TYPE OF BUSINESS AND MANUFACTURER

| | TOTAL | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| BURROUGHS | 11 | 2 | 1 | | | 1 | 2 | | 1 | 2 | 2 |
| CDC | 29 | 20 | 9 | | | | | | | | |
| DIGITAL | 51 | 2 | 34 | | | | | 3 | 6 | | 6 |
| GE | 24 | 2 | | 7 | 3 | | | 2 | 2 | 6 | 2 |
| HONEYWELL | 36 | 17 | | 5 | | 2 | | 2 | 5 | 1 | 4 |
| IBM | 223 | 41 | 27 | 26 | 12 | 2 | 16 | 32 | 29 | 16 | 22 |
| ICL | 98 | 11 | 8 | 10 | 8 | 3 | 5 | 13 | 22 | 13 | 5 |
| NCR | 45 | 14 | 2 | 5 | 2 | 3 | 2 | 4 | 9 | 1 | 3 |
| UNIVAC | 5 | 1 | 4 | | | | | | | | |
| MISC. | 33 | 1 | 9 | 5 | 2 | 1 | | | 7 | 3 | 5 |
| TOTAL | 555 | 111 | 94 | 58 | 27 | 12 | 25 | 56 | 81 | 42 | 49 |

TYPE OF BUSINESS

0 Government or State
1 Education and Research
2 Finance and Professional
3 Farming and Forestry
4 Building and Construction
5 Chemicals
6 Mining, Metals and Motor Cars
7 Manufacturing and Distribution
8 Household
9 Services



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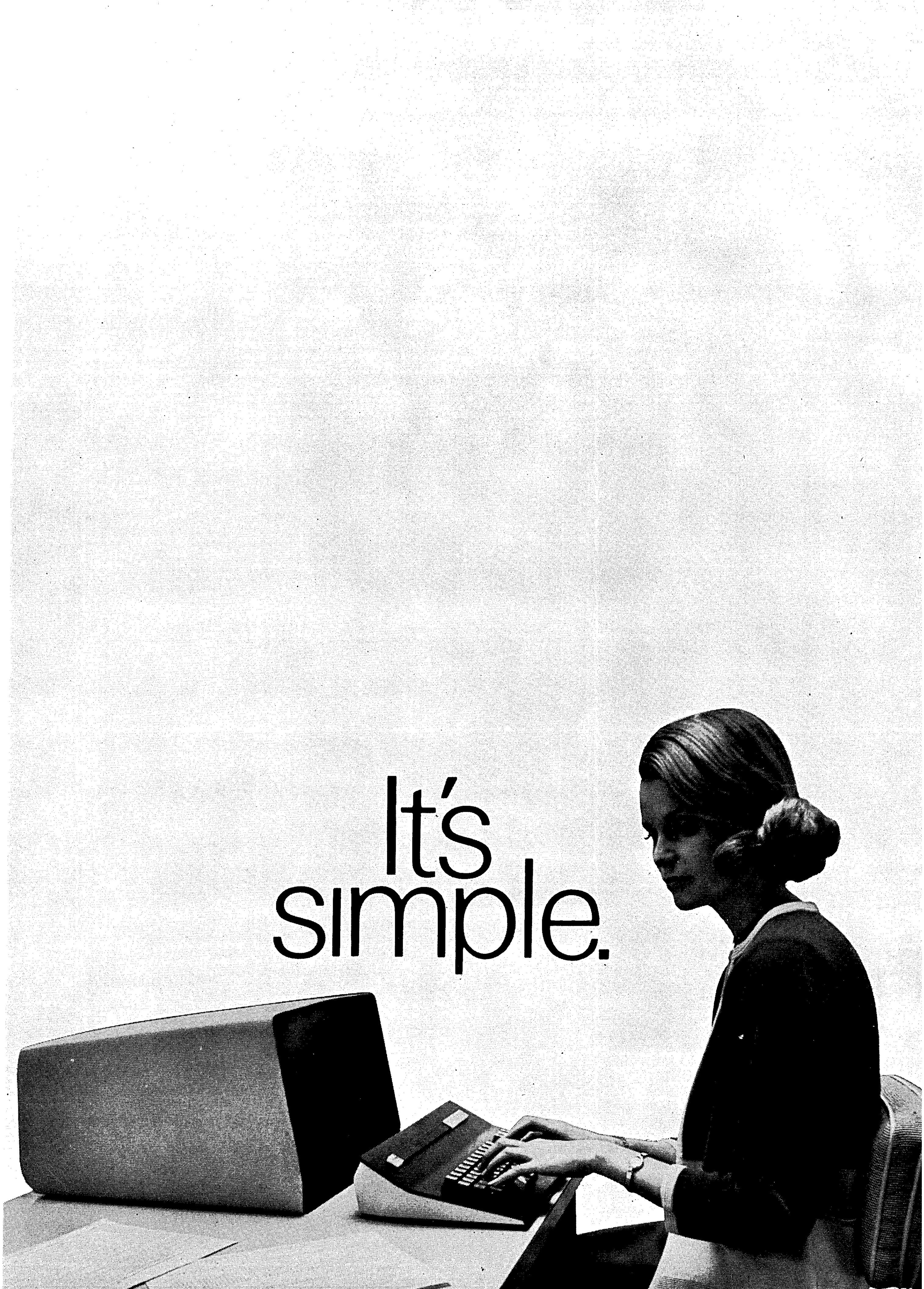
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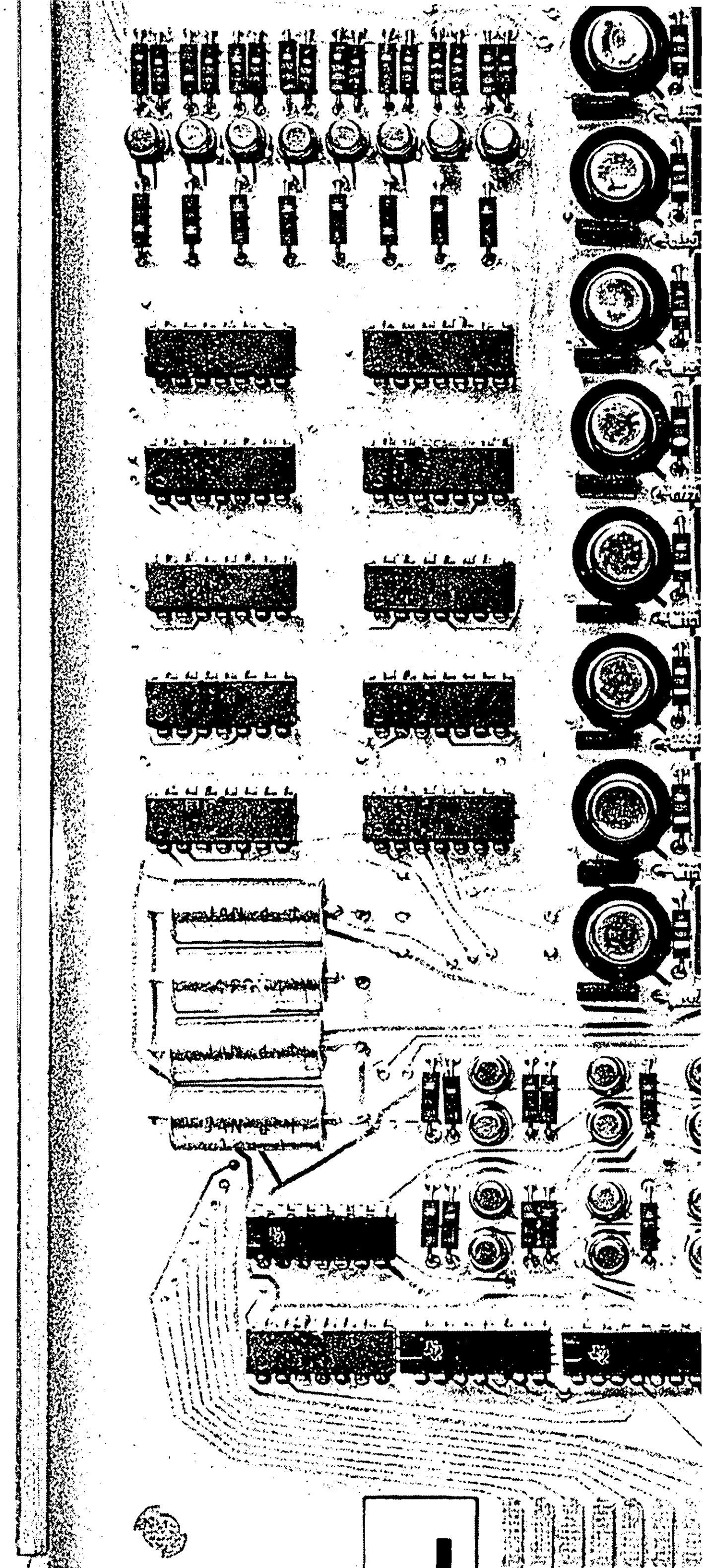

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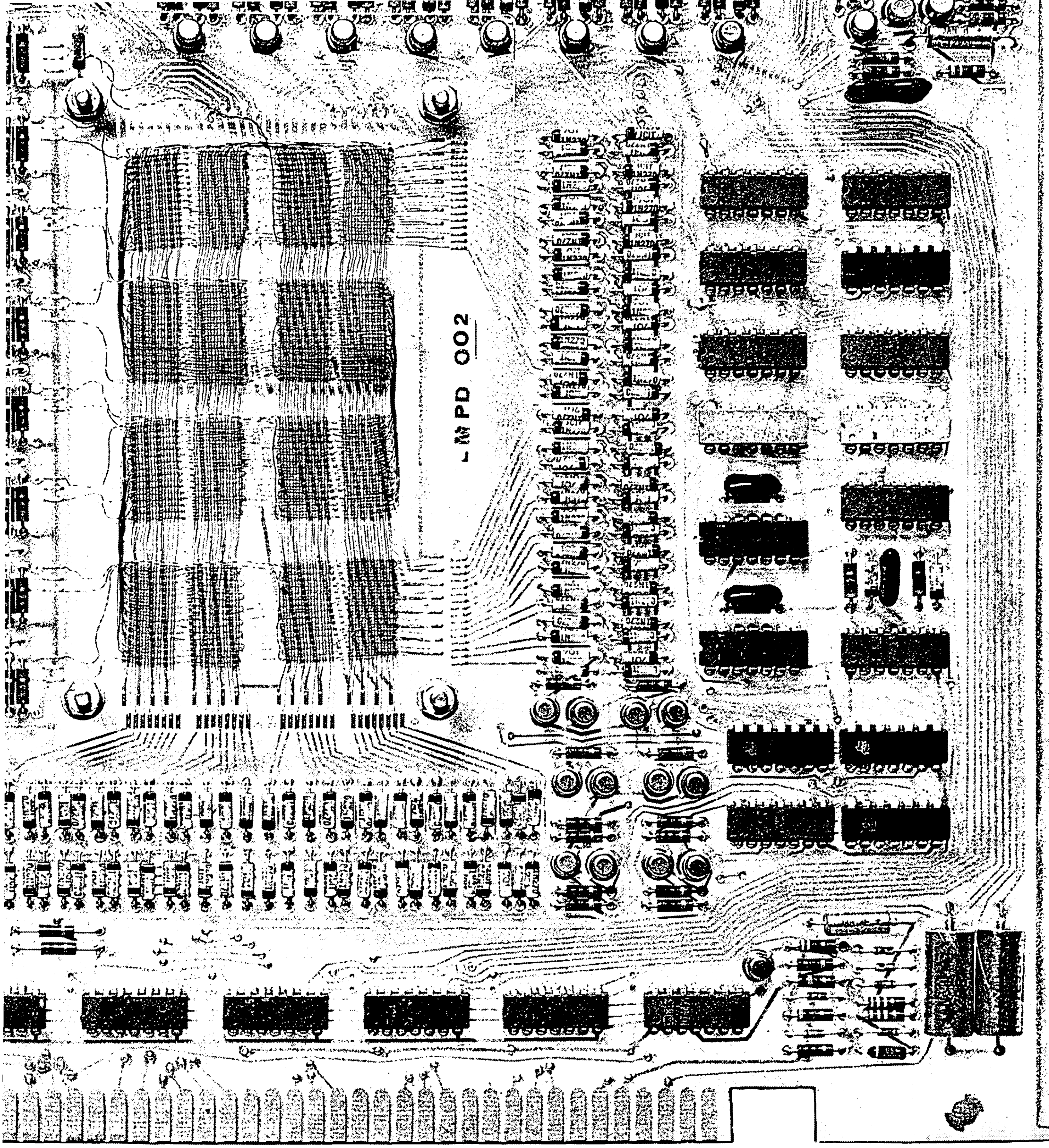


Esso in the Bass Strait, which separates Tasmania from the mainland of Australia. However, BHP is basically the largest Australian company through steel production and it is for this, not oil, that the computers have been purchased. This sale was made after 30th June and is not included in the tables.

Whilst mentioning this period since 30th June the other notable orders in this period have gone to ICL in the education field with the sale of 6 1900 series computers to Institutes of Technology in Victoria and a large 1904A system to the Institute of Technology in New South Wales; and to Burroughs in replacing a 360/40 and a 360/20 at Ford Motor Company with a B3500 and a B2500 by reason of better multi-programming facilities—a changeover assisted by the fact that the majority of programs were already written in COBOL. Lower down the scale of prices NCR has steadily been selling Century computers, their most notable sale being two Century 200's and 36 time-sharing terminals to Thomas Nationwide Transport.

When carrying out a survey of this type, one of the requests most frequently made is that some total value should be put on the market. Because the figures for New Zealand have not been cross-checked, no attempt has been made to give a total value for that country, but so far as Australia is concerned the original undiscounted capital value of the 555 computers installed at 30th June, 1968, was around $120 million and the current annual rate of the market is around $30 million.

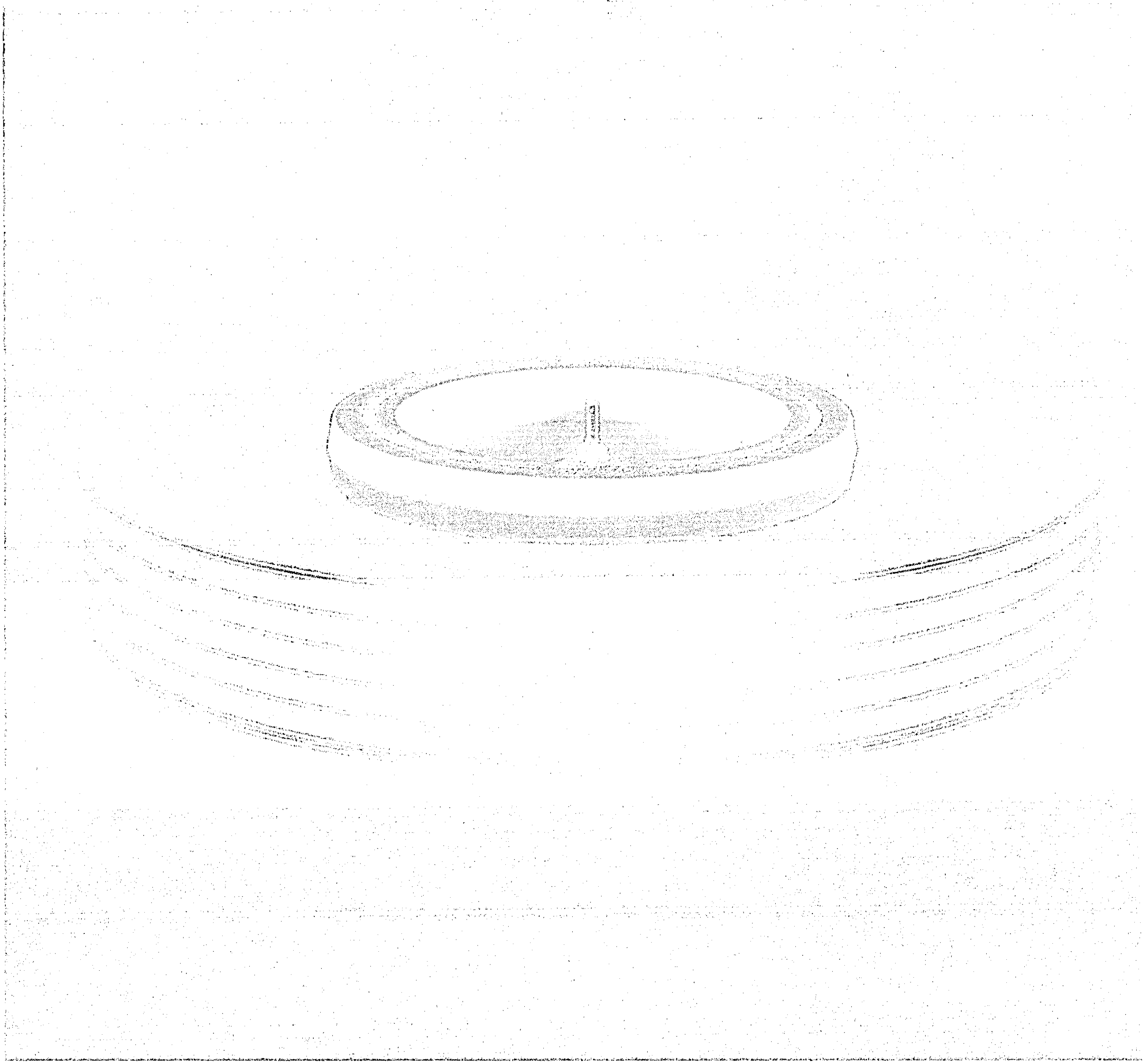
Within these figures four companies which have already achieved sales in excess of $10 million are IBM, CDC, ICL and Honeywell with IBM having sold more than the other three companies combined. It must also be said that ICL's figures include considerable sales of Univac 1004's.

With regard to individual performances of companies, with the exception of Digital Equipment and NCR all companies have suffered a decline in sales after an initial push in earlier years. IBM's decline is from a dominant peak of $20 million in 1966 to a current level of perhaps two thirds of this, which is still a very high level of sales for the Australian market. With many companies firmly established in the main selling area, it does seem doubtful that IBM will return to their former level for several years and then as less than the 50% of the total market they held in the past.

ICL had its low in 1966 and is now firmly back in the picture with an increased share of the current market and orders steadily being added. As mentioned previously, CDC and Burroughs have also had large orders after the end of the survey and have, therefore, begun to move upwards again. Univac has not been in the market continuously over the period under consideration, but has recently—with the introduction of the 9000 series—optimistically opened an office in Melbourne.

Honeywell and General Electric are the two companies currently at low points. Both, however, have a good base of machines already installed and should show a resurgence in 1969. Honeywell has just moved into new headquarters and promises to be selling Keytape hard during 1969, whilst for General Electric 1968 was the year of introduction of its time-sharing service in Sydney.

It will be interesting to see what changes in status there are among the "contenders" when next year's survey is carried out. Important note: The tables accompanying this article do not take account of any machines installed on manufacturers' own premises for service bureau or training purposes. There is a further $16 million worth of machines employed here, 42 computers being installed and another 5 on order. ■



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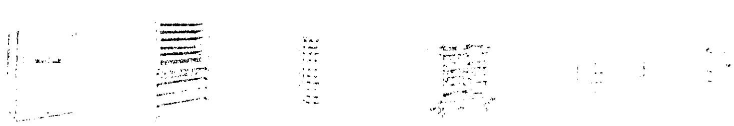

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# ASCHER OPLER: 1916 - 1969

At the last Fall Joint Computer Conference, Ascher Opler moderated a session on "Trends in Computer Programming." After two papers had been given, Opler looked up and asked where the third speaker, Dr. M. Newey, was. No one knew (it turned out Newey had been taken ill), so Opler proceeded to give a brilliant, extemporaneous discussion of the paper—its substance, the important points, its strengths and weaknesses. After a thorough dissertation, the audience sat silent, somewhat stunned, until Martin Hopkins, a former Computer Usage Co. colleague of Opler's, shot his hand up, and said, "I'm preparing a paper for the Spring Joint. Would you mind delivering it for me?"

"The great ability to communicate his special knowledge and experience to other people, and to listen and learn" was perhaps above all the major attribute of Mr. Opler, a preeminent pioneer and continuing contributor to the computer industry. That is, if you could get away with listing one thing.

Opler, who died Feb. 24 at the age of 52, left a long list of professional and personal activities and contributions that will take a scholarly work to examine. After speaking to several colleagues who knew Opler during his 20 years of involvement with the industry, it's clear that no one label, like software expert, adequately describes this multi-faceted and very colorful personality.

Contributions in the concepts of list processing, information retrieval, compilers, compiler-compilers, translation, etc., do not belie the interests of Mr. Opler, who just before his death (with a terminal at home on-line to a 360/67) was developing a conversational system for psychiatry, toying with the design problems of the circular home he was building, working on improving a programmer aptitude test, and researching the possibility of valid computer-aided predictions in the mutual fund area. He had also been actively alerting the industry and the press about his concern that Wall Street, with its millions available to new computer businesses, was drawing too many bright young people "away from what they ought to be doing."

If that isn't enough to verify that Opler wasn't a myopic introverted programming specialist, note how, in his single days, he went about studying the computer operations of several dating bureaus—through the adventures of "first-hand" experience. (We recall him noting that one dating bureau sent him only one name, and the only thing Opler says he had in common with his date was age.)

All that was in some of his spare time. As "wise man in residence" under Dr. Arthur Anderson, director of IBM's Thomas Watson Research Laboratories in Yorktown Heights, N.Y., Opler was helping to evaluate and plan new projects, one of which was a possible 20-volume reference work on programming.

Opler had been at his IBM post only 18 months, although he had consulted for IBM on and off since the early '60's. He was most known as a major figure in the select pool of programming talent that had built Computer Usage Co., one of the oldest software firms in the field.

But his career didn't start there. Opler, like many of his contemporaries, entered computing through the back door. Having graduated from Wayne State University in 1944 with a degree in chemical engineering, he served a short stint as a chemist with a food processor that was most concerned with dehydrating onion soup for the war effort. (He often chuckled about this auspicious beginning.) In 1947, he went on to become a research chemist and physicist at Dow Chemical Co.'s Western Division Physics Laboratory. It was here that he discovered "computing devices," which then amounted to analog computers and punched card equipment. (Opler even built his own analog at home in '48.)

Working with this equipment, he became the first to develop digital techniques for spectrophotometry, heat transfer, color matching, optics, etc. He also developed a machine technique for utilizing the Monte-Carlo method.

While doing pioneering work in multi-component infrared analysis, Opler found desk calculators could not solve the equations he had derived. At this point, early in the '50's, Opler was inadvertently introduced to an IBM salesman who was trying to clinch the sale of a business data processing system by adding that the company could also use it to solve engineering problems. Opler wasn't impressed, claiming he didn't need another "adding machine." But that night he was struck by the possibilities of the IBM digital computer, and first thing in the morning he was "on the phone passing along his equations to the salesman," according to a 1953 biography in *Control Engineering* magazine.

In 1952, showing what was a life-long concern for keeping researchers from "re-inventing the wheel," Opler developed a scheme for programming a computer to search chemical compounds; with this a chemist could quickly determine if a new compound had been discovered or locate a compound with specified chemical structure properties. His work is said to have encouraged the Patent Office to proceed with a program to mechanize patent searching. It also led Opler further into information retrieval work, with colleagues T. R. Norton and Norma Baird, carrying into the '60's.

Also during that period, Opler became interested in the problem of linear programming and wrote several programs designed to find "minimax" strategies for economic games and worked on logical programming for maximizing plant output.

It was rather ironical that Opler, who with Ted Norton was credited with introducing computing into the chemical industry, ultimately left Dow because the firm disagreed with Opler's emphasis on the importance of computing in order to stay ahead in the chemical field.

Thus, in 1958, Opler, who had come to New York to be Dow's consultant for data processing, looked elsewhere for a job. Always looking for leeway to do new projects, Opler chose to go to a growing young software house, Computer Usage Co., rather than IBM. Working with a now-well-known programming group that managed to stay together for about a decade, Opler is credited with directing a number of new developments that set the pace for software as a science and for the industry.

Computer Usage became the first outside firm to be contracted by a manufacturer for software work—because, we're told, Opler told a Honeywell executive that the hardware on the vacuum-tube D-1000 computer was beautiful, but the software was just plain "bad." The stunned executive came back to CUC with a challenge and a contract to improve that situation. Thus, TOOL, an algebraic compiler that was very similar to FORTRAN, was developed for the H-800.

All of Opler's programming efforts weren't so successful. Warren King, ex-CUCer now with IBM, recalls the H-800 didn't have a program to rewind its tapes, necessary in checking out the TOOL compiler. Ascher wrote a little four-instruction program in octal, three of which were wrong, causing the tape to both rewind and unload its data.

Also early in the '60's, Opler directed a CUC-IBM project, TUMULT, which was aimed at investigating the technical and economic feasibility of translating machine language from one computer to another (the IBM 705 to the IBM 7074). The resulting data stands as a major reference work on the topic. In 1961, Opler, always concerned with the burgeoning demands for program production and the shortage of programmers, developed a compiler-compiler, which is still in some use today. This concept is still much in its infancy.

In 1964, Computer Usage was contracted by IBM, its major customer by then, to develop a batch operating system and other systems software for the Federal Aviation Agency's IBM 9020 system, which was in effect the 360/50. As a result of this and subsequent work with the 360 systems, CUC was the foremost non-IBM authority on System/360 software, producing one of the early books on it, *Programming the IBM System/360,* edited by Ascher Opler.

The bustling Opler also had a great interest in programmer education, having worked on CUC's programmer aptitude test, and very little faith in the proliferating programmer schools and home-study courses. In 1965, he moved over from CUC vice president to become director of a new venture, Computer Usage Education, which was to develop a home-study course for System/360 programming. While it was called the best such course ever developed in the field, it was ill-fated at CUC, which could not settle on an effective, profitable way to market it and has since then licensed its use to McGraw-Hill.

Distressed by this failure and feeling out of the mainstream of activity, Opler resigned from CUC in 1967, after 10 years, and subsequently went to IBM to do what he liked best, brainstorming. Dr. Arthur Anderson, under whom Opler worked, noted that he "relied a great deal" on Opler in the evaluation and selection of projects. Within 18 months, he said, Opler, an extremely friendly man, had come to know more programming people and their talents company-wide than anyone else in IBM. We are also told by others that Anderson, Opler, and other research directors were making a great effort to redirect the laboratories' research efforts, one result being the strengthening of computer sciences and computer systems research.

In the embryonic stage was a plan to develop, as noted, a comprehensive 20-volume series on programming, aimed at avoiding the "re-invention of the wheel" (showing Opler's hand again) by providing the field with one reference source on all developments and research efforts to date.

Opler used more than 25 different computers in his career, ranging from the IBM 650 and 700 series, the Univac 1103, Raytheon 250, Burroughs 205, and Bendix G-15 to the 360's. He produced more than 60 papers, articles, books, manuals, and chapters of books—besides giving countless speeches around the world. He was an associate editor for the *Journal of the Association for Computing Machinery* and a contributing editor to DATAMATION. While many of his writings detailed some of the work noted above, a great many more theorized and summarized the problems of the past and the solutions needed for the future. In a Jan. 1967 DATAMATION article, "Fourth Generation Software," he succinctly described what is rapidly becoming a paramount concept in the field, "firmware" (his word), hardware implementation of software functions.

Opler was also a significant influence in the build-up of the IBM user group SHARE, having been one of the first members of the SHARE 709 Data Processing Packaging Subcommittee. The Association for Computing Machinery received much of his time, since he variously served, among other things, as vice president and council member. He also was active in organizing conferences for both the International and American Federation of Information Processing Societies.

As early as 1953 Opler began teaching about computing, giving a course on "Engineering Applications of Digital Computers," at the University of California Extension Division, 1953-55. He also gave lectures and courses at IBM Systems Research Institute in 1960, the last, in 1968, being on Software Design.

The productive Opler also consulted for several government agencies on specialized programs, for the Office of Documentation and the Division of Chemical Technology of the National Academy of Sciences, the American Chemical Society, and for the planning session for the information retrieval project Intrex at MIT.

All this was in keeping with his talent as "communicator," and cohorts will say that "he was able to talk to both university people and people from the worlds of insurance, banking, manufacturing—never dismissing any problem as irrelevant or minor." This may sound overgenerous, but as a neophyte reporter who heard Opler's technical talks and was counseled by him on "what it was all about," his ability as a computer professional to communicate on all levels is rare.

Opler's wife, Tamar, is a fine example of his ability to explain difficult concepts clearly and briefly. Within the 13 months of their marriage, Mrs. Opler, an advertising copy writer and English teacher, developed an impressive working knowledge of computing technology.

"If Ascher Opler had one major weakness," said colleague and friend Martin Hopkins (now with IBM), "it was that he had too much fun—and too much judgment to become obsessed with any one part of life, if that's a weakness." The very restless Opler was constantly looking for a new project, although it was seldom that he and his cohorts didn't finish what was started.

His spare time was spent with a multitude of outside interests, as well. He had developed a scholarly knowledge of classical music ("Seldom was there a composer, movement, conductor that he could not identify—and describe"). His summer home and New York apartment contained an extensive collection of modern art. He was an avid amateur photographer, studied psychiatry, directed amateur plays, and had taken up architecture as a result of the home (with a hyperbolic paraboloid roof) he was building. There were other things on the list to be studied—Hebrew, for example, because of plans to go to Israel for a year or so.

And not the least of Opler's interests were people. He also loved a party. ■

continuous supervision

# DYNET—A DYNAMIC NETWORK PLANNING TECHNIQUE

by A. M. BECKER

Network technique renders valuable service both in planning and when applied to project progress control. Electronic data processing cannot, however, be applied successfully to network management technique unless due attention is given to the problem of data acquisition and the clear presentation of the results to be yielded by the computer. The following method differentiates between planning and supervision cycles. During the planning cycles the network is drawn up, evaluated by the computer, and corrected until all those concerned with the execution of the project are convinced that the plan is practicable.

On completion of the basic planning of a project sequence, the execution of a project is supervised in a series of cycles. At the beginning of a supervision cycle the project leader receives data from the computer with which he follows the project execution during the supervision period. The deadline events are entered in check forms and returned to the computer center on revision day. The computer determines the new deadline situation, points out any delays and at the same time supplies the data for the next supervision cycle. The continuous supervision of the execution of project makes it possible to determine the progress reached in the project at any time.

The customary network techniques are suitable for planning the execution of projects but frequently unsatisfactory for supervising their progress. Occasional corrections to the network do indeed give indirect information on the position

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of the projects but usually no *systematic registration* and *evaluation* of the progress of the project. The conventional evaluation programs only produce time schedules for the complete running times of the projects. Long-concluded activities and those to be performed only in the distant future are treated in the same manner as present activities.

The persons responsible are therefore obliged to extract the *present* values from a multiplicity of superfluous figures. Experience shows that as a result the project leaders tend to make only very slight revisions to the network and only when the plan has obviously deviated from reality. This means, however, that the times best suited for corrective measures are too often passed by. Lack of clarity in the description of the results is a further unwelcome feature of the conventional techniques. Moreover, the results must be laboriously entered by hand into the networks or bar charts (Gantt charts).

The following tasks are designed to surmount the clumsiness of conventional procedures:

1. Drawing up a clearly defined management and information system, which taxes the project leader and his staff minimally, yet forcibly leads to systematic progress control of the project.
2. Periodically, providing feedback from the centers engaged in the execution of the project on its progress with a minimum of work on the part of the participants, the computer center and the data processing system.
3. Detecting schedule delays early enough to take action.
4. Summarizing actual-desired comparison of the progress of the project, which can be asked for at any time.
5. Assuring minimal "production" of "paper."
6. Producing graphs in place of numerical tables.
7. Establishing maximum flexibility of the system.
8. Assuring feasibility of reconstructing the development of the network.
9. Providing simple handling of the input data, to avoid sources of error.

The concept and the computer program developed for this purpose is called Dynamic Network Planning Technique (DYNET).

## concept of project planning/supervision

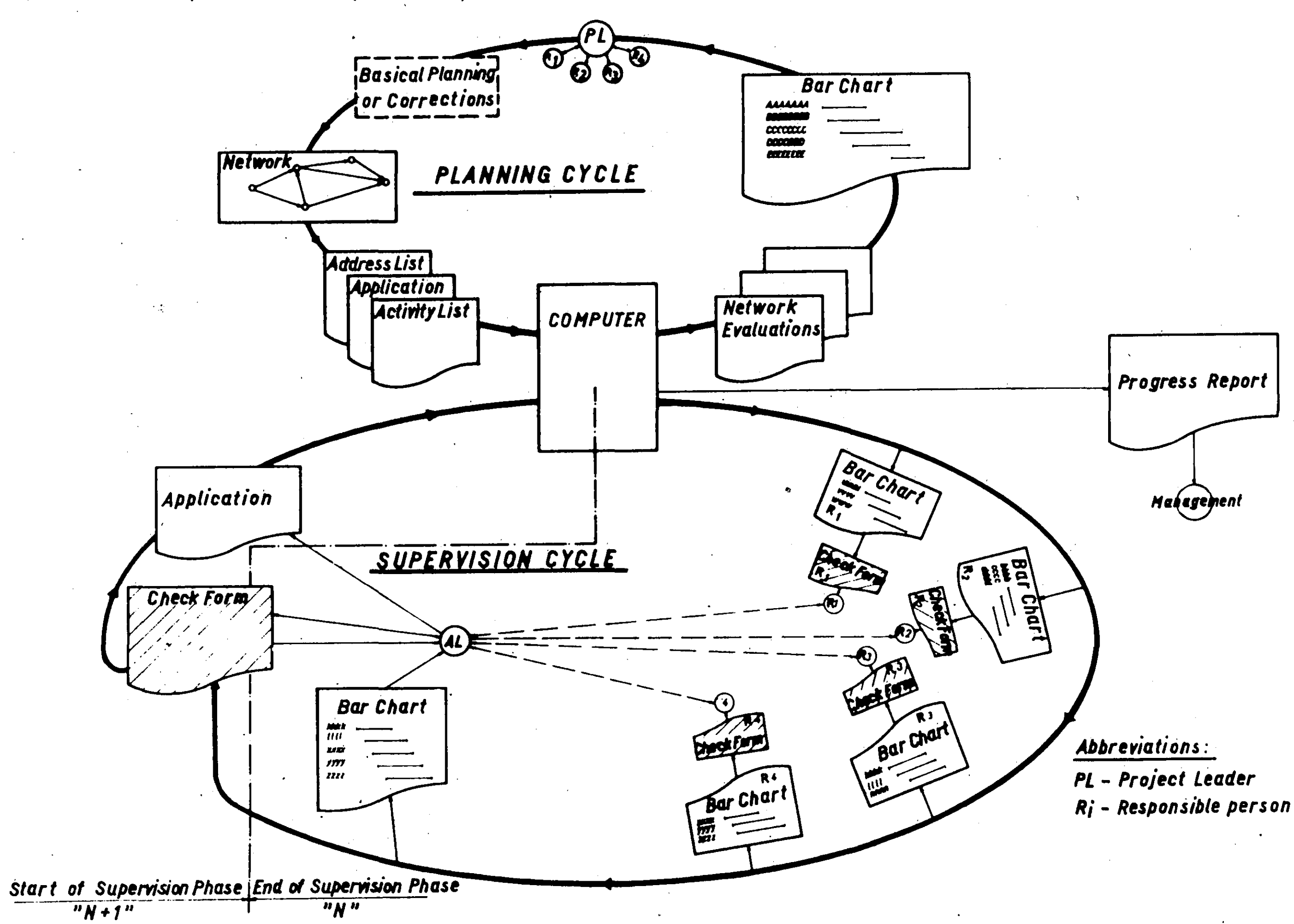
Fig. 1 is a diagram showing the concept of the Dynamic Network Planning Technique—the interplay between the project leader, the leaders of the executive centers participating, and the computer. There are basically two information cycles: planning and supervision.

A *planning cycle* consists of the following stages:

1. The project leader clarifies which persons are to be responsible for the execution of the project.
2. The project leader and the persons responsible draw up a fundamental plan. The individual activities to be performed must be determined, their sequence decided and the running time estimated.
3. Drawing up a network.
4. The information contained in the network is retained

(*Continued on page 119*)

Fig. 1 Diagram of planning and supervision cycles.



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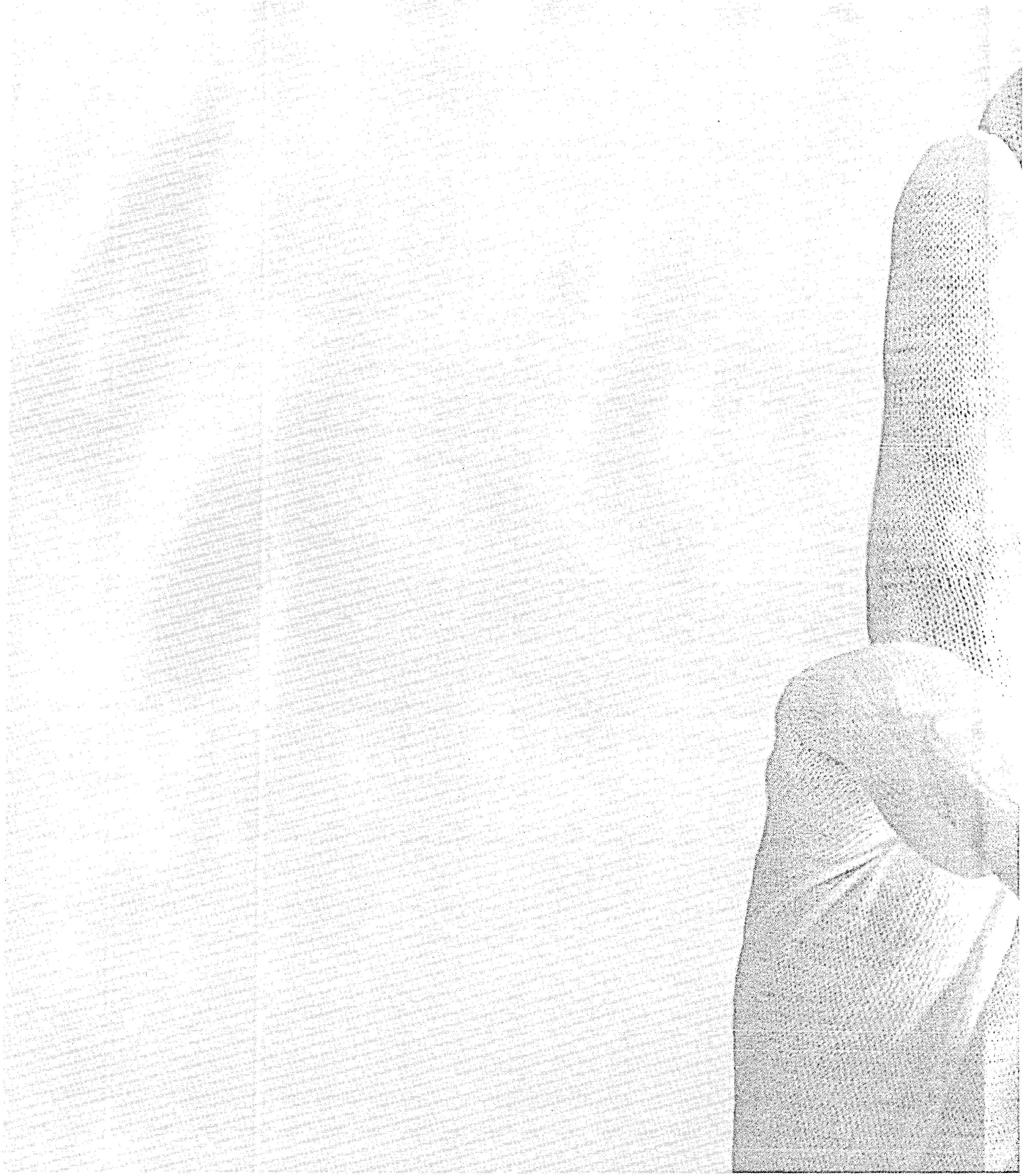

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in a form and transferred to the computer for evaluation.

5. The project leader and the responsible persons receive the results of the network evaluation and a bar chart for the complete running time of the project.
6. The results of the network evaluation are checked by the project leader and the responsible persons. They determine, for example, that the final deadline calculated by the computer satisfies the customer's requirements and the centers performing the work are not overloaded.
7. If necessary, the network is corrected and a revised form of it given to the computer for evaluation. This is repeated until the customer accepts the final deadline and all those participating are convinced that the plan is capable of being realized.

This concludes the fundamental planning, which is followed by the *supervision cycles* sequence:

The project is *continually supervised* in a series of supervision cycles, the duration of which—revision periods—is laid down by the project leader according to *his* judgment. The workflow in such a supervision cycle is divided into three steps:

1. *At the beginning of the revision period* the project leader requests for himself and for the responsible persons engaged on the project the so-called check forms to be produced by the computer, and states a target date. The *target date* fixes the latest day by which the following revision period should be completed. The check form gives information on the *actual position* of the project attained on the revision date and on the activities to be recommenced, continued or terminated during the coming revision period. The project leader's check form contains *all* the current information for the desired period of time, while the responsible persons receive only a portion of the check form with information from *their* own respective field. In addition, the project leader and the responsible persons each receive together with the check form a revised and brought-up-to-date bar chart. The bar charts of the responsible persons contain only those activities which lie within the revision period commenced and lie in the responsible persons' domain.
2. *During the supervision period* the check form draws the project leader's attention to the activities on which the further progress of the project depends at the moment. The check form also poses questions regarding the actual beginning or final date of these activities. The project leader transcribes by handwriting the actual data ascertained by himself and the responsible persons into his check form. If the estimated duration of an activity needs to be corrected, the project leader likewise notes the re-estimated duration on his check form.
3. *At the end of the supervision period* the project leader determines the target date of the following supervision cycle and has the computer evaluate his completed check form. The computer determines the new actual position reached by the project, draws the consequences therefrom and, if necessary, corrects the deadline forecasts. The computer also provides the supervision data for the next supervision cycle.

If the events make an *immediate revision* appear urgent, the project leader need not wait for the target date of the current supervision cycle. He can request the new check form at any time. For this purpose, the old check form must be completed and returned to the computer center with a statement of the time limits of the new supervision period.

We shall illustrate the application of DYNET by a fictitious example. This example is a reliable guide for filling out the forms and interpreting the computer results. However, it describes only one possible method of proceeding with regard to the collaboration between the customer or manager, the project leader and the other responsible persons.

The customer decides to place an order. A project leader is appointed to supervise the work parts of the project and which persons are to participate in the execution of the project. He then consults with the responsible persons and with their help draws up a rough division of the activities to be performed.

The project leader draws up a *network* from the rough planning, working from the facts supplied by the responsible persons on the activities falling within their domain. The duration of the individual activities is estimated and entered into the network. The project is also given a number (the example has No. 1706). The data in the square boxes in the network are milestones, and the computer must constantly check that these are adhered to.

The only preparatory work required for evaluating the network by the computer is the completion of three input forms: the address list, the activities list and the application form.

The address list must contain the names of all the responsible persons engaged in the project, with details of the department number, the telephone number, and a code number to be assigned by the project leader. If an outside firm is participating, its name appears in the column Outside Firm. The address list for each project is only compiled once; alterations which arise in the course of the project execution are entered into the list afterwards.

Each activity listed in the network is given a line in the activity list. The activity list has the following columns:

*Beginning event*—numbering between 1 and 9998.

*Final event*—numbering between 1 and 9998.

*Job description*—24 alpha numeric characters.

*Duration*—indication in days or weeks (only round figures and only the same measuring unit for all the durations should be used).

*Code*—indicating the code of the person responsible for the respective activity according to the address list.

*Milestone*—deadlines can be fixed for important events (e.g., for concluding the project or for specific project phases) and entered into the column Milestone. If a milestone cannot be kept to, this is indicated by a special milestone analysis.

The list of activities is only compiled once for each project and transcribed to magnetic tape. Alterations arising in the course of the project execution are to be entered into the activity list subsequently.

The fundamental planning for the execution of the project produces a specific deadline and work load situation with the persons participating. To obtain clarification on this, the project leader has the network evaluated for the *whole* running time by completing a network evaluation application for the first planning cycle.

The evaluation application consists of two parts:

In the first part the project leader indicates the data required for evaluation purposes, such as calculation unit of the network; planning cycle number; supervision cycle number; and starting date of the project.

In the second part the project leader puts a cross against the evaluations he requires:

1. A dated network evaluation for the entire running time, classified from the earliest start.
2. A bar chart of the entire project for the entire running time, classified from the earliest start.

The address list, the activities list and the network evaluation application are completed and transferred to the computer center, where they are punched and evaluated. The project leader receives the results lists printed by the computer. The bar chart, which was prepared in a revision *during* the execution of the project, indicates the completed part of the project up to the revision date and the valid planning for the further execution of the project. Each activity appears in one line in the bar chart. The two extreme limit dates between which each activity must be performed are indicated: the earliest start and the latest finish.

The bar chart combines all the data appearing on the dated network evaluation lists; it gives the project leader and the responsible persons a clear idea of the planned part of the project, the completed part, and the part still being processed.

**evaluation and supervision**

The project leader and the responsible persons test the results of the network evaluation. The following questions are posed:

1. Can the customer accept the deadline?
2. Do the departments concerned dispose of the required capacity at the times prescribed by the plan (bar chart)?
3. Are the stated deadlines for the activities assigned to outside firms acceptable?

If necessary, the network and the corresponding forms must be corrected and then re-evaluated. This is repeated until the project leader and the responsible persons are convinced that the deadline can be met.

The supervision cycle sequence begins after completion of the last planning cycle.

The length of time of a supervision cycle is fixed according to the duration of the activities and from the consequences of non-adherence to deadlines. The shorter the duration of the activities and the more disadvantageous the results of overstepping deadlines, the shorter the supervision phase. In principle, the evaluation program accepts any prescribed final deadline of a supervision phase which lies within the period of the execution of the project.

The duration of the supervision cycle determines the number of figures which the project leader and the responsible persons receive; it has no influence on the evaluation of the network (in contrast to revision day). Normally it is advisable to select supervision phases beginning one or two weeks before and ending three to five weeks after revision day.

In supervising the typical example, the first two supervision phases will be skipped; in other words, in what follows the computer is to prepare the data for the third supervision phase.

To initiate the supervision cycle, the project leader completes the same application form as for the network evaluation. He indicates the deadlines of the third supervision phase, namely the beginning date and the final date, but does not ask for any over-all evaluations of the network, only an updated extract of the network evaluation for the new (third) supervision phase:

1. The new check form for the project leader.
2. The new check forms for the responsible persons.
3. Bar chart for distribution among the branches participating in the project.
4. A bar chart of the complete project (but only for the current supervision phase).
5. Report on the progress of the project.

The project leader sends this application with the completed check form of the concluded second supervision phase to the computer center.

After one or two days the project leader receives the data which he and the responsible persons required for supervising the new supervision phase.

Each responsible person receives "his" revised bar chart. These bar charts contain only those activities which each responsible person is to begin, continue or conclude during the supervision phase.

The complete bar chart which the project leader receives is a summary of the bar charts of the individual responsible persons.

The bar charts are a simple and clear method of communication between the project leader and the persons participating in the project.

The check form, Fig. 2, serves as a means of communication between the project leader and the computer. The time limits of the supervision phase appear on the top of the form. Only those activities are listed in the form which are to be begun, continued or concluded during the supervision phase. The activities to be performed are grouped according to the responsible persons, whose name, department and telephone number appear in each case in the top of "their" group. On the left side of the form the activities are specified, together with the duration of the activity and the two extreme final deadlines (the earliest start and the latest finish) between which the activities are to be performed. The "desired finish" of an activity is the total of the "earliest finish" and the free floating days of this activity. It is possible to draw out an activity up to the desired finish without the earliest start of the next following activity needing to be displaced. A careful project leader works with the "desired finish" and not with the "latest finish" when supervising the progress of the project.

Five columns for checking the activities are provided on the right side of the check form.

If an activity has begun before the start of the current supervision phase, which has then been established in a previous supervision phase, the computer prints the actual beginning date of this activity in the column Beginning On.

Example: The actual beginning of activity 14-20 (manufacture) on 18.02.66 was reported to the computer at the end of the second supervision phase.

If, in accordance with the plan, an activity has to begin during the current supervision phase, it is noted in the column Beginning On with the sign =/=/=. This sign tells the project leader that the earliest beginning of the activity concerned lies within the current supervision phase. Efforts should be made to ensure that the actual beginning of this activity coincides, if possible, with its earliest beginning. The actual beginning date is to be entered by the marking (=/=/=).

Example: The earliest start of activity 4-6 (ventilation) on 05.04.66 lies *between* 28th Feb. 1966 and 5th April 1966 (supervision phase). The computer asks with the aid of the marking =/=/=: Has this activity really begun and when?

If an activity whose latest finish falls within the current supervision phase is already completed, the actual concluding date of this activity appears in the column Completed On. If an activity must, according to plan, be completed during the current supervision phase, the computer marks this activity in the column Completed On with the mark =/=/=. This signifies to the project leader: The latest finish of this activity falls within the current supervision phase. Whether the activity was really completed must be clarified. The project leader must enter the precise completion date through the marking.

Example: The latest finish of activity 14-20 (manufacture) on 01.04.66 lies *between* 28.02.66 and 05.04.66 (supervision phase). The computer therefore asks with the help of the marking =/=/=, Was the activity completed? When?

If it is observed in the current supervision phase that the over-all duration of an activity was underestimated (or overestimated), the re-estimated over-all duration must be entered in the column Revised Duration. From the next supervision phase on, all evaluations are based on the new duration.

The project leader can use the column Observation for any purpose he chooses.

Column Progress Degree (PD) indicates what percentage of the estimate duration has already passed. This figure coincides with the percentage degree of progress only if an activity is pursued with equal intensity for the entire duration of its execution. The degree of progress of an activity is calculated as follows:

| X | R | Z |
|---|---|---|
| actual beginning of the activity | revision day | probable end of the activity |

Estimated activity duration $T = Z - X$ (in days);

Progress degree $PD = \frac{R - X}{T} 100$ (in %)

Example: Activity 14-70 (switchboard incl. assembly):

Beginning on 18.02.66;

Duration of activity: 6 weeks or 42 days;

$PD = \frac{(02.03.66) - (18.02.66)}{42} 100 = 40\%$

This means that on 02.03.66 40% of the envisaged *duration* of activity 14-70 had already passed. The progress degree computed serves only as a guideline for the project leader. The project leader compares the actual work progress with this guiding value in a discussion with the persons responsible for this activity. The project leader is himself responsible for irregularities in the intensity of the work. The progress degree is absolutely correct only at the beginning (0%) and at the end (100%) of an activity. The DYNET system will provide more meaningful figures for the degree of progress when the phase of capacity planning and capacity acquisition is completed.

At the top of the check form is a free space under Last

Fig. 2 Example of check form.

D Y N E T

C H E C K  F O R M  FROM 28/ 2/1966 TO 5/ 4/1966

PROJECT LEADER MR. X  DEPT. 6051 TEL. 6812  LAST REVISIONDAY 2/ 3/1966  NEW REVISIONDAY / /

PROJECT NO. 1706 NAME TYPICAL EXAMPLE  REV. NO. 3

| START NODE | END NODE | JOB DESCRIPTION | DURATION | REV. CODE | EARLIEST START | DESIRED FINISH | LATEST FINISH | PROGR. DEGREE | CHECK STARTED ON | CHECK COMPLETED ON | CHECK REVISED DURATION | NOTES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MR. WEBER ( 2) DEPT. 1070 TEL. 3090 | | | | | | | | | | |
| | | MR. ULMER ( 3) DEPT. 1136 TEL. 2831 | | | | | | | | | | |
| 7 | 6 | ELECTR. INSTALLATION 2 | 2 | | 14 3 66 | 17 5 66 | 17 5 66 | 0 | / / | | | |
| 14 | 7 | ELECTR. INSTALLATION 1 | 3 | | 18 2 66 | 11 3 66 | 3 5 66 | 80 | 18 2 66 | | | |
| 22 | 15 | INSTALL. OF LIGHTING | 2 | | 18 2 66 | 7 3 66 | 12 4 66 | 98 | 21 2 66 | | | |
| 14 | 70 | SWITCHBOARD,MOUNT,INCL. | 6 | | 18 2 66 | 9 6 66 | 18 8 66 | 48 | 18 2 66 | | | |
| | | MR. BAUR ( 4) DEPT. 2 TEL. 3181 | | | | | | | | | | |
| 14 | 4 | DELIVERY OF VENTILATION | 6 | | 18 2 66 | 4 4 66 | 18 5 66 | 30 | 21 2 66 | | | |
| 4 | 6 | VENTILATION | 1 | | 5 4 66 | 17 5 66 | 17 5 66 | 0 | / / | | | |
| 14 | 15 | HEATING | 1 | | 18 2 66 | 7 3 66 | 12 4 66 | 100 | 18 2 66 | | | |
| 14 | 16 | INSTAL. WATER + AIR | 4 | | 18 2 66 | 21 3 66 | 19 4 66 | 45 | 21 2 66 | | | |
| | | MR. BECKER ( 5) DEPT. 9003 TEL. 2606 | | | | | | | | | | |
| 16 | 6 | DISPOSITION 2 | 4 | | 22 3 66 | 17 5 66 | 17 5 66 | 0 | / / | | | |
| 15 | 16 | DISPOSITION 1 | 1 | | 8 3 66 | 21 3 66 | 19 4 66 | 0 | / / | | | |
| 20 | 19 | MOUNTING | 4 | | 4 4 66 | 3 5 66 | 3 5 66 | 0 | / / | | | |
| 14 | 20 | MANUFACTURE | 6 | | 18 2 66 | 1 4 66 | 1 4 66 | 40 | 18 2 66 | / / | | |
| 35 | 80 | MOUNT. OF MEAS. INSTR. | 4 | | 25 2 66 | 9 6 66 | 16 6 66 | 30 | 24 2 66 | | | |
| | | MR. POMEY ( 6) DEPT. 1137 TEL. 2851 | | | | | | | | | | |
| | | MR. WYSS ( 7) DEPT. 1100 TEL. 2824 | | | | | | | | | | |
| 31 | 6 | EXTERNAL WALL AND GATE | 2 | | 28 3 66 | 17 5 66 | 17 5 66 | 0 | / / | | | |
| 18 | 20 | MOUNTING OF CRANE | 2 | | 18 2 66 | 1 4 66 | 1 4 66 | 90 | 21 2 66 | / / | | |

Revision Day for New Revision Day. The project leader enters the date on which he completes the current supervision phase into this space. The revision day may fall on the last day of the supervision phase, but for safety's sake it should precede it. It must never occur beyond the time limits of the supervision phase.

The computer treats all data entered on the check form by hand which *precede* the data of the revision day as events belonging to the past. With these the computer calculates the progress of the project. Entered data relating to a time later than the revision day are pure forecasts, of which the computer takes no cognizance. This does not, however, prevent the project leader from making such entries in the corresponding spaces of the check form as personal notes.

## project progress

The project progress report gives the project leader and the customer an always available actual-desired comparison in graphic form of the planned and performed running time days for the complete project. The months of the project running time are shown on the abscissa and the running days to be expended on the project on the ordinate. Usually several activities are daily performed in parallel during the execution of the project. The total of these activities produces the performance achieved that day.

The computer examines milestones in the project execution, i.e., dates of important events which must be kept to, to decide whether they can be kept to on the basis of the estimated activity durations and the work performed up to the revision date. If the network evaluation shows that a desired milestone cannot be kept to, the computer reports the length of the resulting delay. It likewise prints a list of the activities not yet concluded, which cause the delay. The project leader can easily see from the milestone analysis in which activities he must intervene. Every project should have at least one milestone, namely, at the last event. The milestone analysis is independent of the supervision phase. If the computer ascertains the overstepping of a deadline at a milestone, it automatically performs the milestone analysis.

The milestone analysis makes it possible to concentrate on short supervision phases without running the risk of overlooking remote milestones and exceeding their deadlines.

## supervision

At the beginning of a supervision phase the project leader receives from the computer the check form for the supervision phase and an over-all bar chart for the supervision phase.

Similarly, all responsible persons receive bar charts and check forms for the activities of their respective fields. They are also informed of the duration of the current supervision phase.

The project leader perceives from his information: which activities are to be supervised and in what respect; and who is responsible for which activity; also the address of the responsible person.

The project leader must next clarify the questions posed by the check form and enter the events established by it on the corresponding check panel.

Once the check form has been completed by the project leader, it supplies information on the state of activities. If any activities are added or withdrawn, i.e., if structural alterations in the network are made, these are entered in a list of activities. The project leader thereupon considers over what period the next supervision phase should extend and completes the new revision application. He sends all the forms (evaluation application, check form and, if structural alterations are involved, activity form) to the computer center. This marks the conclusion of the supervision phase.

The individual supervision phases are joined together without break—*as far as possible overlapping.* This ensures that when supervising a project execution the project leader can rely on up-to-date information. Thus the progress of the project can be determined at any time and the latest forecasts for its further execution can be made. After its completion, the planned and the actual course taken by the project can be compared. The actual execution of the project is reproduced by a bar chart which is prepared for the complete running time after completion of the project. From this diagram, causes of delays can be accurately reconstructed and lessons drawn for the subsequent planning of similar projects.

## computer program and features needed

The computer program contains about 4000 instructions and is written in FORTRAN IV, which means it can be adapted to the normal large computer installation. In its present stage the program is used on a computer with a 32K-word core memory (24 bits per word). The DYNET system utilizes four magnetic tape units, one card reader, and one printer (136 columns).

Up to 1200 activities, 1000 events, 100 milestones and 60 responsible persons may be used for each network or subnetwork. A random numbering of the events is allowed and there is no limit in the number of starting and end events of the project.

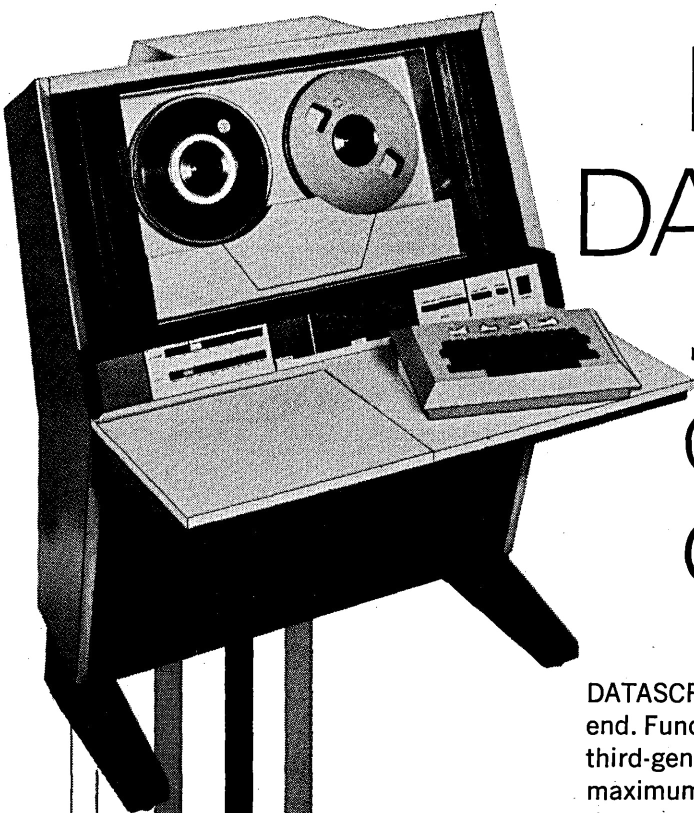
All the networks operated with this system are stored on a master tape containing information on the progress of all the projects. If a revision calculation is made in a specific project, the relative network is correspondingly supplemented, revised and the required evaluations provided. Next, the network, which has now been brought up to date, is transferred to the output tape. All other projects are transferred from the input tape to the output tape without alterations. The output tape which is now the new master tape serves as input tape in the next evaluation. The old input tape is retained for reconstruction analysis.

With this simple data acquisition, data storage and data processing system, one single operator in the computer center can process 20 projects (about 8000 activities) simultaneously and in addition give advice to the users of the system. It must be borne in mind that each of the 20 project leaders can revise "his" project at any time without previously announcing the fact.

The project leader who wishes to supervise his projects with the computer is given a one-day introductory course in DYNET. These persons must, however, already be familiar with the basic principles of network techniques. After two to three revision periods, the project leaders are so well acquainted with the process that they no longer have any difficulties in filling out the check form and selecting the absolutely essential network evaluation. If a form has been incorrectly filled out, the computer locates the error by means of extensive error diagnosis program (such as loop tests, checking the logic of the report in the check form, etc.) and the computation is interrupted. The data on the magnetic tape is not altered in such cases.

Contact between the computer installation and the project is made only by the project leader, who also receives all the evaluations made by the computer for the responsible persons and distributes these after close scrutiny.

If a project leader forgets to surrender his check form after expiry of supervision phase, he receives a reminder from the computer. ■



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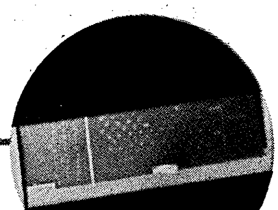

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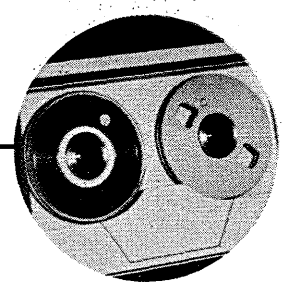

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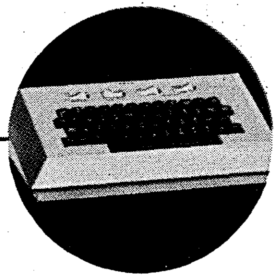

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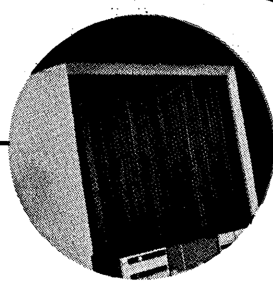

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# AN APPROACH TO MEASURING A TIME-SHARING SYSTEM

by EDWARD YOURDON

During the development of a time-sharing system, the system designers devote most of their attention to a plethora of large and significant problems: the hardware configuration, the languages that will be available on the system, the structure of the file system, the command language, the communications system, and considerations of reliability. In many cases, though, the design does *not* include any provisions for measurement or statistical analysis of the system. The purpose of this paper is to describe the need for statistics on a time-sharing system, some common methods of gathering statistics, and some of the typical types of statistics gathered.

## why measure a time-sharing system?

Almost all time-sharing systems have to keep track of the manner in which their resources are being used—if for nothing else, just to see who pays for the system. The use of statistics for accounting purposes is often only a minor justification for the effort necessary to gather the statistics, however, and may not even be applicable to small, experimental time-sharing systems. *The primary function of statistics is to ensure that the system is capable of operating in the environment for which it was intended.* Statistics can demonstrate that a particular hardware configuration will not support a given time-sharing application, or, in less extreme cases, they can indicate bottlenecks or areas of inefficiency.

Quite often the most important parameter in a system's performance is the behavior of the average user. This information is very rarely known in advance, and can only be obtained by gathering statistics. It is important to know, for example, how long a typical user stays on a time-sharing system during an average session, how many language processors he uses, how much computing power he requires during each "interaction" with the system, and so forth. Modeling and simulation can be of great help in pre-determining this information if the environment is known, but in many commercial or university time-sharing systems there is little control over or prior knowledge of the characteristics of the users.

## methods of gathering statistics

To the systems programmer, the traditional method of gathering statistics is to insert a counter in an appropriate subroutine and output the contents of that counter periodically. There are two disadvantages to this scheme:

1. The various counters are usually scattered about in the time-sharing supervisory programs, thus making it difficult for the new programmer to understand or revise the statistics-gathering process.
2. The results thus achieved usually only show a time-averaged value of the phenomenon being measured.

The latter disadvantage is by far the more serious. A counter, for example, which shows the total number of I/O operations (such as drum swaps) during an eight-hour period of operation gives no information other than a gross average. It is obviously more desirable to obtain a *distribution* of I/O operations over time since this yields information about the performance of the system under heavy loads, light loads, etc. Furthermore, it may be desirable to obtain some statistics as a function of a variable other than *time*—such as the number of I/O operations as a function of the number of users on the system.

The disadvantage of presenting information as a distribution is that it usually requires that more data be kept and

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that a significant amount of overhead computation be devoted to its reduction to some intelligible form. Fortunately, the problem can be simplified for most of the statistics relevant to a time-sharing system. Most of the data tends to fall into one of several discrete ranges, each of which can be measured with a counter. For example, in the case of I/O operations we might be interested in the number of cases in which there were 0-2 operations per second, 2-5 operations per second, 5-9 operations per second, and 8-10 operations per second. This requires only four counters, and the amount of extra information provided (as compared to the original one counter) is tremendous.

There is still some controversy over the proper place for a statistics-gathering program in a time-sharing system. The three most popular methods seem to be:

1. Allow the resident time-sharing monitor to gather and reduce all statistics, outputting the results as it sees fit.
2. Allow the resident monitor to gather the statistics as an "event stream" and output them for later reduction by a user-mode program or even an off-line program.
3. Allow the resident monitor to gather the statistics in the form of counters, etc., that are accessible to a user program, and then run the user program periodically to sample and reduce those statistics.

If possible, it is preferable to follow the "event stream" approach, since it preserves all relevant data for later analysis. This approach essentially considers the operation of the system to be described by an unknown function of many variables. Whenever any one of those variables changes—that is, whenever an event occurs—the values of all the variables are recorded. Unfortunately, the rate of event generation is often so high that the characteristics of the system are changed by the overhead caused by the monitor routines which attempt to record the events on tape or drum. The advantage of the scheme is, of course, that none of the data is lost for future analysis. That is, if a new pattern or phenomenon is discovered next week, last week's tapes can be re-analyzed to obtain the appropriate information (as in the case where it is suddenly decided that I/O operations as a function of users on the system is a more important statistic than I/O operations as a function of time). There is also a great deal more freedom in the manner in which the statistical information is displayed: the statistics can be shown in tabular form, on graphs or charts, or even pictorially on a crt.

There seem to be two disadvantages to allowing a user program to perform data reduction of statistics in an on-line fashion. First, there is a fair amount of overhead involved in actually running the user program: all the overhead normally associated with a user program, plus some additional overhead because the user program must often copy the statistics out of the monitor's addressing space. Thus we again have the Heisenberg-like problem of changing a phenomenon in the attempt to measure it. Second, since the user program is often run on a periodic basis (for example, once every second), a number of interesting events which happen very quickly are lost.

The types of statistics vary, of course, with the particular characteristics of each system, but some fairly standard groups of statistics have grown out of the efforts to measure medium-sized time-sharing systems with one central processor, one or more discs for file storage, and a high-speed secondary storage device for use as an extension to core memory (such as a drum).

## time statistics

An effort should be made to account for the various different ways in which time is spent on a time-sharing system. Typically, a time-sharing system charges its time to one of the following four categories:

*Idle time.* Time during which no requests are being made of the system. This normally corresponds to the case where there are no users on the system or where all the users are idle.

*Monitor overhead time.* Time devoted to the various supervisory computational activities, such as scheduling or processing user requests. This statistic is often an important measure of the complexity of the time-sharing monitor and can range from 5% to 50% of the total non-idle time.

*User time.* Time spent running user programs. In a commercial environment, this usually corresponds to time that can be billed to customers. (It is interesting to note that customers are charged for user time at a rate ranging from 4 cents/second on a GE-265 to 11 cents/second on IBM CALL/360. At this rate, a CALL/360 customer pays $420 per hour for the convenience of time-sharing, while he could buy that same hour for $150-200 on a batch 360/50!)

*Drum time not overlapped by computation.* Time during which users are waiting to run but cannot because their programs or data must be swapped from drum to core. Some time-sharing systems, such as the GE-420, charge their customers for this "I/O time," while other systems, such as the SDS-940, subsume this time under monitor overhead.

Failure to incorporate these different kinds of computer time can result in some meaningless statistics. A time-sharing system that operates on a 24-hour-a-day basis, for example, may be idle 30-40% of the time, and any conclusions about the system's over-all performance should obviously include this fact.

## user statistics

This group of statistics attempts to determine the characteristics of the average user on the time-sharing system. Typical user statistics include:

*Number of users on the system.* The most common barometer of system load. It should be averaged over 5-minute intervals and 1-hour intervals to show peak loads on the system.

*Average terminal connect time for users.* This statistic indicates how long the average user stays on the system. When combined with the compute time requirements of each user, it gives a measure of the type of user on the system, i.e., a highly interactive or highly compute-bound user.

*Interaction time as a distribution.* In many time-sharing systems, it is meaningful to speak of an *interaction cycle* during which the computer types a question or the result of a computation, and the user thinks about the computer output, types new input (a response to the question), allows the computer to process the input, type out a new response, etc. The length of time during which the system must wait for input from the user is sometimes loosely referred to as the *interaction time,* and it is an important parameter to measure. Since most systems associate a very high priority with users who have just completed their terminal input, it is important to know how long the system must wait for the average user, and also whether any Bayesian prediction can be made after waiting for a specified length of time for a user to type his input (i.e., predictions of the sort "given that we've waited this long for the user to type his input, what is the probability that we will have to wait another five minutes?").

*Memory-time product of programs.* The size of a user program multiplied by its compute time gives an important measure of the load that a user places on the system. This statistic is often used for billing purposes, though the majority of time-sharing systems continue to charge on cpu time alone. In addition to the *product* of cpu time and memory size, it is also often desirable to keep the two separately. There is usually a correlation between large programs and heavily compute-bound programs, and this information can be used by a scheduling algorithm.

*Number of users in core.* In a multi-programmed time-sharing system (which most systems are), it is of critical importance to know how many users can simultaneously co-exist in the computer's main memory. In some systems, such as the GE-420, this number is fixed, while other systems allow as many users as can fit in the machine. If the number is too small, the time-sharing monitor will not have enough time to swap in the next user while the current user is running, and will spend a great deal of time in "drum time not overlapped by computation."

*Average compute time per session.* This statistic is necessary for billing purposes, and, when combined with the statistic on terminal connect time, it gives a rough measure of the computational requirements of the average user. It also gives an interesting measure of the capacity of the system. If the average user requires two minutes of compute time for every hour of terminal connect time, then (discounting monitor overhead, etc.) the system should be able to handle a maximum of 30 simultaneous users. Many systems use this measure of capacity, but fail to take into account monitor overhead time, idle time, and unoverlapped swap time—yielding results that even a layman intuitively knows to be wrong.

*Average compute time per interaction.* This statistic measures the compute time required by a user during the interaction cycle described above. It determines, in many systems, the number of users who must simultaneously reside in core to keep "drum time not overlapped by computation" at a reasonable level.

**input/output statistics**

The three major types of input/output statistics are those associated with terminals, disc and drum. The statistics serve mainly to indicate the load on the particular device, but are also useful in predicting serious I/O malfunctions on the basis of a steadily increasing number of intermittent errors.

*Terminal statistics*
Total number of input characters
Total number of output characters
Lines of input:
  per user per minute
  per user per session
Lines of output:
  per user per minute
  per user per session
Terminal errors
"End-of-message" characters other than carriage return/line feed or "end-of-line."

*Drum statistics*
Drum reads
Drum writes
Drum errors
Average number of pages or blocks (i.e., units of storage on the drum) per job.
Average number of drum operations (reads *and* writes) required to pull a job into core.

*Disc statistics*
Disc input operations:
  number of files read
  number of words per file
Disc output operations:
  number of files written
  number of words per file
Disc errors (read errors and write errors separately).

needed accessibility

# REMOTE JOB ENTRY

by E. L. DANIELS and L. HARRIS

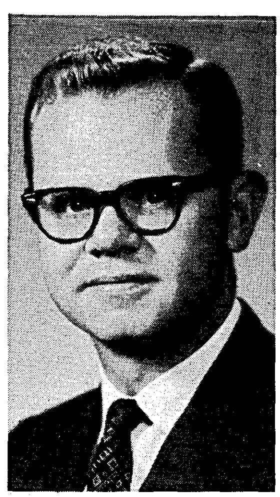
Remote Job Entry (RJE) is a programming system which extends a computer's job input and output capabilities to remote terminals attached via communication lines. It allows users at these remote terminals to submit jobs and retrieve job output in much the same way as at the central computer.

The requirement for RJE exists because many users having geographically scattered operations want to centralize computing operations. Users want to operate in this way for at least three reasons: First, an economic advantage is provided by one large computer as compared to multiple smaller ones. You have possibly heard this referred to as Grosch's Law: "A computer's power is proportional to the square of its price." Second, a common body of information can be shared among separated organizational units having related information needs. Lastly, it is not only economically sensible but highly satisfying to data processing people in small operational units to be able to have access to substantial computing power on an as-needed basis.

The concept is simple enough: make terminals appear to the remote user as if they were local devices directly attached to the computer. Local input and output is for the most part handled with multiprogramming. The idea behind multiprogramming is to balance computer-bound work with unrelated I/O-bound work by doing both simultaneously. For most applications, the heavy I/O load is in reading jobs in and writing out this output. This also usually involves the slowest of I/O devices: card readers, card punches, and printers. So simultaneously with job execution, most systems contain one or more readers and/or writers. Readers are programs which bring job input (job control cards and data) from a card reader or other device, and queue this input on disc storage to await execution. The operating system's job scheduler—a control program component which determines which job is to execute next—accepts jobs from the reader, initiates them, and causes output to be enqueued for the writer. Writers are programs which write output from direct access data sets onto printers and punches. These readers and writers include I/O-access routines which actually contain the programs for operating the card readers, punches, printers, etc.

If we replace these access routines with routines that can handle communication lines, it would seem that we could run remote terminals the same way we run local devices. In other words, we could then have Remote Job Entry.

Unfortunately, it doesn't work out quite so simply. Ask any systems programmer who has written a part of a teleprocessing system, and he'll tell you that you can't program a communications terminal exactly like a local printer. Don't send a printer a new print line for a few seconds and



*Mr. Daniels is manager of Remote Job Entry development in IBM's Systems Development Div. at Research Triangle Park, N.C. From 1962 to 1966, he was with the IBM World Trade Corp. working in systems design and installation of real-time computing systems. He has a BS and an MS in electrical engineering from Michigan State Univ.*

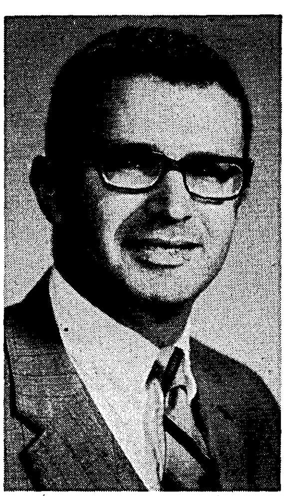
there's no harm done. Leave a communication line idle a few seconds without some reassuring "handshaking" characters on the line and bells go off and error messages start spewing from the console typewriter. Who ever heard of attaching several card readers using one physical address on an I/O channel, such as is the case with multiple terminals on a communication line? One stops reading cards and starts printing in local operation without thinking about it, but when the reader and the printer are both on the end of a two-wire, serial-by-bit, one-direction-at-a-time communication line, even something this simple gets to be a tricky operation.

So special coding must be done to handle the unique requirements of telecommunications. And it turns out that because of additional demands imposed by the characteristics of remoteness and shared usage, even this coding is insufficient. New facilities—beyond those normally available with local readers and writers—are required for convenient use of the system. These facilities are required because the remote environment is definitely different from the local one and extras must be available to bridge the gap.

With local job entry, for example, the job submitter gives the central operator special instructions by speaking to him or attaching a note to his job. Because the remote user also must communicate with the operator, he needs a facility for sending and receiving messages. With local job entry, the submitter is not necessarily the job recipient. The same situation exists for the remote user; he requires a provision for directing his output to alternate terminals.

There are distinct human factors considerations: The remote terminal user will be unhappy unless he can discontinue his output in progress; for example, he may not want that 500K of core dump being transmitted at 250 characters per second. If his output is discontinued because of a malfunction, he will want to continue it from the same point or an earlier point in the job so that the job isn't lost. The requirement to discontinue and continue is widespread: the printer runs out of paper, or the transmission is interrupted, or a higher priority job comes along. The user should also have work-station independence. That is, he should be able to submit his job from a terminal, get the job back on the central computer, submit it again on another computer, and get the output back on a second terminal—all without changing his input.

These are only a few examples of the facilities required to contain the special problems imposed by remoteness, communication lines, and shared usage. Some other requirements peculiar to or aggravated by this kind of operation are user and terminal identification, error recovery, guarantee of job-output security, job-output deferral, and computer-status information. In addition, if the system is going to be convenient, the terminal operator, central computer operator and the programmer should need to know only that which directly affects him, and none should have to know telecommunications.



*Mr. Harris is Remote Job Entry central programs manager for IBM's Systems Development Div. He has been involved in a variety of programs ranging from computer-drawn flow charts to a System/360 macro assembler for the 7010 operating system. He holds a BS in chemistry from Rutgers.*

### structure of os/360 rje

Let's continue this discussion of remote job entry by examining a specific example. OS/360 Remote Job Entry operates under both Operating System/360 multiprogramming control programs: MFT (Multiprogramming with a Fixed number of Tasks) and MVT (Multiprogramming with a Variable number of Tasks). A minimum system for a central site is a 256K 360/40. Terminals may be any computers equipped with binary synchronous communication capability or an IBM 2780 data transmission terminal (a line-printer, reader/punch combination).

The facilities provided within IBM's RJE were dictated by the operational requirements mentioned previously. These facilities, requested with a unique set of RJE statements called Job Entry Control Language, are the base of the Remote Job Entry system.

Job Entry Control Language consists of two kinds of statements—job entry definition statements and work-station commands. A job entry definition statement precedes the remotely submitted job in the input stream. It contains output disposition information beyond that provided by the standard job control language. The job entry definition statement allows users to defer receipt of output to a more convenient time and to specify alternate output destinations. Output deferral allows work stations on switched lines to submit jobs, hang up after the jobs are collected, and then reconnect at some later time to retrieve the output. Alternate output designations allow output to be routed to someone other than the submitter.

The work-station commands are not normally entered into the system along with the job to which they apply. They are entered at a later time to request some system service. The output command, for example, requests the output of a previously submitted job. (The job-output deferral resulted from a job entry definition statement.)

In addition to retrieving output, work station commands are used to attach and detach work stations to and from the RJE system, attach and detach individual users, retrieve job and system status, send messages to other work stations or the central computer, delete selected jobs, and continue interrupted in-process output.

Input to remote work stations are OS/360 jobs. Unless special RJE processing is desired, these jobs—submitted from remote IBM 2780 data transmission terminals or IBM/360 or 1130 computing systems—are identical to the same jobs submitted at a local card reader. If special RJE processing is desired, it is selected with additional statements preceding or following the job. No cards are ever inserted into or removed from the job itself.

Output at the work station is of two types—messages and job output. Messages are small amounts of data transmitted to the remote work station as notification of exceptional conditions, as acknowledgment of job receipt, and in response to work station commands. If the remote work station is a device without a console typewriter, messages appear on the printer between job outputs. If the remote work station has a console typewriter, messages appear on the console.

The output of all remotely submitted jobs to be returned to remote terminals is specified for handling by a system output writer. System output data returns to the device (printer, punch, etc.) at the remote station which was specified by job control statements within the job.

In addition to facilities for two-way communication, RJE includes a capability of broadcasting messages from the central processor to all work stations. Information to be broadcasted is transmitted to the work station upon request, and each time the work station becomes active. The broadcasting facility is provided primarily for system status information such as the addition or loss of a central resource, or an indication of when the central RJE system is to close down.

System security is provided within RJE by a log-on procedure, requiring each remote user to identify himself with a private key before he is allowed to use central computer facilities for input of jobs, or before he may receive deferred output.

Finally, central RJE commands provide for operation supervision of the central system, and for communication with remote users. Central commands are used to send a message to a work station, enter information into the broadcast data set, add users to or delete users from a list of legitimate persons having access to the system, cause output from remotely submitted jobs to be printed locally, and display critical RJE tables and queues.

Several parallels can be drawn outlining relationships between RJE and local readers and writers. With local readers, jobs are collected by a central operator from local programmers and placed in a card reader; with RJE, jobs are collected by a system component from a remote terminal and placed in direct access storage.

In RJE, the Job Entry Control Language in the job stream is translated and maintained in tables just as normal job control language is translated by the OS/360 interpreter and maintained on the job queue. The ultimate disposition of job output is determined by the RJE tables as well as the job queue information.

With local writers, system output is read from the direct access queue specified at writer start time and written to a local device; with RJE, system output is read from the direct-access queue specified at RJE assembly time and written to a communication line.

## rje data flow

The control of events within RJE is centered in a component called the dispatcher. It passes control to different program components based upon availability of and requirements for various resources. The dispatcher within the RJE system controls each RJE subtask. The term subtask is used here in something other than strict OS/360 terminology. Each RJE subtask is a sequence of instructions receiving control only from and yielding control only to the dispatcher. One RJE subtask can never seize control from another.

The dispatcher contains a WAIT macro with one event-control block for each subtask. Each event-control block is a word of storage used to synchronize the different subtasks. The big configuration of the event-control block indicates the status of the subtask—waiting or ready. When a subtask makes a resource available for another subtask, it posts its event-control block—that is, it sets the event-control block bit configuration to a condition which the dispatcher recognizes as "ready." To perform this recognition, the dispatcher includes code to scan the event-control blocks at the time of WAIT macro completion to determine which subtask is operable.

While RJE has nothing to do—for example, when waiting for input to come in from the communication lines—the CPU is available to the rest of the system. When input becomes available from the communication lines, the event-control block representing the event being waited for—completion of communications I/O—is posted and control is passed from the operating system supervisor to the dispatcher. The dispatcher scans the event-control block list to determine which event took place and then passes control to the collector-emittor where the information read is analyzed.

The collector-emittor, used by each communication subtask, contains the code required to service the communication lines. On input, it reads the lines and collects jobs in individual data sets. Any system input data associated with jobs are written to separate data sets. The data definition job control card originally associated with system input is modified to correspond to a data set allocated for the input.

Events within the collector-emittor (or any other component) involving WAIT's cause control to return to the dispatcher. This allows subtasks of RJE for which resources are available to operate during the time other subtasks must wait. It also allows other tasks within the system to operate when all of RJE must wait.

After a complete job is collected, the collector-emittor posts the reader event-control block; that is, it indicates to the RJE system that a particular resource has become available for a subtask awaiting it. The next time the dispatcher is entered and the dispatcher's scan reaches the reader event-control block, control passes to the reader.

The reader subtask processes the remotely submitted input similar to the way the local reader/interpreter processes locally submitted input. The essential difference is that the remotely submitted input contains Job Entry Control Language (JECL) as well as Job Control Language (JCL). In addition to the requirement for delivering JCL to the interpreter subroutine, the reader must pluck out each JECL statement and deliver it to the RJE subroutine designed to process it.

The reader also has the additional requirement of changing the class parameter on each data-definition statement associated with system output. This class parameter, which designates the queue in which the output is kept, is replaced with a unique RJE class and the original class is retained in RJE tables. When any remotely submitted job is completed, system output is queued into the unique class providing an easily recognizable indication of remote job completion, as well as a single collection point for remote job output. When output is eventually returned to the remote work station, the original output class is appended to trigger its proper disposition.

RJE maintains a number of tables indicating the status of remote jobs, the remote terminals, and remote users. The job table contains information concerning the status of each job: job name, completion status (executing, completed, failed, etc.), output disposition (immediate, deferred, etc.), and original system output classes. The user table contains all legitimate user identifications and an indication of whether the user is logged on. The terminal table contains a description of each terminal in the system, the user currently logged on the terminal, and a pointer to the queue of output to be sent to the terminal. The RJE tables are kept in core to provide fast access, and are also maintained on direct access storage to provide restartability in the case of a system failure requiring reloading.

The reader passes all JECL statements to the JECL processing routines. Depending on the statement being processed, these routines either make entries into the RJE tables or search the RJE tables, and enqueue messages or job output onto terminal queues.

After JCL/JECL data set is completely interpreted, RJE preprocessing for the job has been completed. From this point, the remotely submitted job is initiated and executed exactly like any other job in the system. RJE is not again aware of the job until output eventually appears on the unique RJE system output queue.

When a job is completed, output is placed in the RJE system output queue, and the associated event-control block is posted. The RJE writer is waiting for information to be queued into its system output class. When the dispatcher's event-control-block scan reaches this event-control block, the writer is entered. By examining the system output queue, the writer determines what job is responsible for the output. The RJE tables are than searched to determine the action to be taken.

If an immediate return was requested, the output is placed into a queue for delivery to the work station. (The RJE subtask does no actual writing. It queues up output which is ultimately written to the communication line by the collector-emittor.) If deferred output was requested, the output is pulled from the system output queue and its status maintained in the RJE tables. If notification at job completion has been requested, a notifying message is built and placed into the terminal queue.

Within the collector-emittor there is a component called a line scheduler. Its job is to determine what should be done with an idle line; that is, a line not currently being used for reading or writing. The line scheduler has only two choices —it can use the line for reading from or writing to a terminal. If no output is available to be returned to the terminal, the line scheduler has no choice but to attempt to read. The collector-emittor checks the terminal queue to determine if output is available. If both input and output are available, the line scheduler conditions the collector-emittor to transmit all output before receiving new jobs.

The central command subtask uses much of the same code used by the reader subtask to process the commands entered from the central console. As with remote commands, this processing involves manipulating the RJE tables or generating output based upon information in the tables.

A number of control paths have not yet been specifically mentioned. All paths to and from the dispatcher reflect the fact that, as a subtask is forced to wait, it returns to the dispatcher to allow another RJE component to operate. If no RJE component has work to do, control passes via the WAIT macro to the operating system supervisor allowing other tasks within the system to assume control.

## rje and the future

Remote Job Entry programs make possible greater utilization of computer systems from remote locations. We think RJE is a precursor of things to come.

Suppose a remote work station program is written to operate as a task in a multiprogramming system. Now let us put a central RJE program into the same system, and modify the job scheduler interface. It will now be possible for two or more such computer systems to be interconnected by high-speed communication lines such that a job may be introduced at any point in the network of computers and be executed there or at any other computer in the network, with job output being written out at any desired point.

In short, a load-sharing, computing network can be built with RJE central and remote programs as building blocks. Such a network offers a solution to the problem of building large, centralized data banks, as any information accessible to one computer is as easily accessible to all points of the network. Greatly improved computer utilization is possible. By exchanging information among the computers in the network, jobs can be executed at the least-loaded locations. Instead of transmitting data to a central point, transmissions occur on the basis of a new scheduling algorithm.

One of the technological advances required to make such a system practical is the scheduling algorithm. Factored into this algorithm will be such parameters as the job's core-storage requirements, required I/O equipment, computer speeds, location of data files, communication costs, and user-specified options in the job-control language. Such networks will exist in the '70's; they are logical extensions of Remote Job Entry systems. ■

breakthrough

# THE GENESIS OF SUPERKLUDGE

by NATHAN NATKARL

Dr. Rupert B. Pooble was a man to be reckoned with. There was no doubt whatever of that.

When Pooble was summarily fired as Director of Mathematical Action of the Inscrutable Atomic Corporation, his friends in the know were not a whit surprised that he bounded back rapidly, after a year and a half, as the newly-appointed holder of the newly-created post of Potentate of System Architecture with the giant Ball-of-Wax Manufacturing Company.

Ball-of-Wax had been somewhat in the doldrums. Its common had hovered around an all-time low of $513 per share, and trading was sporadic. Even the announcements in mid-fiscal year of the brand new Ball-of-Wax solid state washing machine had produced only a momentary upward flurry in stock price. Value Engineering at Ball-of-Wax had goofed a bit, and the manufacturing cost of the largest model, known as the Dydee-Dunker, proved to be $6.13 per machine above the fair-traded retail price.

Thus it was on one frosty morning in late October that the senile Chairman-and-Chief Executive, G. David Wax, cast the mantle upon Pooble and clouted him with the corporate sword. Pooble was the man selected to lead the procession of the gods into Valhalla.

Dr. Pooble set to work with a will and a vengeance. He fired Henry Glitch, Chief Engineer of Ball-of-Wax, replacing him with Horton Nemo, known as "Incompetent Horty" to his dear friends. Pooble and Nemo organized field teams of five agents each. These teams were sent about the country to spy in the camps of the competition.

Within two months Pooble was ready. He summoned a meeting of all hands to deliver his earth-shaking ukase on the structure of the new design. Running true to form, Rupert B. Pooble was characterized by no lack of boldness.

"Men," he said, "comrades-in-arms. I intend to do no less than completely revolutionize the world of digital computing. It has been in the dark ages long enough!"

Task forces of design engineers rapidly sketched Pooble's ideas on a vast battery of color-coded blackboards. Three slide projectors threw circuit designs, packaging plans, and software specifications on three giant screens simultaneously. The note-taking was furious in Wax Auditorium.

To summarize the great performance in a few words, Pooble declared all present designs obsolete after a deadline of one year. The new millenium was to arrive with the advent of STARSYSTEM 999, an upward, downward, and sideways-compatible family of machines. These were characterized by totally-integrated circuitry, a complete redesign of peripherals, and total absence of machine language. Pooble had even elected to redesign cards, paper tape and mag tape in favor of a complete break with the obsolete past.

For machine language, Pooble proposed to make use of Operating-STRUCTURE/999, a magnificent concept in software languages based on simple concantenations of comprehensive statements of three types: TAKE, MULL, and PUT.

"Dr. Pooble, Sir," asked young Jason Icky, a Junior Engineer in the Softwares Department, "you mean that TAKE statements are sort of like the structure used by Bean-Bag Industries in their FLAPJACK series of machines, language-wise?"

"Son," said Pooble, "don't even mention the FLAPJACK in the same room with STARSYSTEM 999. We're going to make those clods at Bean-Bag wish they'd never thought of trying the computer business."

And so it was decreed. Pooble set to work, taking all of the Ball-of-Wax Manufacturing Company with him. Edicts were decreed. Decrees were edicted. Departments rose and fell with the tide. Elmo Zorch, Director of Personnel for Ball-of-Wax, set up a nationwide recruiting campaign for the express purpose of hiring 5000 programmers with minimum ten-year experience in system programming. Over 2000 logic designers were added to the staff at Ball-of-Wax. Construction crews worked around the clock to finish the mighty new manufacturing facility along the placid banks of the Upper Duckabush River where the STARSYSTEM 999 would be assembled.

With all this activity word leaked out that something big was up at Ball-of-Wax. Retired dentists passed tips to each other in the display rooms of Merrill, Lynch . . . etc. across the country. Little, old, rich widows rushed to safe deposit vaults to trade Coca-Cola for Ball-of-Wax. Driven by the fantastic energy Pooble had generated, the price of Ball-of-Wax common rose inexorably through 600, past 700, and rapidly on toward 800.

At the end of three months, Rupert B. Pooble, though he was running two weeks behind forecast schedule, appeared personally before the board of directors of Ball-of-Wax for a brief 15 minutes, and left with his budget quadrupled.

All through the long, hot summer the STARSYSTEM project proceeded with ever-increasing activity. By now Pooble was giving at least three speeches a week. He was invited to keynote at the National ACCM, and his flawless address, "Piercing the Future," got a five-minute standing ovation.

The construction crews finished the great, chrome-plated edifice along the Upper Duckabush, and the STARSYSTEM builders moved in. With frantic haste they began erecting main frames, stuffing them with circuitry, and rolling quarter-mile rows of tape and disc machines into place. Men with blueprints, wiring harnesses, and cabinet panels raced in all directions. Finally, in July, only seven months behind schedule, the first STARSYSTEM 999, Model Alpha, was ready for turn-on and software checkout.

The sales orders were stacked high on the Honduras mahogany desk of G. David Wax. The Marketing Division had done its job well. The gripe memos were stacked equally high on the modern, steel desk of Dr. Rupert B. Pooble. The preliminary releases were late and full of errors. The few user manuals published were incomprehensible. The Aerospace Sciences Users' Group had organized an ominous series of protest meetings taking exception to the structure of the MULL statements. Pooble was a bit harassed and worried.

But even if Pooble was harassed, the golden dawn was due to break. Tomorrow was D-day, the occasion on which the full-blown operational software for STARSYSTEM 999 would go on the air for Phase-1 operational test. Only the previous week Emil Sniff, Chief of Software, had assured Pooble in person in a regularly-scheduled briefing that all was exceedingly well indeed and that everyone could look forward with confidence to a howling success.

On the appointed day Pooble arrived early. He buzzed his secretary, Miss Campylos. "Send Mr. Sniff into my office!" he said.

Miss Campylos sobbed into the interphone.

"Oh, sir," she said, "haven't you heard the terrible news Mr. Sniff shot himself in the middle of the parking lot last night."

"Good God, you mean . . . " Pooble said. "This is awful. I hope he had his flow charts up to date."

"I'm not sure," said Miss Campylos.

"Well dammit then, get Nemo in here on the double! This is awful."

"I'm sorry, sir. Mr. Nemo left a note for you. He has left to join Bean-Bag Industries."

"Where's that poop-head Whats-his-name, the assistant head of programming?"

"You mean Percy Bugle, sir?"

"Yes, yes, Bugle, dammit. Get him up here!"

"Yes, sir."

Pooble dragged the confused and astounded Percy Bugle into the STARSYSTEM building by one ear. The prognosis was not good.

"Golly, Dr. Pooble, sir," Bugle stuttered. "Mr. Sniff didn't really keep me fully informed. I mean I don't actually have anything ready for today. I mean I'm not exactly sure of precisely what we were supposed to do, if anything."

Pooble turned pale lavender.

"By George, Bugle," he bellowed, "I'd like to blow your brains out. Now you get on that machine and run it even if you have to run something totally archaic, like FORTRAN!"

Slowly, like a great leviathan rising from the depths, the STARSYSTEM went on the air. At the end of the first month Bugle reported to Pooble that the trouble was the discs would not write. At the end of the second month Bugle reported that the discs would not read. At the end of the third month Bugle reported that the discs would read and write perfectly, but the bits came out backwards. At the end of the fourth month Bugle reported that the PUT statements would have to be entirely restructured. At the end of the fifth month Bugle reported that the PUT statements had really been all right in the first place.

And so it went. The gripe memos stacked ever higher on Pooble's desk as Bugle blew time on the STARSYSTEM.

In the offices of Merrill, Lynch, . . . etc. across the country little, old, rich ladies and retired dentists awaited the news of the first STARSYSTEM delivery. The Aerospace Sciences Users' Group held a rather ominous meeting at which Fred Scream of Rickety Aircraft presented a paper entitled "When?" The price of Ball-of-Wax common crept slowly down through 700, past 600, and then, picking up speed, went past 500 and 400 like a dirty shirt to settle finally around a rather unstable $325 per share.

It was at the mid-October board meeting of Ball-of-Wax that the blow fell. G. David Wax, the senile chairman, staggered to his feet, and it was obvious from his opening words that he spoke of Dr. Rupert B. Pooble.

"That bearded beatnick," Mr. Wax began, "I could wring his neck. Who got him in here anyway?"

There was a prolonged silence.

"I said who got him in here anyway?"

"I think you hired him, chief," offered Ethelbert Flurch, the flinty-eyed treasurer.

"Shut up, Flurch," muttered G. David Wax. "Stick to the books and stay out of personnel. Whoever got him in here, he's got to go. He just announced first delivery of that mess over on the river for the seventeenth time. Called in all the New York papers. Dave!"

"Yes, sir," said G. David Wax III, Executive Vice President.

"Dave, you can him. Today! He is out, out, OUT! I never want to see that neatly-trimmed beard coming in the front door again. And by four o'clock this afternoon, you call me. We're going out in the parking lot. I want to see the skid marks where the seat of his pants hit the asphalt, and I want to see them at least thirty feet from the front door. Got it?"

"Done, chief," said G. David III.

The STARSYSTEM 999 number one was delivered to the Inscrutable Atomic Corporation in West Skaneateles on the same day that Pooble once again took up his old chair as assistant professor at Abercrombie Institute. At the dedication ceremony the STARSYSTEM caught on fire while compiling a FORTRAN deck. ■

# THE CONFERENCE PARTICULARS

The 1969 Spring Joint Computer Conference will take place, we hope, in Boston from May 14th through 16th. Initial phases in planning the conference were marked by confusion and disorganization, probably caused by the spiraling growth of the Joint Computer Conferences. As one insider put it, the SJCC is "entirely too big to be run by a volunteer committee." It promises to be the biggest show ever, as 165 firms will be exhibiting. More impressive is that 100 applicant firms were turned away for lack of room in the 107,000-square-foot War Memorial Auditorium. And many of those exhibitors who were squeezed in are smarting from the cuts in the space that they requested.

This will be the last JCC held in Boston; the city simply does not offer sufficient accommodations for people and exhibits. In fact, as our source noted, there is practically no city in the country that can satisfactorily hold all exhibitors who apply anymore. AFIPS does plan to vastly increase exhibit space at future conferences, however. This year's Fall Joint show will offer 185,000 square feet in Las Vegas' hall; the 1970 SJCC will have 229,000 sq. ft. in Atlantic City; and the '70 FJCC will have 310,000 sq. ft. in Houston. Hopefully, this growth in space will keep ahead of increases in exhibits.

Problems with scheduling the War Memorial Auditorium have necessitated that this JCC break with tradition, being forced to hold the show Wednesday through Friday, rather than Tuesday-Thursday. Also, one of the two exhibit floors will be vacated only three days before the conference begins, which should cause some frantic work preparing exhibits at the last minute.

Those of you who noted that pre-registration by mail was offered for the first time this year should have sent your forms and checks in by now to meet the April 18 deadline. In case you haven't done so, you can still register by mail, but your badge must be picked up at the conference. Last deadline is April 30 for receipt of checks. Write for forms to: 1969 SJCC, P.O. Box 662, Brookline Village, Mass. 02147. A ticket to the banquet, to be held at 7 p.m. Thursday, can also be purchased for $9 by mail. Registration will, of course, also be done at the conference. This will begin at the headquarters hotel, the Boston Sheraton, on Tuesday from 2-9 p.m. Charge to members is $20; non-members, $30. The pre-registration fee is not refundable, but may be transferred to another person.

Members of the SJCC sponsor, the American Federation of Information Processing Societies, are: Association for Computing Machinery; IEEE Computer Group; Simulation Councils, Inc.; and the American Society for Information Science. Affiliate members are the American Institute of Certified Public Accountants, Assn. for Machine Translation and Computational Linguistics, Society for Information Display, and the Special Libraries Assn.

Persons with last-minute problems concerning hotel reservations are urged to call the Housing Bureau at 617-426-1250 any time between 9 and 5 up to May 13.

The conference will kick off with the keynote address by Gen. James H. Gavin, board chairman of Arthur D. Little, Inc., who will speak on the "Social Impact of Information Systems," at 9 a.m. on Wednesday in the Main Auditorium. This will be the first of four sessions emphasizing the social responsibility of the computer industry and the means by which technology can be used to solve specific problems.

A panel session entitled "URGENT—Increased Dialogue with Society" (Session 8) will be chaired by Harry T. Larson of TRW Systems. The panel will "establish the basis for the need" of increased dialogue and recommend specific actions to implement the discourse.

A "Computers and the Underprivileged" (Session 4) panel discussion will be led by James H. Burrows of the Mitre Corp. The session will discuss past and current accomplishments and future means for opening the doors of the computer industry to the unemployed. The initial press release noted that, "today it is evident that we have a socially 'damaged' group of people, some are black, some are white, some are harder to classify." The classification difficulty was abruptly overcome with a swift move of a ballpoint pen, however, when a corrected Xerox re-classified the latter group as "both black and white."

"Applications of Computers in the Urban Environment" (Session 19), chaired by Joseph Sussman of MIT, will include three papers and three panelists and will address itself to the use of computers in controlling and monitoring two major areas of the urban environment: First, the notion of automatic control of vehicular traffic by computers is explored. Second, some computer approaches to the handling of the huge amounts of information connected with the typical urban area will be discussed.

Sessions total 34, with 10 panel discussions, 11 paper sessions with a panel of critics (discussants), 12 paper-only sessions, and one session of films on graphics. It is computer graphics that has the largest share of the technical program. The "Computer Graphics Theatre" will be shown from 1:15-4:00 on Friday in the Main Auditorium and will consist of films describing "daily" usage application or very promising research applications of computer graphics, along with critical comments on design of the systems.

A paper/panel session on "Dynamic Graphics—Today and Tomorrow" (Session 25), chaired by Robert N. Davis of MIT, will include four papers, including discussion of the production of motion pictures by computing techniques. Another paper/panel discussion on "Computer Aided Design" (Session 10), chaired by Richard E. Merwin of the Defense Dept., will cover recent developments in test and fault location in large integrated digital networks and interactive design of electronic circuitry. Paper-only sessions on computer graphics include "Techniques for Displays and Picture Processing" (Session 9) and "Graphic Applications" (Session 12).

The technical sessions will also include a host of papers on software and discussions of several applications, including medicine, business, design, education, and libraries. Panels will cover education of computer professionals, computer-assisted instruction, microprogramming—"an opportunity for LSI," on-line business applications, successful computer models in marketing, computers and future libraries, software transferability, management information systems, and small computers for data terminal network control.

An interesting addition to the program will be a paper/panel session on "Topics of Current Interest" (Session 13), featuring six papers which "do not fit the previous patterns and organization of technology," and covering news processing, management information processing, government applications, checkout of computers, file security, and programmer training.

A Science Film Feature with a continuously running series of films whose emphasis will be on new computer applications will be shown. Further, the Multi Media Computer Theatre will explore the theme of the interaction of computer technology and human creativity. Performances will include use of multiple film in slide projections, film clip sound-free tracks, real-time closed circuit TV projections—complete with live performance in simple stage settings. Six performances will be given.

Technical tours will be provided to several manufacturing and computer installation sites in the heavily computer-infected Boston area (unannounced at writing). Wednesday will be "Computer Night at the Boston Pops," with a block of tickets set aside for SJCC registrants. At press time, a special program for the ladies had not yet been detailed, but a complete description is scheduled to appear in the program booklet.

So far, two ACM groups have announced plans to hold technical sessions on May 13, the day before the conference opens for real. The Special Interest Group on Programming Languages has scheduled an all-day affair on "Extensible Languages." For preregistration and further information contact Carlos Christensen at Massachusetts Computer Assoc., Lakeside Office Park, Wakefield, Mass. 01880. The Special Interest Committee on Biological Data Processing will sponsor a session on "The Status of Shared Computer Systems in Hospitals" from 1-5 p.m. at the Sheraton-Boston. Stephen J. Siegel of Bradford Computer & Systems (4 W. 58th St., New York City 10019) is the chairman.

A special one-day session for more than 1000 of the nation's educators is scheduled for May 16. They will learn how computers can help teach math and science and improve skills in logical thinking and expression. The lesson plans for "Human Uses for Computers for Education" include two theses: 1) computer use in schools will become economically feasible much faster than believed; and 2) computers will help education along lines not yet familiar to most educators. The session will be held at the John Hancock Hall auditorium. Education program chairman is Wallace Feurzeig of Bolt, Beranek and Newman, 50 Moulten St., Cambridge, Mass.

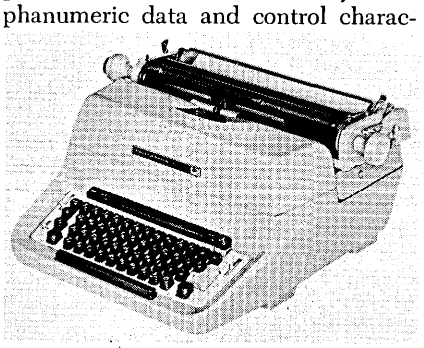
If you missed the Boston JCC's in '59 and '66, better come this time—your last chance to see the cream of the edp professionals crammed into the world's largest college town. ■

# THE PRODUCT PREVIEW

**DATAMARK, INC.**
**Westbury, N.Y.**
The company will unveil two OEM-directed page printers—a 100- and a 300-lpm unit, provided with communications and computer interfaces, intended for use with small computers. The chain teleprinters have a 96-character typefont and will sell for under $10K.

CIRCLE 555 ON READER CARD

**DIGITRONICS CORP.**
**Albertson, N.Y.**
The model 720 typewriter input station broadens the application of the company's DATA-VERTER system for source data acquisition by the addition of full alphanumeric capability. It performs all the functions of a standard typewriter and simultaneously records data on a magnetic tape cartridge for transmission over standard telephones and telephone lines via the DATA-VERTER acoustic attended or unattended transmitters. The 720 keyboard provides for the individual entry of alphanumeric data and control characters using a photoelectric encoding technique. Switch contact unreliability, contact bounce, and RFI/EMI are said to be eliminated. The 720 also protects against operator errors by automatic lockout of the keyboard.



CIRCLE 556 ON READER CARD

**FERROXCUBE CORP.**
**Saugerties, N.Y.**
The Systems Division is introducing the FI-5 1-usec cycle time random-access memory systems with 450 nsec access time. The systems feature capacity to 16K (40-bit) words and can be operated in either full or split cycle. Other features include internal parity check capability, over-under voltage protection, and internal byte and zone control. A separate power supply unit is available if desired. Both the system and power supply are designed for standard 19″ rack mounting, and interface connections are made at back-panel connectors. Storage and buffer applications include system use as a data concentrator, special-purpose main memory, and for mainframe memory extension.

CIRCLE 557 ON READER CARD

**AUERBACH INFO, INC.**
**Philadelphia, Pa.**
A reference service, *Auerbach Time-Sharing Reports,* will be announced. This service is designed to organize, interpret and analyze information about the time-sharing industry, including facts about time-sharing services, terminals and network equipment, languages, and special business applications. The two-volume report will be updated quarterly, and subscribers will also receive special state-of-the-art and economics and evaluation reports. The price will be $425 for new subscriptions and $390 for yearly renewals.

CIRCLE 558 ON READER CARD

**TRANSISTOR ELECTRONICS CORP.**
**Minneapolis, Minn.**
The Model 520 programmable controller is a buffered processor with 16 programmed I/O channels and up to 10 direct access channels. The one usec cycle time ferrite core memory system is expandable to 16K (16-bit) words, plus parity. Complete logic is provided for the company's DATA-SCREEN display terminal used in multistation configurations. Each crt in the system can be used independently while still being subject to network recognition. The controller is also designed to perform as an efficient I/O system; thus, the cpu need not interface directly with communications oriented peripheral equipment. Systems capability encompasses line printers, card handling equipment and Teletype terminals, as well as crt display terminals, allowing the central processor to more efficiently utilize its high-speed computing capability. The 520 can interface to the central processor in either parallel or serial mode at transfer rates from 300 to 4800 bps. An IBM-compatible interface adaptor is available; interfaces for other computer systems are available on request.

CIRCLE 559 ON READER CARD

*(Continued on page 138)*

### MOTOROLA INSTRUMENTATION AND CONTROL INC.
**Phoenix, Ariz.**

The company will show the Phase II configuration of its BDP-1000 systems-oriented digital data processor designed specifically for "hard hat" applications in industry. The slim-line configuration solves the space problem of users who need a rack-mountable package permitting expansion of memory while maintaining minimum package depth. The Phase II is available with memory capacities from 4K to 16K in 4K increments. It will use the "shared command" technique. The machine is an IC-oriented unit which will perform more than 400 commands of various types. The random access, single address memory has a cycle time of 2.16 usec. The unit can be supplied to operate from either 117 VAC, 60Hz or 2 4VDC power. No additional regulation is required. A power fail-restart feature is optional.

CIRCLE 560 ON READER CARD

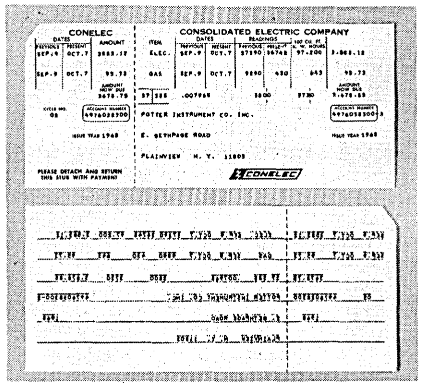
### POTTER INSTRUMENT CO., INC.
**Plainview, N.Y.**

The HSP 3550 is a 1200 lpm fourth generation (MOS-LSI logic) chain printer designed for use with all computer and data processing systems. It can also be used off-line or interfaced with a dataphone for remote applications. The unit offers up to 192 differ-

ent characters—numeric, alphanumeric and symbolic—in sets of 48, 64, 96 or 192. It is modular in design, with all electronics on pluggable printed circuit boards, and features dual speed, servo-controlled paper feed. Power requirements are 208/230 volts, single phase, 50 or 60 cycle. The 3550 is supplied in its own soundproofed cabinet, supported by a welded steel frame.

CIRCLE 561 ON READER CARD

The company will demonstrate a new unit record system featuring a magnetic bar code with an associated alpha numeric character printed on cards of keypunch size. This coded character will be both man and machine readable, offering bit densities of almost 9:1 over conventional cards and performing several of the functions now accomplished by OCR and MICR techniques. Automatic card preparation will be done by a Model HSP-3502A printer operating as an off-line print station. A modified standard typewriter will be used for manual




card preparation. A magnetic mark card reader reads the six-line cards produced both manually and automatically at 300 cards per minute. The hole-free cards provide an effective and convenient turnaround document which is especially suited for utility billing and similar applications.

CIRCLE 562 ON READER CARD

The company will also introduce a new Miniverter 12-bit analog-to-digital converter available in three basic configurations: 100, 150, and 200KHz. A front panel option provides means for short cycling to 8 and 10 bits to attain faster throughput rates. The unit is available with up to 64 channels of multiplexing.

CIRCLE 563 ON READER CARD

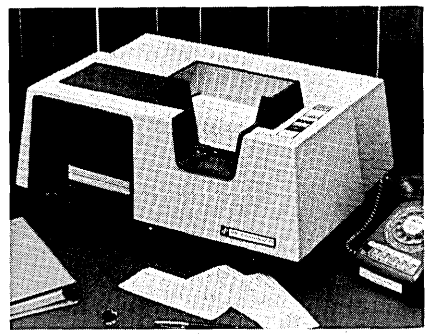
### RAYTHEON COMPUTER
**Santa Ana, Calif.**

The Model 79010 Array Transform Processor (ATP) is an auxiliary processor which attaches to the company's 703 and 706 computer systems as a peripheral device designed to control the flow of data arrays in performing highly iterative arithmetic processes encountered in operational calculus and linear algebra. Organization of the ATP allows indexed addressing to be specified for up to three data arrays which reside in main memory of the central processing system. Logically, these arrays may overlay areas defined as buffer storage by the cpu program. ATP performs the following basic operations: fast Fourier transform process, convolution integral process, vector element processes, move operations, scan, clear, format conversion. The technique of processing data by logical sets or arrays is particularly adaptable to highly repetitive operations that would normally be performed by a program loop because the same sequence of instructions need not be fetched from storage a large number of times.

CIRCLE 591 ON READER CARD

### DATA PRODUCTS CORP.
**Woodland Hills, Calif.**

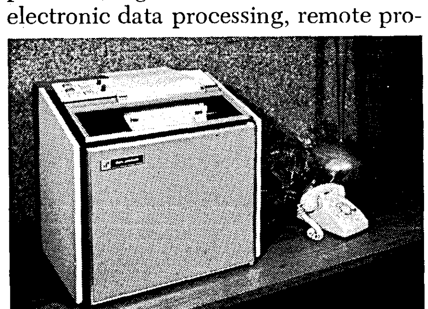
The Speedreader 300 low-speed card reader is designed for use with remote data and communications terminals and any standard small or medium computer. The unit can maintain a de-



mand rate of 300 80-column cards per minute with every card under computer control, with the ability to pick on demand at any rate up to the 300 card-per-minute maximum. The use of TTL logic, solid-state plug-in modules and convenient test points is said to simplify maintenance. The SR-300 measures 20" wide by 15" high by 22" deep and weighs approximately 70 pounds.

CIRCLE 564 ON READER CARD

The company will also announce the Model 4800 communications line/printer designed for communications, electronic data processing, remote pro-



cessing terminals and small computer systems. It will print at up to 1050 lpm, 80 columns wide, with a 64-character alphanumeric set. The 4800 utilizes either fan-fold paper with sprocket feed, printing up to six copies, or friction-feed paper rolls. A unique feature is the ability to remove and replace individual print hammers in less than two minutes without using special tools. The unit occupies less than four cubic feet, including electronics and paper supply, and weighs less than 100 pounds.

CIRCLE 565 ON READER CARD

Data Products' latest memory, the STORE/33, uses 3-wire, 3D organization and 18 mil cores to achieve a full-cycle time of 650 nsec. The memory uses only four types of plug-in circuit cards, which contain the IC electronics used throughout, plus a plug-in magnetic stack. The STORE/33 provides word capacities up to 16K, and optional features include parity generation and check, sequential addressing, memory data protect, display of address and data registers, and self-test exerciser. Cost of the 4K x 16 memory is less than $4,500 in production quantities.

CIRCLE 566 ON READER CARD

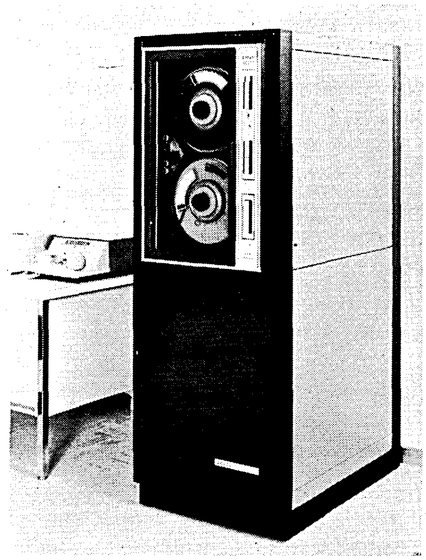
**PERIPHERAL EQUIPMENT CORP.**
**Chatsworth, Calif.**

The Series 7000 digital magnetic tape transport unit is especially designed for small digital computers, data communication terminals, and data acquisition systems. The unit includes all data electronics, bring to load point logic, servo drive, electronics and standard interface, but excludes control logic, inter-record gap and file gap mark generation, vertical and longitudinal parity generation, and cyclic redundancy check. Features include synchronous write/read, IBM 360 compatibility, functional compatibility with PEC Series 5000 and 6000 tape units, dual density, multiple operation up to four tape units, single capstan (pinch roller eliminated), and file protect. The 7000 can read in forward or reverse direction. Erase head is optional. Single unit price is $3,250.

CIRCLE 567 ON READER CARD

**TALLY CORP.**
**Seattle, Wash.**

The computer-compatible 4031 magnetic tape terminal provides point-to-point data communications at speeds up to 1200 wpm serially or 600/720 wpm in a parallel format over ordinary telephone lines. It is completely compatible with all other Tally send or receive terminals in any given transmission network. Recording density can be selected to 200, 556, or 800 cpi on 7-track tape or 800 cpi on 9-track tape. Purchase price for image only (without code conversion) is $23,500;



with code conversion, $25,000. Service rate is $1,140 per year. Monthly lease and service rates are available.

CIRCLE 568 ON READER CARD

Tally's multi-copy serial page printer can print out computer or communications data a single character at a time at speeds up to 600 wpm. The machine can be used off-line to generate printout from paper tape, magnetic tape or punched cards; on-line to any Tally data communications terminal; or as a stand-alone printout data ter-

minal interfaced directly to a data modem using ordinary voice-grade telephone lines. It can also be interfaced to another manufacturer's computer or data system.

CIRCLE 569 ON READER CARD

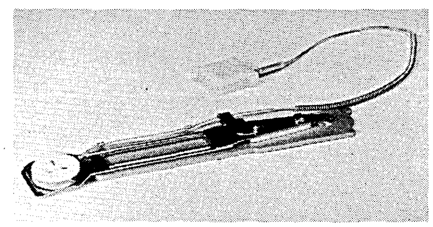
**MEMORY TECHNOLOGY INC.**
**Waltham, Mass.**

The S series Small Braid Systems (SBS) READ-only memories range in capacity from 64 to 2048 (10-80 bit) words and are pin-for-pin compatible with the F series (180 nsec access time, 300 nsec cycle time) and the standard SBS (200 nsec access, 500 nsec cycle) memories. S series specifications include a 700 nsec access time, one usec cycle time, less than 5 watts of power required, TTL and DTL compatible interface, 0° to +70°C temperature range, nondestructive readout, and only one power supply (+5 volts) required. Either individual words or the entire memory contents may be changed in the field within a few minutes. Prices range from $300 to $1300, depending upon quantity purchased and capacity. Delivery is 30 days.

CIRCLE 570 ON READER CARD

**APPLIED MAGNETICS CORP.**
**Goleta, Calif.**

The Model ERW 111501 flying head assembly for use with the IBM 2314 disc drive and equivalent OEM units



operating with disc packs features a straddle erase design to prevent fringing from a recorded track to an adjacent track. A typical disc drive spindle unit contains 20 head assemblies in a combination of five each of ERW-111501-1, -2, -3, and -4.

CIRCLE 571 ON READER CARD

The company is also introducing a series of digital magnetic recording heads. They are industry compatible ½" computer tape format designed. Models available are seven- and nine-track versions of 800 FRPI NRZI and nine-track versions of 3200 FRPI (1600 bpi phase encoded) recording techniques. Features include tilt (tape contact surface profile flat and perpendicular to reference surface) held to within .00015", discontinuities in face no greater than .0015" vertical section in tape contact area, and gap length selected for optimum head and tape performance.

CIRCLE 572 ON READER CARD

**IRA SYSTEMS INC.**
**Waltham, Mass.**

The SP-65 stored program automatic controller is designed for use in real-time process control, instrumentation

# Minneapolis Data Firm Acquires Dallas Company

Data Communications Systems, Inc., Minneapolis maker of data transmission equipment, announces its acquisition of Carterfone Communications Corp., Dallas.

Francis

Carterfone makes equipment to link radio signals with telephone lines and has been involved in court actions that resulted in the Bell System permitting independently made equipment to be hooked-up to its system.

David S. Francis, president of DCS and Thomas F. Carter, president of CCC said the combined firm's headquarters will be in Dallas.

Francis will be the corporation's president.

Francis and Carter said the combining of the two firms will provide an improved product line of coupling devices for both data transmission and radio-telephone communications.

"This makes available for the first time," they said, "integrated communication hardware and systems for total communications needs as well as laying the groundwork for significant new products."

SIGNING ACQUISITION paper is David S. Francis, president of Da Communications Systems, Inc. of Minneapolis. Thomas F. Carter, president o Dallas' Carterfone Communications Corp., waits his turn. The combined firm will produce a full line of coupling devices for data transmission, radio-telephone communications and telephone accessories.

dcs

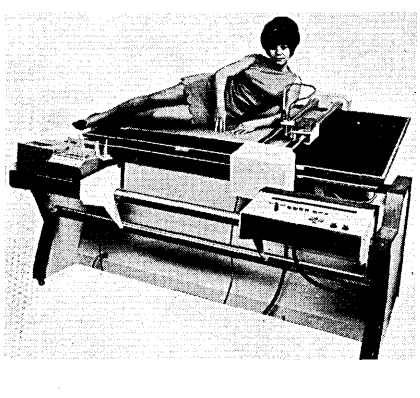
DATA COMMUNICATIONS SYSTEMS, INC. • 4230 CENTRAL AVE. N.E. • MINNEAPOLIS, MINNESOTA 55421 • (612) 788-9295 data acquisition systems, and data base editing/graphic display applications. Features include total core capacity of 65K (16-bit) words, 1.8 usec cycle time, read-only memory, 11 registers (4 "live"), remotable control panel, complete software packages (including Custom Mnemonics and FORTRAN II), direct memory access, Nixie read out, console or rack mount configuration, 200 user instructions. Some options are multi-level interrupt, trap mode direct memory channel, and power fail. Price is $14,900. The controller will plug-in interface to Teletypes or to the company's IRASCOPE.

The IRASCOPE is a stand-alone desktop console with a 1000-character capacity and a 64-character repertoire. The viewing area is 7" x 9½" oriented vertically or horizontally. Keyboard is integral alphanumeric typewriter style. I/O capabilities are 1200 baud half-duplex asynchronous, conforming to EIA Standards RS-232B for data processing terminal equipment. Interface options are available for computers, telephone lines, teletypewriter, paper tape, and magnetic tape. Price is $5,995.

CIRCLE 573 ON READER CARD

**AUTO-TROL CORP.**
**Arvada, Colo.**

The Model 6030 digital coordinate plotter, capable of straight line drawing at .0005" increments, operates either as an off-line system with input from punched cards, paper tape or

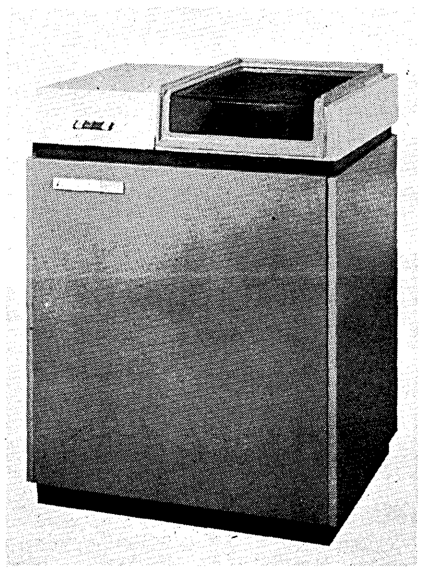


magnetic tape, or as an on-line system. Features include a tiltable flat bed plotting surface in a choice of three sizes (40"x40", 40"x60", 60"x60"), line drawing speeds up to 10" per second, in-line Nixie-type display of each coordinate instruction as it enters the control, three format options (FORTRAN, Machine Tool, Standard), all solid state silicon IC construction, manual entry keyboard, manual slew control, and the ability to draw a straight line at any angle with one input command limited by table size only. Accuracy: ±.008" overall. Repeatability: ±.001". Options available, either as original equipment or add-on, include an alternate drum style plotting surface for form type paper, numeric only and full alphanumeric printers, vacuum hold-down, and input buffer.

CIRCLE 574 ON READER CARD

**CENTURY DATA SYSTEMS, INC.**
**Anaheim, Calif.**

The Model 111 disc drive, directly plug interchangeable with the IBM 2311 disc drive and using the IBM 1316 disc pack or equivalents, is the first of a family which will have faster access times than the IBM units. (The 111's average access time will be less than 50 msec; IBM units average 75 msec.) The unit features convertibility to higher capacity Century Data equipment to be announced at a later date and will function with the IBM 2341 controller. Storage capacity is 7,250,000 bytes (58 million bits) and a transfer rate of 156K bytes/second. The electro-mechanical positioner is faster than hydraulic versions, and is



said to be more reliable. Century Data products will be serviced by the 24 California Computer Products' organizations throughout the country, including Hawaii, and in Europe.

CIRCLE 575 ON READER CARD

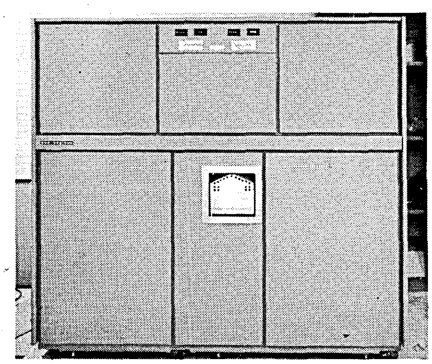
**MANDATE SYSTEMS INC.**
**New York, N.Y.**

SCADS (Supervisory Console Assembler Debugging System) is a software package which enables IBM 360 DOS users to debug their programs directly from the 360 console typewriter. By typing instructions at execution time the programmer can take dumps, create break-points and cause branches while the program is running. He also can change and restore instructions in the program. Without re-assembling, the programmer can test several loops and conditions in one shot. OOPS (On-line Object Patching System), which is an adjunct of SCADS, simplifies machine language patching of object decks and saves a great deal of re-assembly time. The combination is available at $1,000 per installation plus $200 for each additional computer owned by the same company up to a maximum total of $2,000.

CIRCLE 576 ON READER CARD

**CALIFORNIA COMPUTER PRODUCTS, INC.**
**Anaheim, Calif.**

The Model 890 is an off-line standalone plotting system consisting of a



magnetic tape transport and controller and a Honeywell 516 computer. The electronic plotter records information from a crt onto microfilm and/or photographic paper.

CIRCLE 577 ON READER CARD

CalComp will also show their Model 702 flatbed plotter in operation with the IBM 1130 computer. This is accomplished by using the new J-11 module which allows the 1130 to operate the drum plotter.

CIRCLE 578 ON READER CARD

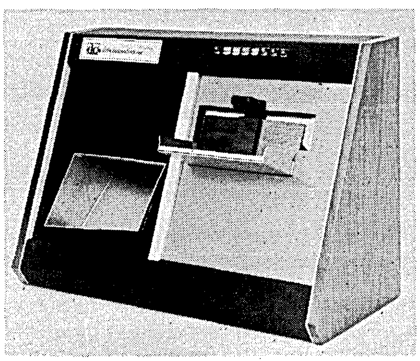
**RIXON ELECTRONICS, INC.**
**Silver Spring, Md.**

The first in a new family of data communications equipment is the 9600 bps data set that will be utilized on land lines, submarine cable and microwave facilities. The full-duplex unit is not pattern sensitive with regard to input data, since the use of an internal code translator results in a near flat spectral component distribution. The basic line signal will be a four-level AM, suppressed carrier, vestigal sideband signal, with lower sideband being transmitted. The data set will operate with either a manually adjusted or an automatic equalizer. Error rate performance over any 4C line is better than 1 in $10^5$ as long as the signal to noise ratio is 23dB or better. The 9600 bps data set will sell for under $10K.

CIRCLE 579 ON READER CARD

**BROGAN ASSOCIATES, INC.**
**Westbury, N.Y.**
**for**
**DATA COMPUTING INC.**
**Phoenix, Ariz.**

The CARDLINER 10 cardreader is designed for use with Mod 33 and 35 Teletypes via a plug-compatible interface that takes only one minute to install. Other interfaces are planned for



the near future. The 42-pound unit has only two moving parts and is designed so that cards cannot be lost. Standard punched cards may be read remotely by the Teletype "X-ON" command. Normal Hollerith card reader characters plus carriage return and line feed are converted to ASCII for transmission. The pricing scheme makes the unit particularly suitable for time-sharing customers: Charges are based on utilization, and the $60/month minimum rental includes 3K cards. Contracts may be on a month-to-month basis. Purchase price is $3,400.

CIRCLE 580 ON READER CARD

**REDCOR CORP.**
**Canoga Park, Calif.**

The RC 70 Midi-Computer (Midi-Computer: "Submicrosecond, 16-bit computer compactly packaged and megacycle throughput-rated for OEM and systems requirements.") is an 860-nsec, 16-bit machine featuring an 8K memory (plug-in expandable to 32K), memory parity, memory protect, bi-directional index register, high-speed multiply and divide, direct memory access, and priority interrupt. It is a real-time system for product testing, data acquisition, and applications with special systems requirements that need actual memory cycle throughput rates. Two-week delivery includes operational software with single pass assembler, FORTRAN IV (ASA Standard), math subroutines, utility package, and diagnostics. And the $21.5K price tag includes an ASR 33 Teletype as standard equipment.

CIRCLE 581 ON READER CARD

**SANDERS ASSOCIATES, INC.**
**Nashua, N.H.**

The Sandac 200 programmable communications processor is a special-purpose computer which can stand alone as a system controller for all types of data traffic or can be used as a message concentrator, a preprocessor, or for message switching. Up to 256 I/O terminals can operate simultaneously with display terminals, Teletypes, and other peripheral devices. The processor features modular construction ranging from 4K or 8K words of memory with a 16-channel buffer control unit and standard software to 65K (131K bytes) words of directly addressable core memory. Other features include multilevel interrupt system; independent block transfer on each I/O channel; direct memory transfer by bit, character, or word; independent selection of character length, information code, and transmission rate of each channel; communications ori-


ented instruction set with 65 basic commands; 15 hardware index registers with double indexing; and communications supervisory program and subroutine library. Memory parity and overwrite protection, real-time clock, dynamic core allocation, remote program loading, parity check on all I/O data, and extensive internal error protection are standard features.

CIRCLE 582 ON READER CARD

**ADAGE, INC.**
**Boston, Mass.**

The company will introduce the AGT/50 graphics terminal, the SMS2 disc system including the AMOS disc operating system, the HWD1 hardware windowing operator, and the LCG1 character generator. Demonstrations will be held using Adage standard graphics software and, for the first time, the BUILD operator which permits on-line interactive image construction.

CIRCLE 583 ON READER CARD

**AMPEX CORP.**
**Culver City, Calif.**

Each 7 X 12 X 1.2 inch card of the 3DM-3000 memory can contain from 128 4-bit words to 1K of 12-bit words; eight such modules may be tied together, yielding a maximum of 8K 12-bit words of core storage. Built for applications such as refresh memories for crt displays or remote terminal buffers, the 3DM-3000 is not particularly fast. Its average access time is 1.2 usec; half-cycle times run 1.5 usec. What the unit does boast is small size (the system fits into a 5½-inch rack space with its power supply and control logic) and low price (ranging from about $390 to $990). For convenience and economy in adapting the memory to OEM applications, a single power supply voltage is used, rather than three voltages, which the manufacturer claims is the norm. One unusual feature is listed in the specs: the 3DM-3000 is constructed on a five-wire basis: probably that helps in implementing that single voltage power concept.

CIRCLE 584 ON READER CARD

**OMNITEC**
**Phoenix, Ariz.**

The company will introduce seven new data communications devices at the conference.

The Model 812 keyboard/tape subsystem combines a keyboard terminal, strip printer, acoustical coupler, and magnetic tape cartridge. It provides a choice of communications from the terminal environment: 1) keyboard to tape; 2) coupler to tape; and 3) tape to coupler.

The Model 806, companion unit for the 812, is used at the computer site to re-structure IBM-compatible tapes for direct computer input. The unit is fed from either tape cartridge or coupler input.

The Model 800A keyboard terminal features BCD code for computer input and a strip printer which operates at 15 cps.

The Model 701A acoustical coupler introduces into the terminal environment of a remote computer user a dual mode capability for simultaneous input from 1) any teleprinter; and 2) remote plotter, or other EIA devices.

The Model 750 acoustical coupler is especially designed for European time-sharing or remote batch users (compatible with European electrical and physical requirements).

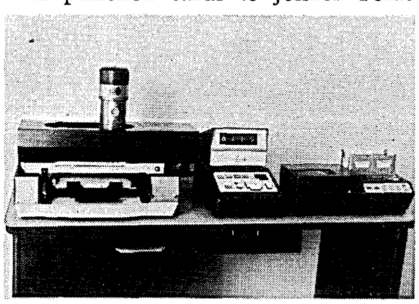
The Model 702 communications modem combines ORIGINATE and ANSWER capabilities enabling terminal-to-terminal communications, as well as interfacing between voice-grade line transmission with the computer center.

The Model 703 communications modem provides automatic dial-up answering capabilities at a multi-access computer center (similar to the 103A).

CIRCLE 585 ON READER CARD

**JONKER CORP.**
**Gaithersburg, Md.**

The J410 automatic data entry machine allows the user direct conversion from punched cards to Jonker Term



cards. The user can store 10 million bits of information in a cubic foot of space and retrieve or correlate any of this information in two minutes. The system may be linked directly to a computer system and can also serve as a completely independent information retrieval center.

CIRCLE 586 ON READER CARD

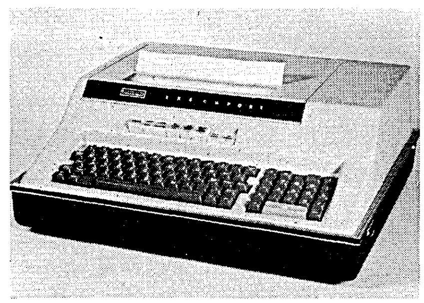
**SYKES DATATRONICS, INC.**
**Rochester, N. Y.**

The COMPU/CORDER cassette-loaded magnetic tape transport is specifically designed for use with small computers. Average access time to any file on the tape is five seconds. All tape transport commands are performed under program control. Features include read/write transfer rates of 5K bps, packing density of 1K bps on each of four program selectable data tracks, and bi-directional 110 ips file access capability. Software packages and complete electrical interfaces for the small DEC, Data General and Varian computers are provided to users without charge. The COMPU/CORDER is priced to sell at $2,500 in quantities of one, with quantity discounts and OEM price schedules available. Shipments are scheduled to begin in June.

CIRCLE 587 ON READER CARD

**COMPUTER TRANSCEIVER SYSTEMS INC.**
**Upper Saddle River, N. J.**

The EXECUPORT 300 is a small data communications terminal that transmits data to a remote computer, receives data from the computer, and provides both an input and an output printout. Designed to operate over or-



dinary telephone lines, the terminal provides 96-character full USASCII capabilities. Its additional 32 characters include symbols and lower case alphabet. Included as integral components are a keyboard; a 10, 15 or 30 cps (operator selectable) thermal page printer; solid-state control logic; built-in telephone coupler and interface; and a universal interface for peripheral accessories. All this and the carrying case weigh less than 30 pounds.

CIRCLE 588 ON READER CARD

**HOUSTON INSTRUMENT**
**Bellaire, Texas**

END-STEP mode software designed for use with the company's COMPLOT MTR-9 off-line digital plotting system is said to require 10 times less computer time and mag tape than previous systems. The code structure permits a significant reduction—typically a factor of 20—in the number of characters that need to be written on magnetic tape to produce a given plot, compared with systems requiring a character be written for each step to be taken by the plotter. END-STEP is supplied with each MTR-9 and requires no more memory space than conventional plotter software. A standard 10½"-reel Mohawk unit is included in the system. Either 200 bpi, 7-track or 800 bpi, 9-track are supplied; or an existing unit of the 700 or 900 series can be used. The Mohawk is used as the tape handling input. When not active as a plotter input, it can serve in any other capacity to which it is suited. Also, manual keyboard entry allows generation of plotter curves without the need for computer time. The commands are simple and few in number. No operator attention is needed other than initial tape loading and start commands. Signals from the Mohawk are fed to the plotter controller unit mounted in the desk. This unit interrupts the tape instruction and gives conventional increment signals to the plotter. The controller completes the END-STEP loop comprising this software/hardware combination of the MTR-9. The incremental plotter can be of any speed or size. The system, including the Mohawk tape transport and input keyboard, desk-mounted controller, END-STEP software and five-year up-date service, costs $21K for 7-track 200 bpi and $22K for 9-track 800 bpi. The system without the Mohawk sells for $13,000 for use with 7-track and $13,500 for use with 9-track. The system does not include incremental plotter.

CIRCLE 589 ON READER CARD

**GENERAL ELECTRIC CO.**
**Waynesboro, Va.**

The TermiNet 300 electronic data communication terminal can be used in private and commercial time-sharing systems as well as in terminal-to-terminal communications. The printing concept centers around type characters which are rotated horizontally in front of a bank of hammers. This is said to account for the speeds of 10, 15 and 30 cps (two to three times faster than other similar equipment) which can be achieved. The 94 printable characters in USASCII are all provided for; two complete sets of 94 characters allow upper and lower case printing. The terminal can be applied to telephone lines by employing the GE DigiNet 110 or 111 or Bell 103 data sets. DigiNet 114 and 115 acoustically coupled data sets also provide interconnection to telephone transmission circuits with the advantage of portability. The TermiNet 300 is a self-contained unit with all the electronics necessary for transmitting and receiving; it is approximately office typewriter size and weighs 65 pounds. The logic is designed so that basic terminal functions and options are modular and can be replaced as needed. Options include a photoelectric paper tape reader, paper tape punch, and a horizontal tabulation feature. ■

CIRCLE 590 ON READER CARD

## SESSIONS AT A GLANCE

| Day | Morning (9 a.m. – 12 N) | Afternoon (2 p.m. – 5 p.m.) |
|---|---|---|
| WEDNESDAY, MAY 14 | KEYNOTE SESSION (9 a.m. – 10:30 a.m.) | |
| | 1. Microprogramming – An Opportunity for LSI | 6. Software |
| | 2. Operating Systems | 7. Models of Intelligence |
| | 3. On-Line Business Applications | 8. URGENT–Increased Dialog with Society |
| | 4. Computers and the Underprivileged | 9. Techniques for Displays and Picture Processing |
| | 5. The Successful Application of Computer Models in Marketing | 10. Computer-Aided Design |
| THURSDAY, MAY 15 | 11. Time-Sharing Systems | 16. Managing Large-Scale Software Projects; 21. Tools for System Programming |
| | 12. Graphic Applications | 17. Information Retrieval and Libraries |
| | 13. Topics of Current Interest | 18. Computers and Communications; 22. Topics in CPU/Memory Subsystem Design |
| | 14. Papers Relating to Memory | 19. Applications of Computers in the Urban Environment; 23. Software Transferability |
| | 15. Computers in Service to Libraries of the Future | 20. Education of the Computer Professional; 24. Computer Assisted Instruction: Current Status – Future Problems |
| FRIDAY, MAY 16 | 25. Dynamic Graphics – Today and Tomorrow | 30. Computer Graphics Theatre |
| | 26. The Dartmouth System and Its Applications | 31. Small Computers For Data Terminal Network Control |
| | 27. Computer Systems vs. Health Systems: Who is Winning? | 32. MIS ≡ Accounting ≧ MIS? |
| | 28. Measurement and Modeling of Digital Hardware/Software Systems | 33. Computation and Program Specification |
| | 29. Scientific Applications | 34. Hybrid Computer Systems and Languages |

# THE SESSIONS

The chairmen of several of the sessions have written descriptive paragraphs on their sessions specifically for DATAMATION. Further explanations of these and other sessions may be found in the official conference program booklet.

Wednesday, May 14, 9 a.m.
Main Auditorium
**KEYNOTE SESSION:**
**Social Impact of Information Systems**

Speaker: General James M. Gavin
Arthur D. Little, Inc.
Cambridge, Massachusetts

1. Wednesday, 10:30-12:30
Main Auditorium
**MICROPROGRAMMING—**
**AN OPPORTUNITY FOR LSI**

Chairman: Henry S. McDonald
Bell Telephone Laboratories
Murray Hill, New Jersey

The panel will discuss the microprogramming requirements from a systems point of view while at the same time examining the opportunities offered by the several new materials technologies. The role of microprogramming as a maintenance tool will be discussed. The possibility of microprogramming a peripheral of data interface so it conforms to a specified external standard will be examined. The panel plans to explore possible materials alternatives such as semiconductors, magnetics, optical or other storage media in the light of the variety of systems they represent.

Panelists:
Edward Bennett, Viatron Computer Systems Corp.
Thomas E. Osborne, Hewlett-Packard Corp.
Stanley H. Pitkowsky, IBM.
Stuart G. Tucker, IBM.

2. Wednesday, 10:30-12:30
Grand Ballroom
**OPERATING SYSTEMS**

Chairman: George H. Mealy
Computer Consultant
Boston, Massachusetts

Papers:
A Modular Approach to File System Design, by Stuart E. Madnick, Massachusetts Institute of Technology.
RTOS—Extending OS/360 for Real-Time Spaceflight Control, by J. L. Johnstone, IBM.
Panelists:
G. Edward Bryan, Scientific Data Systems.
T. Kallner, IBM.
Kirk Sattley, Massachusetts Computer Associates, Inc.

3. Wednesday, 10:30-12:30
Room 200 Auditorium
**ON-LINE BUSINESS APPLICATIONS**

Chairman: John T. Gilmore, Jr.
Keydata Corporation
Watertown, Massachusetts

On-line computing systems for business applications are fairly new and somewhat controversial. They have advocates and detractors. But whether pro or con, all admit that such systems are here to stay. That does not mean that on-line systems can be considered the panacea for all the ills of business, any more than one kind of pill can be expected to cure all the ailments of mankind. Depending on the volume and characteristics of their operations, some businessmen do not need on-line systems and should not have them. Others need but cannot afford them. Still others have them but either do not need them at all or make too little use of their power and potential. So, the primary purpose of the panel on on-line business applications, as I see it, is to bring this whole subject into much sharper focus.

Now for a bit more background . . .

The average businessman today has as tough a problem to solve as the scientist has—perhaps even more so if one considers the countless variables and fluctuations which confront him. His basic problem is his data base. He cannot watch it or experiment with it as the scientist or engineer can. More often than not, access to "current" information takes several days or weeks.

However, prevailing computer techniques and on-line communication techniques will enable him to keep his data base truly current and accessible in milliseconds. With this kind of luxury, the modern businessman could in time become as sophisticated a computer user as the modern scientist is. When he does, and when there are many like him, the impact on the business community will probably cause the operations research textbooks to be rewritten and the economists to take a second look at their crystal balls.

What it boils down to is this. On-line business applications, whether on-line to one's own computer or to a computer utility, will provide a dynamically updated data base. Once that occurs, the businessman will be able to request various operations at will or automatically. This will provide him with up-to-the-second information so essential to maximum efficiency at minimum cost in a highly competitive environment. Changes in a data base will, of course, automatically affect other parts of the same data base and, through the use of communications, make changes to other data bases.

For example, in performing its simultaneous invoicing and inventory control function, the Keydata system signals the terminal operator (in her own office) when a reorder point is reached based on the quantity just processed in the invoice being prepared by her. The ordering of the item is presently done manually. But the time could soon come when the computer will not only inform the operator but also communicate directly with vendors (through terminals in their offices), request prices and delivery dates, compare them, select the most favorable vendor, and order a forecast-calculated quantity of the item. Or the same signal could trigger a production order message to another terminal in the plant or perhaps directly to a process-control computer. Such examples could go on and on, but all are predicated on a data base that is being dynamically updated.

Among other questions I feel the panel should discuss are:

What are some of the problems in dynamic data base systems? What protection must be provided to safeguard information? What reliability and availability criteria are required? What kind of back-up procedures are needed?

How can a businessman economically justify each successive stage of developing what for him will be the optimum on-line system? What are some of the major impasses? What are the intermediate and final payoffs? What kind of time period is involved in developing a sophisticated computer-oriented business community?

The time allowed for the session is necessarily short. But if the panel succeeds—as I believe will be the case—in sharpening the focus on this subject, as I mentioned earlier, it will have made a substantial contribution to a better appreciation of on-line business applications.

Panelists:
Charles T. Casale, Paxon Corp.
Martin Greenberger, The Johns Hopkins University.
Frederick Plugge, American Airlines.
William M. Zani, Harvard University.
Kenneth L. Zearfoss, Westinghouse Electric Corp.

4. Wednesday, 10:30-12:30
Cheri 1

**COMPUTERS AND THE UNDERPRIVILEGED**

Chairman: James H. Burrows
The Mitre Corporation
Bedford, Massachusetts

The panel session will present current and post programs addressed to bringing into the expanding field of computers, their operation and use, the source of untapped resource represented by the underemployed and unemployed of the ghettos. Government programs addressed to assist industry in absorbing excessive training costs and to develop selection and training techniques will be discussed.

Round table discussion will bring forth the current problems and future potential of the field to continue as an industry whose growth demands that artificial barriers for entry positions not be erected as they have been in stable or declining job markets.

It is expected that participation by the audience, both in questions and discussion, will take place; and if sufficient interest is shown, an open evening session to continue discussion and interchange between interested parties and to strengthen some of the growing communication channels in use by people and organizations dedicated to hasten the progress of the development of jobs for a segment of American citizenry currently unable to work at or near capacity.

Panelists:
Milton Bauman, Price Waterhouse and Co.
John J. Donovan, Massachusetts Institute of Technology.
William B. Lewis, U.S. Department of Labor.
Allen L. Morton, Jr., Computer Personnel Development Assn., Inc.
Joseph Seiler, U.S. Department of Labor.

5. Wednesday, 10:30-12:30
Cheri 2

**THE SUCCESSFUL APPLICATION OF COMPUTER MODELS IN MARKETING**

Chairman: Charles A. Huebner
American Can Company
New York, New York

Panelists:
Adam Block, Product Group, Inc.
William Harden, Advanced Computer Techniques, Inc.
A. R. Solomon, Xerox Corp.

6. Wednesday, 2:00-5:00 p.m.
Main Auditorium

**SOFTWARE**

Chairman: John J. Donovan
Massachusetts Institute of Technology
Cambridge, Massachusetts

Papers:
Batch, Conversational, and Incremental Compilers, by Harry Katzan, Jr., Pratt Institute.
TRANQUIL: A Language for an Array Processing Computer, by Norma E. Abel, Paul P. Budnik, David J. Kuck, Yoichi Muraoka, Robert S. Northcote, and Robert B. Wilhelmson, all of the University of Illinois.
SNAP—An Experiment in Natural Language Programming, by M. P. Barnett and W. M. Ruhsam, RCA.
The Compiled Macro Assembler, by W. D. Maurer, University of California.

Panelists:
Fernando Corbato, Massachusetts Institute of Technology.
Bernard Galler, University of Michigan.
Butler Lambson, University of California.
Nathaniel Rochester, IBM.

7. Wednesday, 2:00-4:30
Grand Ballroom

**MODELS OF INTELLIGENCE**

Chairman: Leonard Uhr
The University of Wisconsin
Madison, Wisconsin

This session will present papers that reflect a variety of the problems and approaches that currently interest researchers in artificial intelligence and simulation of intellectual processes. For the first 10 years of this very new research effort (roughly, from 1955 to 1965), people wrote programs that embodied one approach or another, using this or that set of "heuristics" or "features," for such isolated tasks as recognizing letters of the alphabet, playing checkers or chess, proving geometry theorems, or simulating concept formation. These programs, although they were often extremely large, complex and powerful, have been to some extent *ad hoc* to their problem areas—collections of bright ideas ("heuristics," "features") that the programmer thinks (hopes) will work.

This is perfectly natural and reasonable during the early stages of a new science. For we must first strap together mechanisms just to get a working system—whether a model of a bridge that doesn't fall down or a radio that works or one function of the living brain. After several such models have been finished, and have achieved a certain amount of success, we can examine them, compare them, and begin to develop general principles that will deepen our understanding of our problems.

The papers in this session seem, in my opinion, to be moving in this direction of attempting to organize our present understanding, to come up with more general, integrative, and wholistic methods. Naylor attempts to organize a great deal of pattern recognition research along two major structural dimensions, in order to show how more powerful systems might result from a combined approach. Zobrist broadens out the research on game-playing programs to attempt to handle (so far as I know, for the first time on the full 19 by 19 board) the Japanese game of GO, which is, in the opinion of most game buffs, the most difficult game of all. For a first program, Zobrist plays a surprisingly good game (plans are apparently being made to have the program available through an interactive time-sharing system so that it can play against interested adversaries at the Boston meetings). But in my opinion more important than its level of ability on a particular game, Zobrist's program is the first to make extensive application of pattern recognition techniques of a very general sort to a difficult game.

Sutro and Kilmer will present a very interesting example of a new trend toward integration—the putting of all the functions that have up to now been examined separately into a single whole: a robot. Their project is also unique among robot projects in that they are designing and building an analog computer that tries to incorporate what we know about living brains and nervous systems. Cioffi and Fiorillo examine the problem of handling faulty circuits (of the sort we see in living nerve nets, and will probably find in nerve net robots when they are fabricated with the integrated techniques around the corner).

Maybe I'm forcing coherence on a set of four papers that happened to be chosen as the best (of a rather large number) submitted for a national conference. Each paper contributes to its own particular problem area. But from the point of view of integration, each does indeed show a tendency to generalize, apply methods across areas, put parts together into a whole, and attempt to integrate.

Papers:

Some Logical and Numerical Aspects of Pattern Recognition and Artificial Intelligence, by W. Clark Naylor, IBM.

A Model of Visual Organization for the Game of GO, by Albert L. Zobrist, University of Wisconsin.

Assembly of Computers to Command and Control a Robot, by Louis L. Sutro, Massachusetts Institute of Technology, and William L. Kilmer, Michigan State University.

Diagnosis and Utilization of Faulty Universal Tree Circuits, by Giacomo Cioffi, Fondazione U. Bordoni, and Eugenio Fiorillo, IBM Italia.

8. Wednesday, 2:00-5:00

Room 200 Auditorium

**URGENT—INCREASED DIALOGUE WITH SOCIETY**

Chairman: Harry T. Larson

TRW Systems

Redondo Beach, California

Panelists:

James M. Brownlow, IBM.

Milton A. Lipton, U.S. Army Electronics Command.

T. G. Paterson, RCA.

A. J. Pennington, Drexel Institute of Technology.

Hal Sackman, System Development Corp.

William L. Konigsford, IBM.

9. Wednesday, 2:00-5:00

Cheri 1

**TECHNIQUES FOR DISPLAYS AND PICTURE PROCESSING**

Chairman: Robert H. Stotz

Computer Displays Inc.

Waltham, Massachusetts

The papers are rather technical in nature and are aimed principally at the specialist. The keyboard paper will be of interest to hardware people. The Metzger paper describes programming algorithm for a rather knotty display problem. The Anderson and Huang presentation will concern itself with digital processing of grey scale images. The paper on the scan display system contains a tutorial section on scan display processing and specific information on the system being built at the Univ. of Illinois.

Papers:

Solid State Keyboard, by E. A. Vorthmann, Micro Switch Div. of Honeywell, and J. T. Maupin, Honeywell.

Computer Generated Graphic Segments in a Raster Display, by Richard A. Metzger, Rome Air Development Center.

Errors in Frequency-Domain Processing of Images, by Grant B. Anderson and Thomas S. Huang, Massachusetts Institute of Technology.

10. Wednesday, 2:00-5:00

Cheri 2

**COMPUTER-AIDED DESIGN**

Chairman: Richard E. Merwin

U.S. Army Sentinel System Office

Arlington, Virginia

Activity and interest in the field of computer-aided design has risen sharply in the past few years in response to the rapidly evolving state of semiconductor technology and the availability of interactive graphic terminals. The development of LSI chips with 50 to 300 active circuit elements requires the development of entirely new maintenance and fault location techniques and these can only be implemented with the help of a data processor. At the other end of the spectrum is a requirement to provide optimum tolerance requirements for LSI circuit elements to maximize process yields.

The session on computer-aided design addresses both these topics with three papers describing specialized techniques for detecting fault conditions in LSI arrays and a fourth paper covering interactive tolerance analysis using a graphic display device.

This session will be of special interest to persons engaged in design and maintenance of large digital systems to be built with LSI components. In addition, those interested in interactive graphic design processes will hear about a successful application of these evolving techniques.

Papers:

Interactive Tolerance Analysis with Graphic Display, by L. A. O'Neill, Bell Telephone Laboratories.

A Method of Automatic Fault-Detection Test Generation for Four-Phase MOS LSI Circuits, by Y. T. Yen, National Cash Register Co.

A Method of Diagnostic Test Generation, by A. B. Carroll, M. Kato, Y. Koga, and K. Naemura, University of Illinois.

Programmed Test Patterns for Multiterminal Devices, by Francis J. McIntosh and W. W. Happ, NASA.

*(Continued on page 150)*

# Here's what a programmer looks

Cycle Time Interrupt for rapid light-pen tracking regardless of display file's length. Essentially a Real-Time Clock available for other functions.

Automatic scissoring of display elements at screen edge.

Availability of peripherals such as readers, printers and mass storage.

A 32-key function keyboard with interchangeable 8-bit coded overlays. Signals available on key depression and release. Also key illumination under program control.

Hardware character, line and circle generation with simplified display commands. Saves programming effort, time and memory.

Full-screen vector drawing requiring only one- or two-word instructions.

Full-screen availability of CRT. Also, ability to adjust viewing area.

Light-pen interrupt independent of fingertip switch.

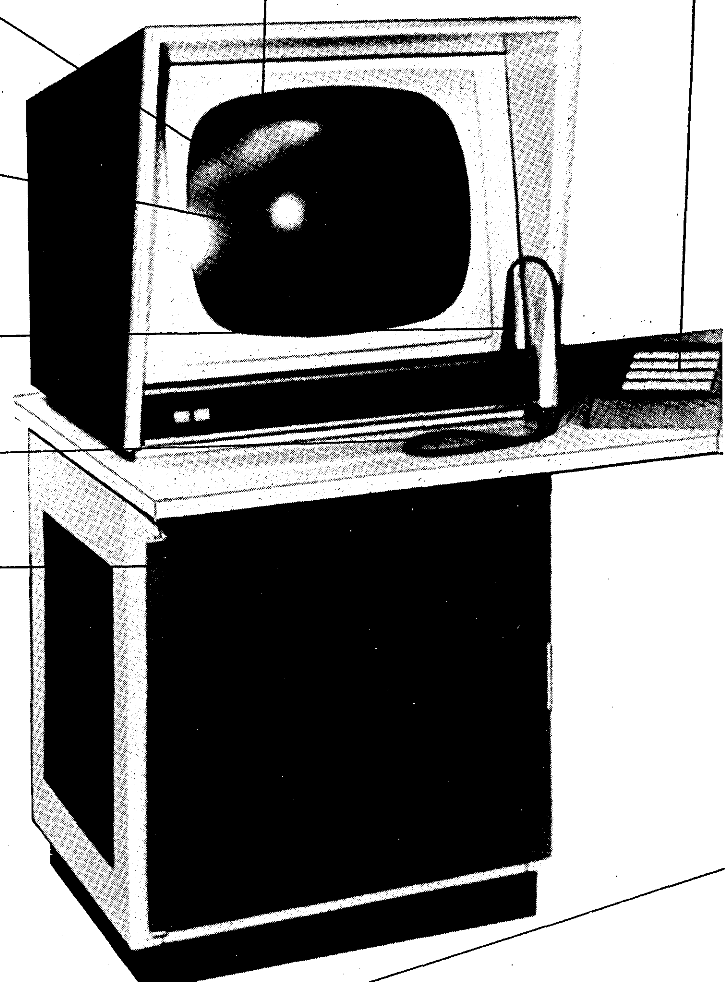
Enable and disable of light pen by display command.

Display frame may be synchronized with line frequency under program control.

Best cost/performance ratio in the field. (Help keep management smiling.)

Standard interfaces for direct or remote operation with any central computer.

Strong programming documentation.



An Index Register in the display processor which can function as an iteration counter for shading and drawing grids.

Display file jump and halt commands may be made conditional.

FORTRAN IV Compiler.

# Why not get your second display first?

# for in his second interactive display:

Standard instructions for memory (over 100), display file (28 + 11 sub-instruction fields) and display I/O (33).

Software for debugging and diagnostics.

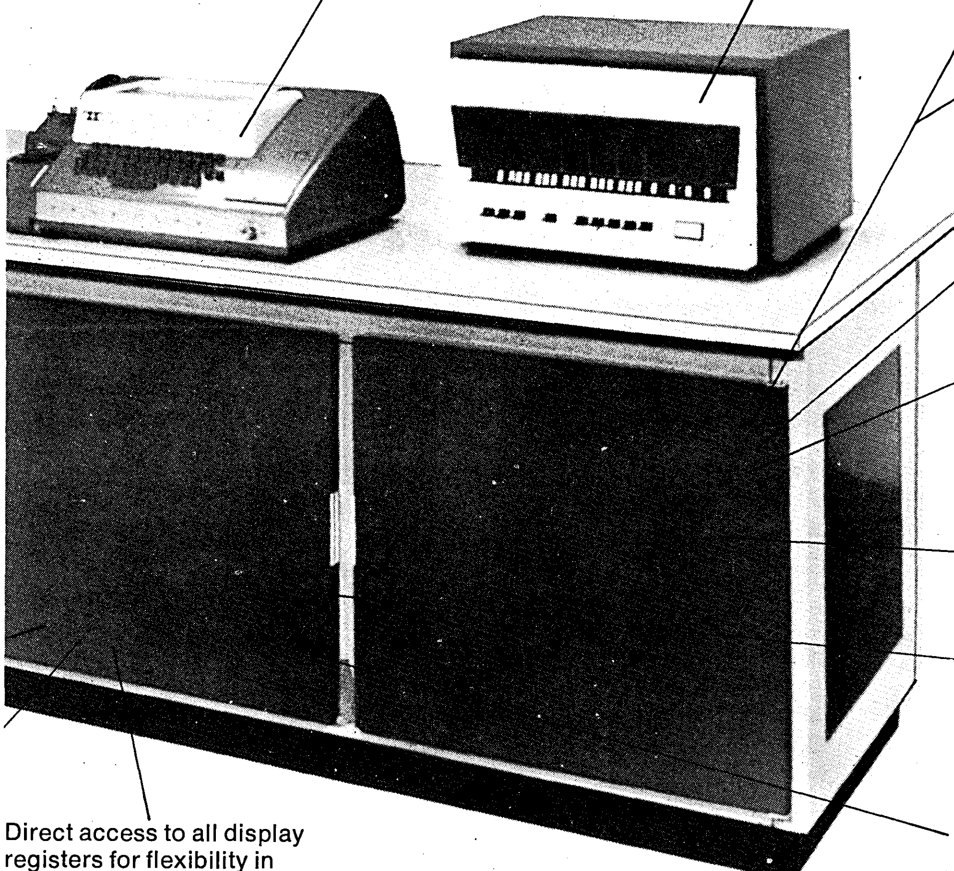
Proven software for drawing graphs, light-pen tracking, and text editing.

Construction of display files similar to computer programming, e.g. subroutining, indirect jumping, etc. (Affords built-in familiarity with display programming.)

A programmable memory expandable to 32K.

Greater memory space availability through use of efficient display commands and hardware display generators.

Greater memory time availability afforded by direct memory access channel.



Programmable recursive display subroutining.

Relative addressing to permit relocation of display files anywhere in memory.

Display Processing Unit and Central Processing Unit operating independently and simultaneously from a common core memory.

Multi-level indirect addressing.

Direct access to all display registers for flexibility in programming and debugging.

Single-command control of hardware blink, and variable character sizes, line structures and intensities. Applicable to any portion of display.

# IDIIOM

**Information Displays, Inc.**

333 N. Bedford Rd., Mt. Kisco, N. Y. 10549
(914) 241-1000 TWX 710-571-2179

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To get the full picture on Interactive Displays, write for IDI's "Comparison Brochure."

**SESSIONS . . .**

11. Thursday, May 15, 9:00-12:00 a.m.
Main Auditorium
**TIME-SHARING SYSTEMS**

Chairman: Bruce W. Arden
The University of Michigan
Ann Arbor, Michigan

Papers:
OS-3: The Oregon State Open Shop Operating System, by N. Ronald Crandall, Fred A. Dayton, and G. Rose, Oregon State University.
Virtual Memory Management in a Paging Environment, by N. Weizer and G. Oppenheimer, RCA.
An Operational Analysis of a Remote Console System, by Herbert D. Schwetman and James R. DeLine, The University of Texas at Austin.
A Model for Core Space Allocation in a Time-Sharing System, by Maurice V. Wilkes, The University Mathematical Laboratory.

12. Thursday, 9:00-12:00
Grand Ballroom
**GRAPHIC APPLICATIONS**

Chairman: David Evans
Evans and Sutherland Computer Corp.
Salt Lake City, Utah

Papers:
Picture-Driven Animation, by Ronald Baecker, Massachusetts Institute of Technology.
Computer Graphics Displays of Simulated Automobile Dynamics, by Calvin M. Theiss, Cornell University.
Fast Drawing of Curves for Computer Display, by Dan Cohen and Theodore M. P. Lee, Harvard University.
A Class of Surfaces for Computer Display, by Theodore M. P. Lee, Harvard University.
POGO: Programmer-Oriented Graphics Operation, by Barry W. Boehm, Vivian B. Lamb, Robert L. Mobley, and John E. Rieber, The Rand Corp.

13. Thursday, 9:00-12:00
Room 200 Auditorium
**TOPICS OF CURRENT INTEREST**

Chairman: Fred H. Scaife
Control Data Corporation
Minneapolis, Minnesota

Papers:
Computer-Aided Processing of the News, by J. F. Reintjes and R. S. Marcus, Massachusetts Institute of Technology.
An On-Line Information System for Management, by G. F. Duffy and F. P. Gartner, IBM.
Computers and Congress, by Edmond S. Mesko, Technical Information Services Co.
Automatic Checkout of Small Computers, by Marvin S. Horovitz, Digital Equipment Corp.
Cryptographic Techniques for Computers, by Dennie Van Tassel, San Jose State College.
Montessori Techniques Applied to Programmer Training in a Workshop Environment, by Elizabeth R. Alexander, California Division of Highways.

Discussants:
W. L. Gordon, The Boston Computer Group, Inc.
D. F. Manzer, Honeywell.

14. Thursday, 9:00-12:00
Cheri 1
**PAPERS RELATING TO MEMORY**

Chairman: R. Leonard
Honeywell Inc.
Waltham, Massachusetts

Papers:
Variable Topology Random Access Memory Organizations, by Martin Fischler and Allen Reiter, Lockheed Aircraft Corp.
Fault Location in Memory Systems by Program, by C. V. Ravi, University of California.
Characteristics of Faults in MOS Arrays, by H. R. Lambert, Autonetics.

15. Thursday, 9:00-11:30
Cheri 2
**COMPUTERS IN SERVICE TO LIBRARIES OF THE FUTURE**

Chairman: Calvin N. Mooers
Rockford Research Institute Inc.
Cambridge, Massachusetts

It is the purpose of this session to bring to computer professionals a more realistic understanding of the necessary service role of computers in the libraries of the future. So far, computer technology has had only a limited impact in library service because it has failed to meet three basic requirements: it has not been applied to valid library targets, the technology has not been agreeable to work with, and it has not been cost competitive.

In this session, three library experts who are knowledgeable in the potential capabilities of computers will develop the several facets of this topic. After each of their presentations, audience discussion is encouraged. In the first paper, Prof. Locke will give a refreshing view of what a large library is and what are the primary job tasks and costs which a librarian must worry about. The audience will be able to observe that neither Project MAC nor Project INTREX, despite their claims for breakthroughs in computerized information science, have provided any substantial contribution to the solution of these tasks. The next paper by Mrs. Avram will recount some of the problems, frustrations, and successes in applying computers to a large international information exchange program using magnetic tapes. Here the matters of standards, documentation, permanence of method, compatibility, and ease of interchange are of tremendous importance. Computer science has often been most casual, if not remiss, in these areas. The final paper by Mr. Dillon will describe several projects where computer technology has been put to limited use, and will describe the successes and failures and some of the reasons why.

In the end, the main question to be settled is who is to serve whom. Must the librarian and his staff bend their ways and habits to serve the "third generation computer" and its disorderly and transitory supporting technology? Or should computer technology, both in its machines and people, come to develop and to practice an honest service and supporting role, one that will provide for the convenience and benefit of the users and workers in the libraries of the future? The librarians have decided. Have you?

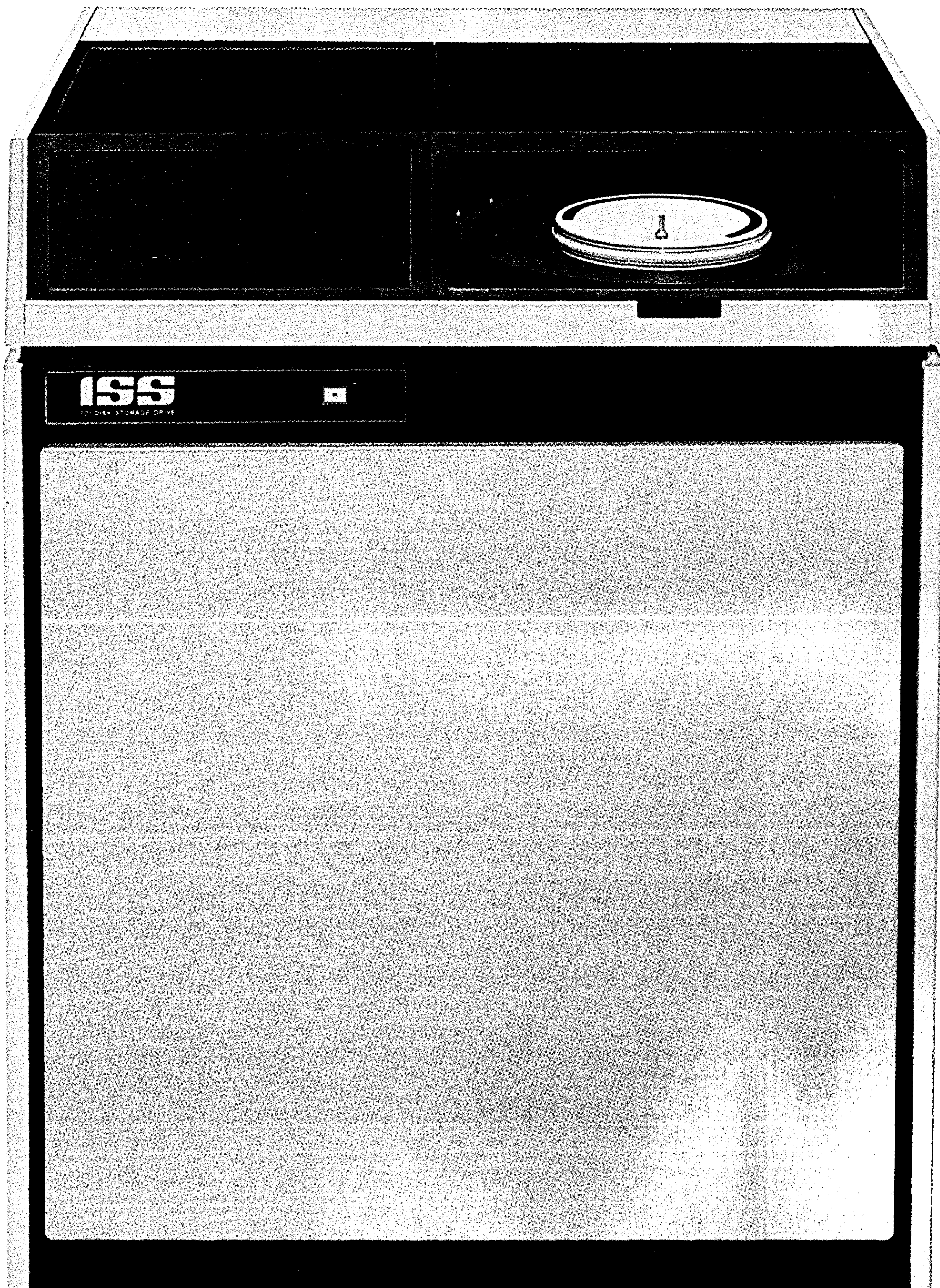
Papers:
Library Requirements—Tell It Like It Is, by W. N. Locke, Massachusetts Institute of Technology.
Using Computer Technology—Frustrations Abound, by Henriette Avram, Library of Congress.
Projects on the Go—Recounting a Few Successes, by Howard Dillon, Harvard University.

16. Thursday, 1:30-3:15 p.m.
Main Auditorium
**MANAGING LARGE-SCALE SOFTWARE PROJECTS**

Chairman: Malcolm M. Jones
*(Continued on page 155)*

# The new standard is 30ms

# econds



# we'll write a new page at Boston's Statler-Hilton, May 14th-16th


There wasn't quite enough room for us at SJCC proper, and we've got so much to talk about that we decided to have our own mini-show in the vicinity. That's where we'll be writing some new pages in memory stack and system technology. Page one will be a complete line of revolutionary new Planar Stacks™ designed to provide the absolute low in ferrite memory costs combined with fast, fast delivery cycles . . . without compromise in volumeteric efficiency or performance. Page two will be a complete line of PDM™ memory systems. PDM stands for **P**oint **D**esigned **M**emories and that's exactly what they are—memory systems designed to provide optimum performance/cost ratios at specific capacities and speeds. Not built-up or cut-down compromise systems.

If you're going to Boston, make it a point to stop at the Statler-Hilton.

If you're not, drop us a line and we'll send you our complete file of technical pages.

DATARAM CORPORATION
PRINCETON, NEW JERSEY

Massachusetts Institute of Technology
Cambridge, Massachusetts

The difficulties encountered by most of the computer hardware manufacturers in meeting their commitments to deliver the complete versions of the complex operating systems for their new third generation computer systems has focused a great deal of attention on the problem of producing large software systems. In actuality, this problem has existed since the later 1950's when first the SAGE system, followed by a number of military command and control systems, experienced similar difficulties. However, the commercial computer systems users and to some extent, the manufacturers as well, were largely unaware of the previous software difficulties (which had purposely been given little publicity by the military).

A large part of the difficulty in developing these software systems is due to lack of experience in how to manage such projects. The manufacturers had not developed a team of software managers and managerial techniques capable of managing hundreds of programmers, working on one large complex system which embodied substantial advances in the state of the art and which were often subject to a publicly announced time constraint.

This session, consisting of three prepared papers and comments, criticism and discussion by three knowledgeable panelists will try to discuss in depth the nature of the problem of managing large-scale software projects.

Mr. Ronald H. Kay opens the session with a paper summarizing a number of divergent and sometimes contradictory views of knowledgeable people regarding the difficulties of managing software projects. Following this, Mr. F. M. Trapnell of Switzerland describes his perspective (gained from firsthand experience with the development of OS/360) on how to manage software projects. The third paper by Dr. Malcolm Gotterer focuses attention on the specific area of the programmer himself.

Using these three papers as an introduction to the topic, the three panelists, Messrs. Robert Bemer, John A. Harr and Dr. William F. Brown will add their own comments about the problem of managing large-scale software projects. Both the authors and panelists will then be prepared to engage in a lively discussion with interested members of the audience who wish to state their own positions they hold on this topic and/or ask questions.

It is the intent of this session to both

clarify the problem and suggest techniques for its solution. Although this session will principally be of interest to professional programmers who now find themselves in manager roles (e.g., the Chiefs), it will also be of interest to the programmers who find themselves being managed (e.g., the Indians) and to computer center managers as well who often take the blame for the software difficulties.

Papers:

Management and Organization of Large Scale Software Development Projects, by Ronald H. Kay, IBM.

A Systematic Approach to the Development of System Programs, by F. M. Trapnell, Qandac Associates, Ltd.

Management of Computer Programmers, by Malcolm Gotterer, The Johns Hopkins University.

Panelists:

Robert W. Bemer, General Electric Co.

John A. Harr, Bell Telephone Laboratories.

William F. Brown, Avco Computer Service.

17. Thursday, 1:30-5:00

Grand Ballroom

**INFORMATION RETRIEVAL AND LIBRARIES**

Chairman: John A. Gosden

The Mitre Corporation

McLean, Virginia

Papers:

Interactive Search and Retrieval Methods Using Automatic Information Displays, by M. E. Lesk, Harvard University, and G. Salton, Cornell University.

The Leader Retrieval System, by Donald J. Hillman and Andrew J. Kasarda, Lehigh University.

A Progress Report on Project Intrex by authors associated with MIT's Electronic Systems Laboratory, consisting of four papers:

System Characteristics of Intrex, by J. F. Reintjes.

An Experimental Computer-Stored, Augmented Catalog of Professional Literature, by Richard S. Marcus, Peter Kugel, and Robert L. Kusik.

Remote Text-Access in a Computerized Library Information Retrieval System, by Donald R. Knudson and Stephen N. Teicher.

A Combined Display for Computer-Generated Data and Scanned Photographic Images, by Donald R. Haring and James K. Roberge.

18. Thursday, 1:30-3:15

Room 200 Auditorium

**COMPUTERS AND COMMUNICATIONS**

Chairman: Richard G. Mills

Massachusetts Institute of Technology

Cambridge, Massachusetts

Papers:

A Study of Multiaccess Computer Communications, by P. E. Jackson and Charles D. Stubbs, Bell Telephone Laboratories.

A Communications Environment Emulator, by Jack M. Pearlman and Richard Snyder of Honeywell and Richard Caplan, Consultant.

Panelists:

John E. Cox, Western Union Planning and Engineering Organization.

Raymond L. Dujack, Western Union Planning and Engineering Organization.

Edward Goldstein, AT&T.

James F. Holmes, Business Equipment Manufacturers Assn.

Andrew J. Lipinski, Stanford Research Institute.

19. Thursday, 1:30-3:15

Cheri 1

**APPLICATIONS OF COMPUTERS IN THE URBAN ENVIRONMENT**

Chairman: Joseph Sussman

Massachusetts Institute of Technology

Cambridge, Massachusetts

The urban scene has had widespread attention in the past decade. Specifically, there have been many attempts to bring modern technology to bear on the problems of controlling the urban environment. In particular, computers have been proven useful in many urban applications. The purpose of this session is to discuss several applications of computers in controlling and monitoring urban activities. Among the many applications of computers in this context, we focus on two in particular.

First, we consider large scale urban information systems. Associated with the management of the modern day city, there is typically a great deal of data including such items as land use information, tax and election records, etc. The use of the computer is becoming essential as a mechanism to help in the handling of these huge amounts of information. Two papers associated with this area are presented. One concerns a proposed urban data system for New York City and considers the specific requirements of that area. The other paper draws upon experiences with the Model Cities programs in Massachusetts and, from the prototype in this program, derives some basic requirements for a more comprehensive urban oriented information system.

These papers should be of interest to two types of people. The urbanologist or urban manager as the user of urban data systems will find the discussion of external aspects of value. Since urban data bases have a good deal in common with other large scale information banks, designers of data oriented systems should find the internal aspects of interest.

Second, the automatic real time control of vehicular traffic by computers is discussed. In this field, a good deal of practical experience has been accrued and some specific statements as to the usefulness of these systems can now be made. The computerized control system that is described was implemented some years ago in the city of Toronto, Ontario.

Based on the performance of this system, some conclusions on operational effectiveness and economic benefits are drawn. This paper should be of interest to both the designer of control systems of this type and the urban traffic engineer interested in measures of benefits of automatic control.

Each of the three presentations will be followed by questions and answers by the participants and followed by audience participation.

Papers:

Development of New York City's Geographic Data Network, by Robert Amsterdam, Office of the Mayor, New York City.

Requirements for the Development of Computer-Based Urban Information Systems, by Steven B. Lipner, Massachusetts Institute of Technology.

Automatic Traffic Signal Control Systems—The Metropolitan Toronto Ex-

perience, by John Hodges and Douglas W. Whitehead, Traffic Control Center, Toronto.
Discussants:
Elizabeth Schumacker, Massachusetts Institute of Technology.
J. Pistrang, The City College of the City University of New York.
W. Jessiman, Peat, Marwick & Mitchell.

20. Thursday, 1:30-3:15
Cheri 2

**EDUCATION OF THE COMPUTER PROFESSIONAL**

Chairman: Elliott I. Organick
University of Houston, currently at MIT
Cambridge, Massachusetts

Panelists:
Jack B. Dennis, Massachusetts Institute of Technology.
George E. Forsythe, Stanford University.
Lotfi Zadeh, University of California.
Alan J. Perlis, Carnegie-Mellon University.

21. Thursday, 3:30-5:30
Main Auditorium

**TOOLS FOR SYSTEM PROGRAMMING**

Chairman: Robert M. Graham
Massachusetts Institute of Technology
Cambridge, Massachusetts

Papers:
SAL—Systems Assembly Language, by Charles A. Lang, University Mathematical Laboratory.
BCPL: A Tool for Compiler Writing and System Programming, by Martin Richards, University Mathematical Laboratory.
EXDAMS (EXtendable Debugging And Monitoring System), by Robert M. Balzer, the Rand Corp.
Panelists:
Thomas E. Cheatham, Jr., Computer Associates, Inc.
Martin Greenfield, Honeywell.
Robert F. Rosin, State University of New York at Buffalo.
Jean E. Sammet, IBM.

22. Thursday, 3:30-5:30
Room 200 Auditorium

**TOPICS IN CPU/MEMORY SUBSYSTEM DESIGN**

Chairman: Donald H. Gibson
IBM Corporation
Poughkeepsie, New York

The 1969 SJCC has designed this session to display work now being conducted in the design of hardware subsystems. The papers chosen reveal hardware design as a maturing discipline, with focus being placed upon both theoretical and practical problems related to increasing speed.

For example, the author of the first paper notes "the widespread opinion that we are fast approaching the physical limit in speeds for computers." He presents an intriguing new design philosophy: exchange absolute circuit speed limitations for tolerance limitations. His opinions will be of interest to those concerned with CPU design of processors having cycle times less than 100 nanoseconds.

The author of the second paper is, on the other hand, concerned with the general problem of asynchronous design. The work by J. B. Dennis has been expanded into a systematic design procedure based upon an action graph. This procedure will be of great interest to the theoretician or the engineer concerned with interlocking modules in an asynchronous design.

The author of the third paper is interested in the design of floating point arithmetic, specifically to obtain higher speed without increasing systems cost. His work contributes substantially to the discipline of shifting probabilities in floating point addition/subtraction. The designer of execution units or of floating-point subroutines will find his paper quite valuable.

These topics are representative of the state-of-the-art within hardware subsystem design.

Papers:
Maximum Rate Pipeline Systems, by L. W. Cotten, National Security Agency.
Systematic Design for Modular Realization of Control Functions, by Stanley M. Altman and Arthur W. Lo, Princeton University.
Optimizing Floating Point Arithmetic Via Post Addition Shift Probabilities, by James A. Field, University of Waterloo.

23. Thursday, 3:30-5:30
Cheri 1

**SOFTWARE TRANSFERABILITY**

Chairman: James A. Ward
Dept. of Defense, Research and

**SESSIONS . . .**

Engineering
Washington, D.C.

Panelists:
Robert W. Bemer, General Electric Co.
John A. Gosden, The Mitre Corporation.
Grace Murray Hopper, Navy Programming Languages Group.
Edward Morenoff, Rome Air Development Center.
Jerome D. Sable, Auerbach Corp.

24. Thursday, 3:30-5:30
Cheri 2
**COMPUTER-ASSISTED INSTRUCTION: CURRENT STATUS—FUTURE PROBLEMS**

Chairman: Patrick Suppes
Stanford University
Stanford, California

Panelists:
Wallace Feurzeig, Bolt Beranek and Newman, Inc.
Duncan Hansen, Florida State University.
Eldo C. Koenig, The University of Wisconsin.
Seymour A. Papert, Massachusetts Institute of Technology.

25. Friday, May 16, 9:00-11:30 a.m.
Main Auditorium
**DYNAMIC GRAPHICS—TODAY AND TOMORROW**

Chairman: Robert N. Davis
Massachusetts Institute of Technology.
Lexington, Massachusetts

Papers:
A Picture Is Worth a Thousand Words—and Costs, by J.C.R. Licklider, Massachusetts Institute of Technology.
Computer Animation for the Academic Community, by W. H. Huggins and Doris R. Entwisle, The Johns Hopkins University.
Graphics in Time-Sharing: A Summary of the TX-2 Experience, by W. R. Sutherland and J. W. Forgie of Massachusetts Institute of Technology and M. V. Morello, Adams Associates.
Teaching Heart Function—One Application of Medical Computer Animation, by Allan H. Gott and Bruce R. Kubert of The Aerospace Corp. and Allen F. Bowyer and George W. Nevatt of Loma Linda University.

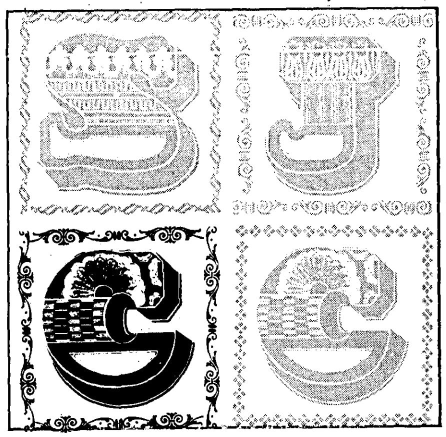
Panelists:
Richard Berman, Education Development Center Inc.
T. G. Hagan, Adage Inc.
J. W. Meyer, Massachusetts Institute of Technology.

26. Friday, 9:00-11:30
Grand Ballroom
**THE DARTMOUTH SYSTEM AND ITS APPLICATIONS**

Chairman: Thomas E. Kurtz
Dartmouth College
Hanover, New Hampshire

This session will be the first public presentation of the Dartmouth Phase II general purpose time-sharing system and its place in the greater university community. The Phase II system differs markedly from the earlier Dartmouth time-sharing systems. The most important feature is the general file capability in which the modules of the operating system are part of the same file structure as the user's programs and his data. This design permits relatively simple construction of a wide variety of computer services and capabilities including: processing of many small jobs in a variety of languages, file manipulations and editing, foreground initiated background, foreground initiated use of central peripherals, systems programming and debugging, and maintenance of the software system while the system is in operation.

The opening talk, "The Many Roles of Computing on the Campus," will establish the setting and provide a picture of the general extent and manner to which computing in its various forms have affected the college community. The next two papers discuss design considerations. "Design Consideration for an Educational Time-Sharing System" discusses some overall design considerations and presents an overview of the organization of the computer system. "A Flexible User Validation Language for Time-Sharing Systems" discusses the more specific problem of control of access to the system as well as allocation of the system resources to its users. The fourth paper, "Project IMPRESS: Time-Sharing in the Social Sciences," discusses an important effort to make available to students and faculty alike the ability to explore from the terminal large social scientific data bases. The final paper in the session, "Secondary School Use of the Time-Sharing Computer at Dartmouth College," discusses the introduction of terminal service into over 20 secondary schools in New England and its impact on the science and mathematics curricula for the more than 4,000 secondary school students affected per year.



This will be a general session of interest to anyone concerned with the role of computing in education and also to those wishing an introduction to the design and architecture of the Dartmouth Phase II System.

Papers:

The Many Roles of Computing on the Campus, by Thomas E. Kurtz, Dartmouth College.

Design Considerations for an Educational Time-Sharing System, by Robert F. Hargraves, Jr., Dartmouth College, and Andrew G. Stephenson, Time-Share Corp.

A Flexible User Validation Language for Time-Sharing Systems, by John S. McGeachie, Mandate Systems, Inc.

Project IMPRESS: Time-Sharing in the Social Sciences, by Edmund D. Meyers, Jr., Dartmouth College.

Secondary School Use of the Time-Shared Computer at Dartmouth College, by Jean H. Danver and John M. Nevison, Dartmouth College.

27. Friday, 9:00-11:30
Room 200 Auditorium
**COMPUTER SYSTEMS VS. HEALTH SYSTEMS: WHO IS WINNING?**
Chairman: Moses M. Berlin
William Beaumont Hospital
Royal Oak, Michigan

*(Continued on page 162)*

**SESSIONS . . .**

Relatively few computer-based information systems are genuinely, profitable, operational within the health industry. Yet, very few, if any, of the basic systems requirements within the health field are markedly different from requirements in other fields that enjoy successful computer implementation.

For at least a decade, this anomaly impertinently has been blamed on the "gap at the interface between doctors, hospital executives and computer people." During this same decade, some few have succeeded in designing and constructing a bridge across the gap, and have intelligently used a computer system in support of medical research and practice, hospital administration and management, and as a tool for institutional planning.

This session will include presentations by some of the successful bridge builders, who will relate how they developed their systems, and thereby guide the audience on how to use, and how not to try to use, the computer in a hospital environment.

The sessions will be of interest, and likely will stimulate (provoke?) an audience of physicians, computer engineers and programmers, and hospital and industrial executives—for all of these types will be represented as session speakers or panelists.

It is intended that the presentations elicit questions, comments, insights and foresights from the audience. Ample time is being designated for this type of interchange.

Papers:

Health Information and Planning Systems: The Need for Consolidation, by P. F. Gross, University of Saskatchewan.

Computer Assisted Instruction in the Diagnosis of Cardiac Arrhythmias, by E. J. Battersby, M. D., Vanderbilt University.

Hospital Automation: Something More Than a Computer, by Walter L. Bennett, Institute of Living.

Computer-Based Medical History in an Outpatient Clinic, by Warner V. Slack, M.D., University of Wisconsin.

Computers in Medicine: Automation vs. Improvement of Status Quo, by Alvan R. Feinstein, M.D., Yale University.

Panelists:

Kathryn Erat, Peter Bent Brigham Hospital.

E. R. Gabrielli, Edward J. Meyer Memorial Hospital.

Tate Minckler, M.D. Anderson Hospital.

Owen R. Pinkerman, William Beaumont Hospital.

John Wright, Honeywell.

28. Friday, 9:00-11:30

Cheri 1

**MEASUREMENT AND MODELING OF DIGITAL HARDWARE/SOFTWARE SYSTEMS**

Chairman: Martin Graham
University of California
Berkeley, California

Papers:

An Analytic Model of Multiprogrammed Computing, by Robert R. Fenichel, Massachusetts Institute of Technology, and Adrian J. Grossman, Borden Inc.

Software Measurements and Their Influence Upon Machine Language Design, by L. Presser and M. A. Melkanoff, University of California.

Measurement Based Automatic Analysis of FORTRAN Programs, by E. C.

Russell and G. Estrin, University of California.

More on Simulation Languages and Design Methodology for Computer Systems, by David L. Parnas, Carnegie-Mellon University.

29. Friday, 9:00-11:30
Cheri 2
**SCIENTIFIC APPLICATIONS**

Chairman: Richard M. Moroney
Consultant
Boston, Massachusetts

Papers:

Calculating and Plotting Equipotential Lines for Objects with Cylindrical Geometry, by William W. Shrader, Raytheon Co.

A Modular System for Reactor Calculations, by L. Just, A. Kennedy, P. Walker, A. Rago, and G. Leaf, Argonne National Laboratory.

Performance Testing of Function Subroutines, by William J. Cody, Jr., Argonne National Laboratory.

Towards an Abstract Mathematical Theory of Floating-Point Arithmetic, by Davis W. Matula, Washington University.

30. Friday, 1:15-4:00
Main Auditorium
**COMPUTER GRAPHICS THEATRE**

Chairman: William H. Ninke
Bell Telephone Laboratories
Murray Hill, New Jersey

Because film candidates for inclusion in this session will be considered just before the conference opens, a list of included films will not be printed here. A list will be posted at the conference.

31. Friday, 1:15-3:00
Grand Ballroom
**SMALL COMPUTERS FOR DATA TERMINAL NETWORK CONTROL**

Chairman: George W. Patterson
Sanders Associates, Inc.
Nashua, New Hampshire

Panelists:

Christopher B. Newport, Honeywell.

O. W. Rechard, Washington State University.

Dan W. Scott, University Computing Co.

32. Friday, 1:15-3:00
Room 200 Auditorium
**MANAGEMENT INFORMATION SYSTEMS ≥ ACCOUNTING ≥ MANAGEMENT INFORMATION SYSTEMS?**

Chairman: James L. McKenney
Harvard University
Cambridge, Massachusetts

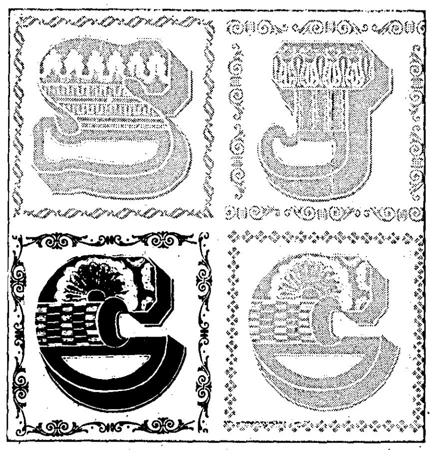
Panelists:

Frank Coyne, Northern Pacific Railroad.

John Dearden, Harvard University.

Felix Kaufman, Lybrand Ross and Montgomery Inc.

Paul Strassmann, National Dairy Products Corp.



33. Friday, 1:15-3:00
Cheri 1
**COMPUTATION AND PROGRAM SPECIFICATION**

Chairman: Michael A. Harrison
University of California
Berkeley, California

The development of automatic techniques for the construction of software necessitates specification of the syntax and semantics of languages. Given such a syntactical representation, one must construct parsers for the languages.

The present session contains papers which focus on several of these issues. The first paper, "A System for Designing Fast Programming-Language Translators," gives an algorithm for converting from a BNF specification of the language into a type of pushdown automation.

The paper "Generating Parsers for BNF Grammars" gives an algorithm which produces a parser for a special type of BNF description. The method works for a class of languages which contains the bounded right context ones and is contained in the LR(k) (or deterministic) languages.

The paper "An Extended BNF for Specifying the Syntax of Declarations" provides an extension to BNF which allows for the specification of richer sets than just context free languages. The treatment of declarations is discussed in some detail.

The concluding paper, "A Hierarchical Graph Model of the Semantics of Programs," introduces a new model for the semantics of programs in programming languages. The model involves hierarchies of directed graphs.

In summary, the session contains a number of papers which should be of interest to programmers and others interested in language specification and parsing.

Papers:

A System for Designing Fast Programming Language Translators, by Victor Schneider, University of Maryland.

Generating Parsers for BNF Grammars, by Franklin L. DeRemer, Massachusetts Institute of Technology.

An Extended BNF for Specifying the Syntax of Declarations, by Gordon E. Whitney, Western Electric Co.

A Hierarchical Graph Model of the Semantics of Programs, by Terrence W. Pratt, The University of Texas at Austin.

34. Friday, 1:15-3:00
Cheri 2
**HYBRID COMPUTER SYSTEMS AND LANGUAGES**

Chairman: Robert M. Howe
University of Michigan
Ann Arbor, Michigan

Papers:

A Flexible Standard Programming System for Hybrid Computation, by Wolfgang Giloi, Dieter Beckert, and Hans C. Liebig, Technical University of Berlin.

A Real-Time Programming Language and Its Processor for Digital Control of Industrial Processes, by Liang Liang.

New Graphics Display/Plotter for Small Digital Computers, by Granino A. Korn, Stevens Simons, Russell Steinbach, and Claude Wiatrowski, The University of Arizona.

Stability Contours for the Analysis of Analog/Digital Hybrid Loops, by R. Vichnevetsky, Electronic Associates, Inc. ■

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# ADAPSO TIME SHARING SYMPOSIUM

The Association of Data Processing Service Organizations proved its recognition of time-sharing service bureaus as a significant and unique part of its membership by staging the "First Time-Sharing Symposium" in Las Vegas, Feb. 13. Attended by more than 100 members, the symposium was run in parallel with a general association conference. A president of the new ADAPSO Time-Sharing Section was also announced: Joan Van Horn, VIP Systems president who won infamy by kicking up a highly effective fuss about IBM's Datatext service pricing, calling government antitrust attention to the giant's service bureau activities.

The first session, "Transmission and Data Communication Lines for Computer Time Sharing," pitted AT&T's William Quirk and Robert Simms Jr. (Bell Labs) against five representatives of the computer industry. The session should have been called "Dump on The Phone Company."

Before going into the arguments, here are some of the technological improvements and experiments noted by Simms of Bell Labs. AT&T has publicized the experimental T-1 and T-2 carrier systems, which provide a line speed of one megabit/second and six megabits/second respectively. T-1 is now being used only by newspapers for high speed facsimile transmission (500K baud); T-2 is being tested for Picturephone and data transmission. But currently there is insufficient data traffic at high enough speeds to make either system economically usable for data transmission. (One T-1 line point-to-point could handle 10,000 Teletypes.) Simms also noted that the 50KB (bandwidth) service, with new modulation and equalization techniques being developed, could be expanded to 90-108KB. Among new data sets planned is a modified 203, which can transmit 3600 bps one way and 150 bps the other to accommodate the terminal and computer.

This month, Simms noted, Bell and a university will begin a cooperative experiment called Datrex, which will use a new data concentrator to provide direct terminal-to-computer access by "pushing a button" rather than dial-up. This would be for clustered environments like universities and industrial parks which want numerous terminals (up to 300 bps speed) on-line to one or two computers.

Simms also noted that Bell is continuing to study new transmission network technologies, including a digital network, but it is not yet clear which method would be best.

Howard Steadman of Tymshare, Inc., complained of the carrier's "unresponsiveness" to many requests. "I'm afraid I find the phone company beautifully equipped to solve yesterday's problems; they haven't defined the problems of five years from now, and they have little impetus to change." Steadman saw microwave networks as the computer user's hope. Applauding this idea was Ed Berg, from University Computing Co.'s subsidiary, Microwave Transmission Co.—which has hopes of becoming a common carrier. He opined that by changing from a standard voice grade line to a "different data standard" the common carriers could provide microwave service at the same low cost being proposed by a common carrier applicant, Microwave Communications Inc. (fighting its case before the Federal Communications Commission now).

Stuart Mathison of A. D. Little noted that if MCI and other new common carriers are permitted, Bell will probably have to change its costing structure. (Currently, the tariffs are based on an average of costs, which vary from section to section in the country. MCI proposes a low-tariff service for Chicago to St. Louis, relatively trouble-free terrain—which AT&T calls "cream-skimming.")

Several arguments raged over what AT&T ought to provide, what is possible technologically, and what is feasible economically. One thing was certain: the user and the carrier seldom agree. One major complaint was that AT&T won't commit itself to an error rate on its lines. Simms and Quirk noted that this can only generally be deduced from information theory, but it provides no practical gauge for a particular line, since the variables, such as failures caused by nature, can not be determined. Steadman countered that "what has to happen is some recognition that when performance degrades beyond a point, something must be done about it."

A practical solution came from the floor, where a time-sharing aficionado noted that "you just have to program around it."

Other complaints: the phone company keeping network control and switching devices unto itself ("Is a phone company-provided signal less degrading to the line than the signal supplied by equipment from a manufacturer?"); intrastate tariff increases "aimed at making private device interconnection extremely expensive;" and the lack of tariff structures oriented toward data processing. A permanent staff of data processing experts at the FCC was recommended as one solution to these "inequities."

In the session of "Time Sharing Hardware and Software Systems," the audience was treated to a mix of time-sharing experience: ex-GEer R. D. Ward of University Computing Co., which has Univac 1108's and PDP-8's and 9's; Larry Hittel, GE time-sharing developer, who has recently formed his own new firm; Richard Crandall of Com-Share Inc., which uses SDS-940's and is buying Sigma 7's; David Dahm, Remote Computing Corp. (Burroughs 5500); Walter Bambrick, Statistics for Management, Inc. (B-5500); Sherby Gangweere of Advanced Programming Inc. and Jerry Weiner of Mandate Systems Inc., who both worked on the GE-Dartmouth time-sharing project and, under Computer Applications Inc., on IBM's Call 360/BASIC time-sharing system.

Their discussion ranged from the manufacturer capability to provide a commercial time-sharing system and software, to the profitability of time-sharing service bureaus, to arguments on what system functions should be done by hardware as opposed to software.

The technical discussion essentially revolved around "rending unto" hardware only that which is standard or stable. For example, in the position papers set forth by Weiner and Hittel, it was concluded that stored-program communication controllers had an advantage over hard-wired controllers because they are more easily adapted to communications changes—new terminals, carrier communications services, etc. The much-favored Burroughs TC-500 programmable terminal, which has a disc, is an example; a hard-wired controller is difficult to convert to handle such a device. Weiner noted that, in his experience with GE time-sharing, there were two competitive projects—the stored-program Datanet 30 and hard-wired controllers. "Every six months," he said, some external communications change was made requiring a redevelopment of hard-wired equipment—which would take up to a year. "It took three weeks to reprogram the Datanet 30 for the changes."

Richard Crandall noted that there are several stored-program controllers available, but not always from the same manufacturer who supplies the time-sharing system. The result is that when the service bureau owner mixes equipment, he gets into maintenance and "refereeing" problems. (The "whose fault is it?" syndrome.) He may either have to develop an in-house maintenance capability or go to an outside service. The best solution is to find one vendor for all this equipment, which is a reason Com-Share went to SDS for its next system, the Sigma 7, which has such a front end available. (The SDS-940, currently used, did not.)

It was generally agreed that the manufacturers are not providing the best time-sharing system. "You pick out the one that has the kinds of faults you can best live with," quipped one attendee. The mainframe maker's software is not good enough for commercial time-sharing, mostly because he does not have the experience or the stimulus to develop a dedicated time-sharing system; he is just "too busy" trying to develop general purpose software for a broader range of applications.

Another criticism is that the architecture of current machines is "wrong," with the exception of Burroughs equipment. The panel generally sounded like a Burroughs admiration society—the reason being the TC-500 and the old "fourth generation" 5000 series. The latter incorporated the concept of a higher level of machine language. Essentially, the machine has practically used ALGOL as the machine language—allowing the user, in debugging, to deal with the conceptual problems of the application, rather than "bit-diddling." Gangweere and Weiner emphasized that more of this is needed—"analogous to but not identical to the B5000 series design, which did not take the concept far enough." The higher level languages, FORTRAN, COBOL, BASIC, have been standardized enough to permit putting some functions into hardware as machine instructions. Both noted that BASIC had been accepted in a standardized form by GE, IBM (Call/360), SDS and is a prime candidate for such a concept in time-sharing.

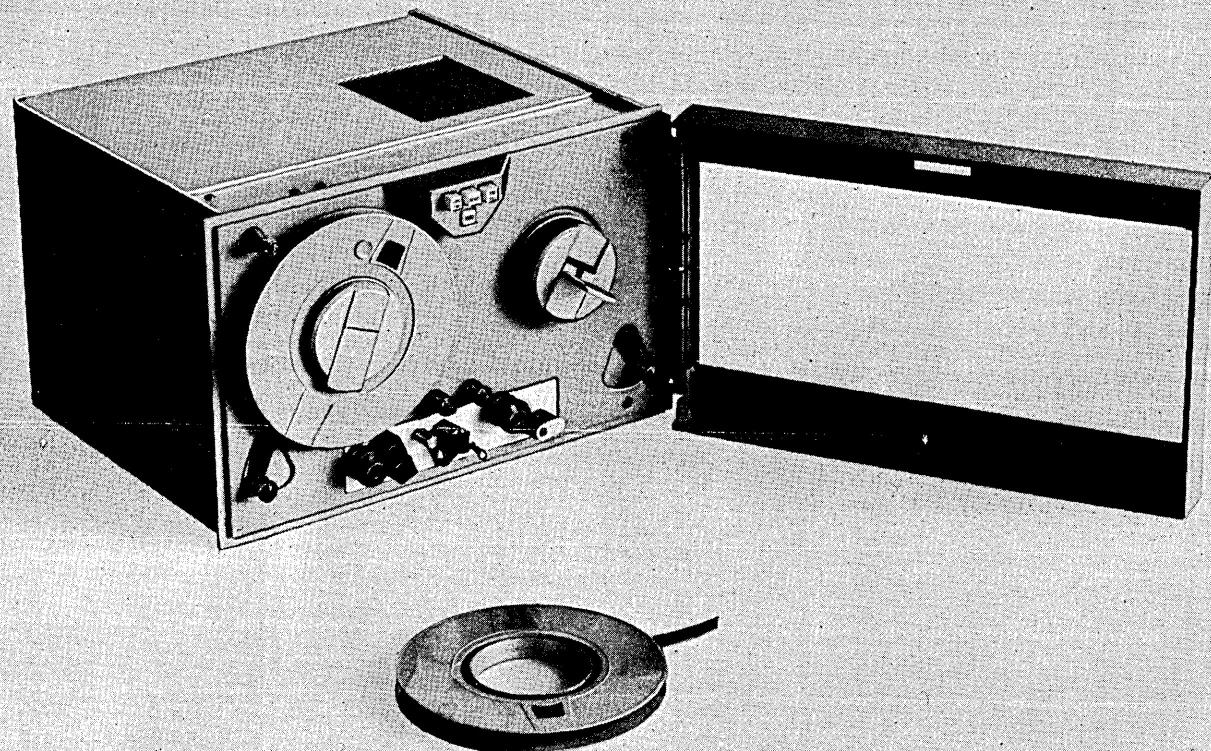
The talkative but informative Mr. Weiner further noted that LSI microcircuitry is making the cost of logic decrease in proportion to core, disc, and overall system cost. Thus, whereas one register may have cost \$50 before, with LSI, 50 registers would cost \$1 (based on a \$35 cost of 1K bits of control logic).

Hittel remarked that he was surprised that, with all the specialized requirements of a time-sharing system, no one new has gone into the time-sharing manufacturing business. To this, Weiner answered that there will be some new suppliers on the scene. Finally, but not least important, can a time-sharing service bureau be profitable?

Dahm and Ward both noted that there are time-sharing firms and remote-batch service firms that are now in the black. But generally, it was thought that a system doing both time-sharing and remote batch processing (let alone plain batch) could not be profitable for a center. According to figures presented, a time-sharing configuration costs much more than batch or remote batch and cannot be fully, profitably utilized with the latter two applications on it.

Some general guidelines for ultimate profitability: "Throw the development people out of the room once the system is completed, go to a multi-machine network (for backup reasons), and be prepared to lose money for a while."

—ANGELINE PANTAGES



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# news scene

*an interpretive review of recent important developments in information processing*

## GE BROACHES SATELLITE SYSTEM TO FCC AND NASA RECEIVES NAS STUDY

A domestic satellite system which could tremendously expand the use of time-shared computers and slash the cost of record communications to a level competitive with present airmail postal rates, was proposed recently by GE to the Federal Communications Commission. The system could be fully operational by 1980, at a cost of $321 million, GE said.

Another satellite study, oriented largely toward scientific uses, but encompassing commercial point-point communication problems, has been sent to NASA by the National Academy of Sciences. It advises the space agency to invest $200-$300 million per year in developmental research directed at "practical, earth-oriented applications of satellites . . . in close cooperation with potential users."

GE said its domestic satellite system could transmit a 600-word message for 33 cents in 1975, 14 cents in 1980, and 10 cents in 1990. By comparison, it now costs $1.80 to send a 600-word Telex message from New York City to Washington, and $6.00 to move the same communication between New York and LA. The day rate for a 600-word telephone message between the same points is 80 cents and $1.75, and the night rate is 60 cents and 75 cents, respectively.

The GE system would have two groups of customers: the general public and communication common carriers. It would interconnect the carriers' telephone exchanges, teletypewriter exchanges, private wire customers, and data terminal exchanges. The public market would include teletypewriter subscribers and remote access computer users. The system would provide variable bandwidth, store and forward, automatic callback, message netting, multiple address, and automatic format translation services to both groups.

### substitute for mail

GE also proposed satellite transmission of business communications that are now sent through the mail. About 16% of the messages currently being handled by the post office are suitable candidates for this "telemail" service, the company said. In 1967, there were 12.5 billion pieces of potential telemail. By 1980, there should be about 20 billion. GE indicated that the satellite system would need to attract no more than 8% of this volume, but could easily attract more.

Communications-oriented computer installations (COCI) would supply another big slice of the satellite system's message load. The net value of COCI shipments from manufacturers to users in 1970 will be $2.16 billion, versus $30 million in 1967, said GE. By 1975, shipments will reach an annual rate of $6.64 billion, and the value of systems in place will total $28.13 billion. By 1980, $18.54 billion of such systems will be shipped and installations in place will be worth $91.98 billion. At that time, there should be 50-75K COCI's, and 1-1.5 million terminals.

A domestic satellite system, besides cutting communication costs significantly for remote terminal users, will change the whole character of the time sharing market, GE said. Unit communication costs will become, relatively, a much smaller percentage of system expenditure, permitting far greater sharing of specialized data bases and specialized software, over a much wider area.

GE's proposed system consists basically of a satellite, earth stations, user terminals, and two 500 megahertz (MHz) bandwidths for transmission to and from the satellite. Use of each data transmission channel would be time-shared among the earth stations by a "routing center"—a single switching complex linked to all of the stations. A single satellite, plus a backup unit, would be operational by 1980. Either could serve 100K data users simultaneously, and 1.8 million such customers altogether. Data would move to and from the satellite at a rate of 20 megabits/sec.

### opposition

GE's plan faces two big political hurdles. One is competition from other groups like Comsat and the Ford Foundation. They have proposed their own domestic satellite plans. GE tried to mollify this opposition by saying that its plan doesn't prevent implementation of other proposals.

The second obstacle is Ma Bell and other common carriers. They fear that a satellite system may reduce the market for terrestrial communications. Since a satellite permits direct long-distance communication between sender and receiver without intermediate switching centers, it is inherently far cheaper than land-based systems.

Earlier satellite system proposals avoided a direct confrontation with the carriers by not infringing on their existing switched communication networks. GE's proposed system, however, would compete directly with these networks. Apparently, the company hopes that as the benefits of the new technology become evident to an ever-growing user market, support for "parallel service" will grow.

FCC has a crucial role to play in this drama. It is currently studying the policy issues involved in establishment of a domestic satellite system. One such issue is the question of who should own and operate the facilities.

"Existing communication common carriers will contend with considerable force," said GE in its satellite system proposal, "that . . . applications for specific satellite authorization should be restricted to such entities—at least for the furnishing of common carrier service. This position naturally warrants serious consideration in the Commission's deliberations. (But) equally worthy of serious consideration is the . . . desirability (of) enhancing . . . communications service by authorizing an entirely new common carrier . . . one not deterred by existing capital or other commitments in the present common carrier system."

### group advice

The satellite study that the National Academy of Sciences did for NASA was researched by 13 technical groups; only one of these concerned itself with point-point communications. But since NASA already has legislative authority and funds to advance communications satellite technology, the recommendations of this group could be particularly significant.

*(Continued on page 171)*

The group advised NASA to "continue and strengthen" its Applications Technology Satellite program along a number of lines, including traffic aspects of point-point satellite systems, cost break-even points, frequency-sharing constraints, and cost-effectiveness of components. "It is recommended that NASA pursue studies and essential developments in these and other system-type problems so as to maintain the expertise needed to advise . . . the policy-making agencies."

—PHIL HIRSCH

## *PRIVACY IS NOT A PERSONAL THING; MAYBE ORWELL WAS RIGHT*

1984 no longer seems distant by any measure, but its proximity is strikingly demonstrated when you consider that *you,* today, do not know what "personal" information is being circulated about you, do not know who is receiving that information nor who is giving it . . . or, more likely selling it. Thanks to a set of Guidelines issued by the Associated Credit Bureaus, Inc., and to a bill pending before the U.S. Senate, that "personal" information may soon be as easy for you to get as it has been for someone else to buy.

Much information about all of us is readily available. We leave a trail of records from our birth certificate until our Social Security death benefit is paid. Prior to the establishment of large computer-accessed data banks, the dissemination of personal information was held at tolerable levels due to the time and expense required to establish a dossier on a particular person. It is no longer difficult, time-consuming, or expensive to compile that dossier . . . or to access it.

One group that might very well have your file is the Associated Credit Bureaus, a confederation of 2077 credit reporting agencies in the United States, Canada, and overseas, and of 1453 collection agencies. The ACB's millions of files are maintained by ITT in 360-based banks, and accessed through a file maintenance and information retrieval package called CREDIPAK II, jointly developed by the ACB and IBM.

### guidelines

Developing a package of principles for the use of the information in its files proved almost as difficult for the ACB as was developing the software. Although all of its member organizations had either explicit or implicit rules of conduct, it took the association more than two years to come up with a compact agreeable to all of its members. After much effort, the association's committee delivered a document that expresses the ACB philosophy in less than 850 words. The "Protection of Privacy Guidelines" cover six main points, which, roughly stated, are that the credit bureau shall:

(1) provide an individual access to his own records for purposes of identifying verifiable errors, provided that the individual *"shall furnish full identification and shall sign a statement granting immunity from legal action both to the credit bureau and to its sources of information;"* [italics ours]

(2) supply, under contract, identification information only to noncredit granting government agencies, except in response to legal process;

(3) supply information only for the purposes of credit granting or other bona fide business transactions;

(4) maintain personal information, when held for personnel reporting services, separately from credit files, and shall not incorporate such information into credit reports;

(5) maintain records such as bankruptcies, suits—and their disposition where known—arrests, and notices of nonresponsibility;

(6) shall retain information in the files for only certain periods of time. Except for bankruptcies, which are reported for fourteen years, and tax liens, which have no statute of limitations, most data is held for seven years or until *"the source of information can no longer verify the item in question from its records of original entry."* [italics ours]

### their use

The Guidelines are a statement of philosophy, not of mechanics. How those statements will be implemented depends upon the agency involved. Characteristically, a credit agency operates to provide credit granters with the information they require to make a credit-granting decision. Typically, a phone call is placed to a bureau to request the information. The caller identifies himself and his account by name and code number, and identifies the credit applicant by name and address, possibly including his Social Security number and wife's name. A search of the files is initiated, generally by an operator at a terminal of some sort. The operating software attempts to make a distinct match of the information given against a particular entry in the files. If a match is not found on the first pass, either more information is requested, or the program identifies the closest file found, along with a notation of what level of search the match required—and, therefore, how reliable the match is. The data is printed or displayed, and the operator and caller decide on the validity of the match. The transaction may be handled with punched cards, with printed reports, with crt's, or by a variety of other means, but all are variations on the same basic theme.

The sources of data for the files, in addition to court records, are primarily the credit granters themselves, who opt to share information for their mutual protection.

It is clear then, that the operation—and the privacy—depend upon the care taken by the source, upon the legitimacy of the request, and upon the conscientiousness of the operator. Although in noncomputerized installations there is more room for error, and for the abuse of records, even in the fully automated system the human element is the controlling one, and this is a worrisome thing.

### the alternative

The effectiveness of the self-imposed controls may well determine whether the government grows another arm to regulate yet another industry. Since the 1966 hearings held before the House subcommittee on the invasion of privacy, which was chaired by Rep. Cornelius Gallagher of New Jersey, testimony on the subject has also been heard before the 1968 Senate subcommittee on administrative practice and procedure chaired by Sen. Edward Long of Missouri, and before the Senate antitrust and monopoly subcommittee under Sen. Philip Hart of Michigan.

In February, a bill (S823: Fair Credit Reporting Act) was introduced by Senator Proxmire of Minnesota that is now before the Senate Banking and Currency Committee. That bill, if passed, would require that all information agencies such as the credit reporting, personnel reporting, and insurance investigating agencies: (1) ensure the accuracy of their information, (2) allow individuals the right to correct inaccuracies in their records, (3) ensure the confidentiality of the records, and (4) destroy any records that might constitute an invasion of privacy. The bill covers a broader spectrum than the credit reporting industry, and is more stringent in its requirements. Like the Guidelines, however, it is aimed at the human controlling element in information transactions, and would rightfully place the burden of responsibility on the individual who reveals information about another.

—R. A. MCLAUGHLIN

*(Continued on page 174)*

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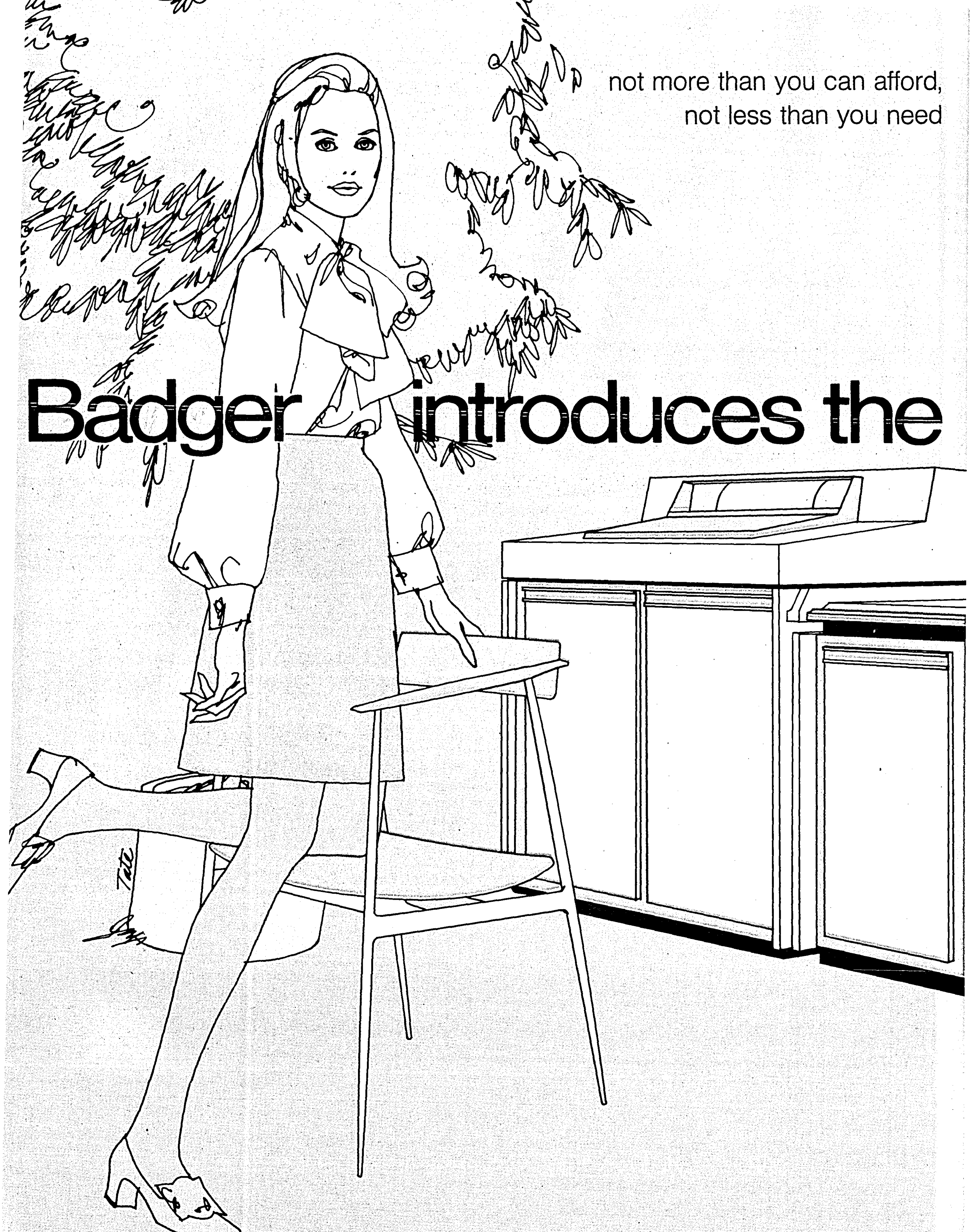

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ly supplied by the (original) Prater & Wei decision."

# CCPA RECONSIDERS PATENT DECISION AND PRATER & WEI WAIT 'ER AND PRAY

The question of whether computer programs are patentable was raised again last month, when the Court of Customs and Patent Appeals reconsidered its earlier ruling in the Prater & Wei case. CCPA's final pronouncement was expected at any moment, as we went to press; but a final decision on the basic question isn't likely for some time, since the case—no matter which side wins the present round—is almost certain to be appealed to the Supreme Court.

Much of the fight involves abstruse patent law, but much of the incentive springs from a more mundane environment. If software is ultimately found to be patentable, many software companies believe they'll be able to compete much more effectively with hardware companies, particularly if separate pricing of software and hardware is adopted industry-wide.

A basic issue running through the voluminous briefs submitted in the Prater & Wei case is whether a computer program, when fed into a computer, converts it into a new and "unobvious" machine. If the answer is "yes," then programs are patentable under existing law; otherwise, they are not.

The Patent Office has tried to straddle this issue by saying that programs, per se, are not patentable. This is because they are "mathematical processes," which are considered a type of "mental process," and such processes are explicitly unpatentable under present law. But, says the Patent Office, a program may be patentable if it is described in terms of "functional steps"—i.e., in terms of changes in the state of specified machine components.

The trouble with this approach is that a program may be "novel" and "unobvious" and hence meet one of the basic requirements for patentability, even though it utilizes already-known machine processes. Basically, this was the enigma presented to the Patent Office by the Prater & Wei application, which covers a computerized spectrographic analysis technique. The inventors, two Mobil Oil Corp. technicians, described both a process and a special purpose machine —an analog computer—for carrying out the process. They added that the analysis could also be carried out by a digital computer.

The Patent Office didn't even consider whether the *program* was novel, reasoning that it was a mental process. The machine claims were rejected because analog and digital computers are part of existing technology and it would be an "obvious" modification of that technology, said the Patent Office, to reprogram either device to implement the Prater & Wei invention.

## decision reversed

CCPA overruled the Patent Office last November. The court said that a process capable of being performed by mental steps may be patentable if performance is accomplished "without human intervention" and is "directed to an industrial technology—a 'useful art' within the intendment of the Constitution."

CCPA subsequently decided to reconsider its verdict, partly because Judge A. M. Smith, who wrote the opinion, died soon afterward, changing the court's makeup. The other four CCPA judges agreed with Smith's verdict, but one of them indicated that he had not had a chance to study all the issues completely. Also, both the Patent Office and IBM filed detailed requests for reconsideration of the November ruling. New briefs have since been submitted by Prater & Wei, IBM, Honeywell, Bell Telephone Labs, Applied Data Research and the Association of Independent Software Companies.

The nonlegal issues at stake in the case were described by Attorney Morton C. Jacobs, who prepared the ADR-AISC brief:

"Hardware manufacturers, such as IBM, have tended to develop substantial monopolies in the 'free' software that they have supplied with their hardware," he said, "inasmuch as it is extremely difficult for a software company to compete against a free price even if it has a superior product. These business activities of IBM, which tie the software to the hardware, are now being challenged as violations of the antitrust laws by the United States government . . . as well as by a private party, Data Processing Financial and General Corporation . . . Two remedies are required to make it possible for software companies such as Applied Data to compete with hardware companies such as IBM in the sale of software: separate pricing . . . and . . . patent protection for software programming. The latter remedy is needed in order that a software company may be assured that its innovations are not imitated with impunity by hardware companies or other competitors. This remedy . . . was effective-ly supplied by the (original) Prater & Wei decision."

## ibm accepts

IBM, significantly, accepted CCPA's judgment that computer program patent applications shouldn't be rejected because they involve "mental processes," but for other reasons (stated below). This concession, which implies that IBM, once nearly its sole support, no longer supports the Patent Office's position, suggests that even if last November's decision is ultimately reversed, the Patent Office might have to find a new basis for turning down software claims. That, in itself, might improve the competitive position of software houses; it would certainly make administration of the patent law more logical. For, as Bell Labs pointed out in its brief (which supported CCPA's November decision): "the law should not be in a position to say that if a designer puts into a system a special circuit, as for counting, he has a potential part of a patentable combination, whereas if he decides to have that function performed by an existing subroutine, he can no longer have a potential of a patentable combination. Such a distinction is one divorced from technical reality."

Jacobs, in his brief, pointed out the marketing significance of this distinction when he argued that IBM is consistently able to get programs patented by describing them in hardware terms. The patent office, he added, insists on hardware-oriented descriptions "to discourage the filing of patent applications by the larger number of inventors who make programming inventions . . . This Patent Office practice has seriously injured the small business concerns in the software segment of the industry."

IBM, even though agreeing that processes performed by mental steps may be patentable, nevertheless remains opposed to software patents. It suggested a new basis for rejecting such claims by arguing that computer programs, per se, are not processes which advance the "useful arts," and thus fail one of the requirements specified by CCPA last November.

"It seems to us," said IBM's brief, "that the true rule is that a given innovation may have a patentable machine aspect, it may have a patentable process aspect, or it may have both aspects . . . But a patent may issue only to protect what is clearly a process in the useful arts and be infringed only by a person practicing a useful art . . . Whatever Prater & Wei may have 'discovered' or 'invented,' it was not a digital computer . . . Their actual discovery was . . . a mathematical procedure;

such a discovery is not a 'process' or a useful art of any sort."

**but has a new idea**

In a related development, IBM has proposed a new way of registering software claims to the Patent Office. A copy of the program, and a description of the concepts used, would be deposited with a registrar, not otherwise identified, and at the option of the program owner, detailed documentation would also be deposited. The registrar would "maintain the program per se and the detailed description in secrecy" until the end of the protection period, but he could make public the description of the concepts. The only examination required at the time of registration would be a determination that the concepts were described in the proper format. Unauthorized copy, translation, use or transfer of a registered program, or of the documentation, would be prohibited under this scheme. However, "no liability will be incurred . . . by one who uses the published conceptual description to independently create a new program."

Knowledgeable sources we contacted don't think much of IBM's proposal. "Anybody who wanted to infringe a registered program could do so easily, simply by using a different set of instructions," said one software developer. "This would be easier under IBM's scheme, because the program concepts could probably be obtained quicker than they can now."

—P.H.

## *FROM THE WELFARE ROLLS TO OVER $7,000 A YEAR IN FOUR MONTHS*

Since its inception last fall, the Urban League Data Processing Training Center in Los Angeles has in each of its three programs—programming, computer operator, and keypunching—taken people off the welfare and unemployment rolls and put them onto payrolls. The center is operated by the Urban League with help from IBM Corp.—which is supplying the equipment and instructors—and the Bank of America Foundation, which donated and maintains the building, an ex-B of A data processing facility.

According to Phil Belinsky, a member of the center's advisory committee and dp manager at Litton Data Systems, the quality of all the programs is "exceptional." The instructors are better equipped for the job than in any other institution from which he has attempted to hire graduates, and the curricula, especially in the operator and programming courses, are far more detailed and complex than those of any of the schools with which he is familiar. Belinsky says that the three programmers Litton has hired from the Urban League center are "comparing favorably" to the college graduates the company has hired as programmer trainees. And a girl who was at the bottom of her operator class is doing an "outstanding" job as a tape librarian.

A rugged, bearded truck driver became a clean-cut computer operator after six weeks. A previously unemployed man is now on the OS operations team at one of the largest data centers in California. A large aerospace company that had interviewed over 80 applicants for programming positions vacant for three months hired three from the programming class. A young lady on welfare became one of the outstanding performers in the programming class. When she couldn't get a baby sitter for her 11-month-old child, she brought him with her. She's now working at a Los Angeles software house for more than $7,000 a year. Before, she had no marketable skill and could not command even $300 a month in salary.

**the training programs**

The keypunch class lasts four weeks, the last two being a workshop in which the students use "live data," not theoretical exercises. Students whose speed and accuracy are not at acceptable industry levels are not recommended for placement until their skills improve sufficiently. No student (in any program) who has not succeeded is graduated or recommended for employment, although he may stay on until he does succeed. One keypunch graduate had learned to express herself so well that when she went in for an interview she was hired as a customer service representative instead of a keypunch operator.

The low percentage of dropouts in the program is due partially to the applicant screening process and partially to the dedication of the instructors. Prospective students are given an aptitude test administered by the Urban League. If results show they might do well in data processing, the Urban League conducts a subjective evaluation to determine the probability of that applicant's success in the industry. Those not showing promise are led to other types of jobs.

Of the 12 programmers who graduated from the first programming class last February, 11 are now working. The one still unemployed graduate was not recommended by the Urban League for a full programmer trainee position.

The programming class, 12 weeks long, at least eight hours a day, starts out with a study of data processing and business concepts, goes on to computer concepts, then programming fundamentals and introduction to COBOL, and finally a six-week DOS/COBOL workshop. The students do everything from developing their own data bases and punching their own cards, to running, debugging and documenting their programs. They learn to debug other's programs as well. Modular programming techniques are taught, and the students learn to use the debug package as well as the usual debugging techniques. Two of the programming graduates were hired as a team by one of the largest tool manufacturers in the U.S. to do the programming for new applications for the company's remote locations that will be interfaced with input via teleprocessing. They will work with a programming manager and a systems analyst in the project.

The programming students learn the rationale of the concepts they are taught. For example, they learn what an operating system is in general and what it does for the program; and *then* DOS is taught in detail. Then they can understand other operating systems when they need to.

It's the same in the six-week operator's class. The students have to explain each button they press. They are prepared to go to work and operate a computer whose green "clear to zero" button does the same thing as the blue "system reset" button they used at the training center. As in the keypunch and programming courses, they work with real programs, not exercises. The final exam: The student is alone in the machine room with an evaluator. He is given a deck of cards for a real billing procedure. The student reproduces the deck on the unit record equipment and does an alpha sort. He goes to the computer. It is off. The printer is disassembled. None of the disc packs or tapes are mounted. He IPL's the system and tries to run the program. But the job control is wrong . . . job cards are missing, you name it. The student must make all the necessary changes, respond to messages on the console while the program is running . . . and all the time the evaluator is running after him asking "why, why, why."

Potential employers who don't believe the training programs can be so good have been invited to come down to the center with their own company tests which they administer and grade right there. And they have most often been amazed at the results.

Ed Wendt, project manager in the software systems division at Computer Time-Sharing Corp. who hired one of

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the programming class graduates, says the quality of the program is better than he has seen in any commercial training school. "They learn the use of tape and disc, random access file organization and techniques, debugging. The other schools are 'card-oriented.'" Although the students learn only COBOL, 90% of commercial installations will use the language, he continued. His employee has a good feel of programming concepts, and he thinks she could readily pick up other languages.

Ray Stuart, a member of the center's advisory board and manager of professional and technical training at System Development Corp., one of the largest software organizations in the nation (it's trained more than 12,000 systems programmers over the past 12 years), is impressed with the depth and scope of the program presently offered. John Adams, director and an instructor at the center, feels that in regard to the COBOL training, it is comparable to that given in the in-house courses of the big dp users and manufacturers.

This program is not aimed at the "hard core" unemployed. It is directed to those of all races with potential and aptitude who are unemployed and underemployed and who can, with this vehicle for training, handle these semitechnical professional positions. A person who is intelligent but who will never get to college need not be relegated to a $1.65/hour job in a taco stand for the rest of his life when it has been proved that he can be trained as a successful programmer . . . *given the opportunity.*

The overall objective of the project is that the facility be made an on-going training center. The Urban League is seeking continual financial and other support from industry in this goal. The next programmer class—16 students—will graduate June 9. Operator and keypunch graduates are ready to be employed now. Companies that would like to consider hiring the graduates or offering other assistance should contact John Adams at the Urban League Data Processing Center, 7226 So. Figueroa St., Los Angeles, Calif. 90003 (phone 213/753-4244).

This type of training program shows promise of being able to be successfully duplicated across the country. Specific information on all phases of the programs and organization of the training center—including the course outlines developed by the instructors especially for this project—is available to organizations interested in exploring the possibility of setting up similar training centers.

—JANET EYLER


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# news briefs

## NEW BELL SERVICE CHARGE BRINGS NEW USER HEADACHES

Most of the Bell operating companies are ringing a change in service charges. If their repairman is called and the trouble turns out to be with some attached non-Bell equipment, instead of the Bell circuit, you'll owe the phone company $10—and in some areas $15.

The new charges, levied in connection with the AT&T tariffs filed Jan. 1, go into effect at varying times, depending on the area. The Bell Telephone Co. of Pennsylvania started theirs Feb. 1.

The issue was discussed at the annual liaison meeting of the petroleum industry with AT&T representatives in New York in February. The phone company's explanation was that the charge was necessary because of previous trouble encountered when computer system devices have been connected with the phone system—with IBM mentioned as the major offender. The Bell spokesman claimed that many companies call the phone company repairman when there's any trouble. He makes a free visit, finds that the trouble is not in the Bell circuit, then the customer calls the high-priced computer serviceman. Bell explained that there will be no such charge as long as all the equipment used is furnished by the phone company.

A second-level problem for users is that application of the charge is not determined on the spot by the repairman. Instead, he files his work order, which shows what he found the trouble to be, and this must pass through the maze of the phone company's accounting department for final determination of the charge.

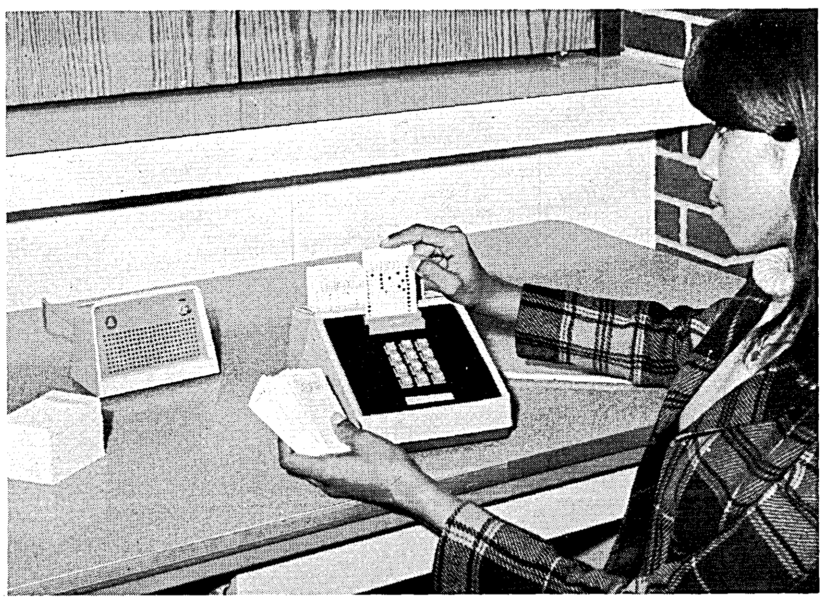
Responses from users indicate new interest in developing test procedures that will isolate troubles more accurately—or asking the vendors to supply such fault-tracing techniques.

## SHARE TO HOLD EXCLUSIVE SEMINAR

The SHARE Advanced Planning Committee will hold a seminar on long-range planning in the context of information processing at the Jack Tar Hotel in San Francisco, June 23-25. Tom Steel of SDC is chairman of the seminar organizing committee, which is now establishing the agenda and facing the unenviable task of rounding up the "responsible, thoughtful, and informed" people who will be engaged in the seminar. The purpose of the meeting is to elicit from the attendees imaginative and unconstrained thinking on the future of edp that would ultimately take the form of lists of presumed relevant factors. These could then be analyzed for common patterns to serve as a basis for planning for the future. There will be no publication of the proceedings, as such, but the SHARE Advanced Planning Committee will do the analysis and publish the results. Attendance is by invitation only and will be limited to 200, to non-IBM people (with a few exceptions), and the meeting will have no formal press coverage.

## HARVEY GOODMAN EXPLAINS HOW TO START A BUSINESS

The New York Chapter of the ACM put on a surprise show in February by bringing in IBM nemesis Harvey Goodman, Data Processing Financial



## COMPUTER MONITORS HOOKY PLAYERS IN MICHIGAN SCHOOLS

The Oakland School District in Pontiac, Michigan, is using a computerized attendance checking system that not only provides immediate information on attendance patterns, but furnishes long-term information on individual students and school areas that helps school officials to spot possible delinquency and prevent dropouts.

The system utilizes an IBM 7770 audio response unit (ARU) in the district's data processing center linked to a 360/50, also in the center, and to Touch-Tone telephones located at each of the district's schools. The ARU, which employs a recorded female voice to give instructions to the human attendance monitor, is activated when the monitor taps out a code on the Touch-Tone phone. The monitor is then instructed to send his school's ID, which is done by the insertion in the phone of card dialers coded with the name of the school and information regarding the type of attendance required by the school—hourly, daily, etc.—and the period covered. Attendance is then registered by the insertion of individual card dialers for each pupil who is tardy or absent. The data is transmitted to the 360/50, which provides printouts for school officials.

The district claims that use of the system has resulted in a substantial decrease in the number of students referred to authorities under the compulsory attendance law because it enables officials to intervene early in cases of excessive absenteeism.

and General, as a last minute substitute to talk about "So You Want to Start a Business." Goodman, who is suing IBM for $1 billion in an antitrust action, joined Robert Johnston, of investment firm Johnston & Associates, on the roster.

Unfortunately, the two speakers represented two of the hottest topics in the field: how to sue IBM, and how to satisfy enterpreneurial fever, both deserving of separate sessions. The room was packed with a record crowd, most looking for a way to get their first million rather than for a way to get Goodman his first billion.

Robert Johnston started the discussion off noting good-naturedly that one criterion for starting a business is to "pick an area where IBM might be stepping on you so that you can sue them and get a very good rate of return on investment." Speaking seriously, he stated that the current dollar market won't continue as it has, meaning the voluminous amount of cash that has been available to computer enterpreneurs. He expects to see a high attrition rate among firms within the next year or two, because current investors will be reluctant to provide that second supply of money to the firms that do not show a good record. Johnston felt what the whole industry has felt—firms have been getting backing to go public that a normal money market would have ignored before Wall Street fell madly in love with everybody, anybody in the industry.

In looking for investors, the new firm should first establish the core of its group, personnel that will accomplish the goals and remain with the firm. A new venture ought to be able to show good management, marketing, and technical know-how. A sound analysis of revenue and profit expectations must be done and documented. Investors, said Johnston, are interested in the logic and reasoning with which these figures are established. Another factor to be considered in seeking backing is the fundamental question: what competitive risk is being taken by exposing unprotectable ideas to the close-knit financial community?

Once a firm has a well-thought-out plan and quality people, it must then seek the financial source—by going to an accountant or lawyer, to friends, or to a finder, broker, or promoter who will obtain the money and arrange the terms, handle document writing. The neophyte firm must also be cautious about the terms of financing: how much of an interest it is giving up to investors, whether investors will be willing to provide a second financing after the initial backing has been depleted and at what cost.

Johnston & Associates is a New York investment group specializing in venture capital for proprietary computer programs, communications systems, and peripheral equipment. Pandex, Software Resources, Interdata, and Morrissey Assoc. have been some of its clients. In addition to obtaining the venture capital for a new company, Johnston says he plays an intermediary role between investor and management, maintaining communications so that the investor will understand the problems and progress of the firm and keep faith and dollars in the company.

Goodman advised that the entrepreneur should be less concerned with negotiating a maximum financial deal for himself and more concerned with developing a "vehicle that works."

"Don't start out wanting to top Fletcher Jones (*wealthy Computer Sciences leader*). It is hard to conceive rational wants beyond $1 million," said the multi-millionaire, drawing a guffaw from the audience. "Don't lose control to the Wall Streeters," he warned, noting that with each additional financing, the investor gains a larger percentage.

Goodman related how he got dragged, kicking and screaming, from an IBM position into the computer leasing industry early in the '60's. "I have lovely pension benefits coming to me," he had argued, when a Wall Street friend had found his whimsical "not-serious" idea on how to make money through computer leasing an irresistible one.

From there on in the discussion, Goodman made his case for his suit against IBM, which alleges antitrust violations, mostly in the form of bundling services under a single price, to obtain a monopoly of the computer industry. It was an out-of-court airing of the issue, which some disapprove of, much the same as they did IBM's defensive two-page ad on the huge amount of competition in the industry. But when did the computer industry ever stand on protocol?

"I don't need the aggravation of the suit. We did all we could to avoid it, having spent over a year with a completed complaint," which IBM was shown. When IBM increased its maintenance charges on purchased equipment (last fall), Goodman said his firm went to IBM to complain that IBM, while it had the right to raise maintenance, could not discriminate against 15% of the users—the purchasers. IBM was said to reply: "Well, if we increase maintenance charges across the board, it will be only a very small percentage of rental," to which Goodman said he responded, "It's an even smaller percentage if applied to the Gross National Product."

The questions and answers went something like this:

"Where would you be today without IBM?"

"Oh, in law, accounting, certainly not in the position I am today."

"Well, aren't you ungrateful?" (a verbatim quote)

"I have no right to the luxury of personal gratitude. It's not fair to the stockholders. We did all possible to avoid the suit. We're a major league company and have to behave thus. If it costs $1 million to sue, that's only 3¢ a share. I feel we have a case that can't be lost. Without the Sherman Antitrust Act we don't have a capitalist economy. We'd have a General Motors owning steel companies, rubber companies, printing, laundries.

"We're not interested in the money from the suit, but the prophylactic relief, that's a legal term, which will open up new markets."

With no prodding, Goodman went into the reasons for the request for separation of IBM into several firms, covered here in previous issues. Goodman rattled off dozens of points, not the least of which was to create an environment for "creative people," which he feels IBM does not. Surprisingly, Goodman indicated a willingness to compromise for out-of-court settlement, but whether that means the compromise will still include an IBM reorganization was not clear.

Then the meeting ended, but 15 or 20 people stayed on, and it was probably the only time that IBM personnel and Goodman will stand publicly and argue the case without their lawyers. Lawyer, CPA, ex-IBMer Goodman comes off earnest, articulate, and emphatically, excitably righteous—and lots of people doubt him. The IBM personnel, interested technical professionals, politely shot questions at him, each one showing a firm sense of loyalty. Isn't what IBM has done simply good marketing? they asked. How can one claim that the practices of a few salesmen, it true, are those of the whole company? Hasn't the industry accepted and followed IBM's practices for many years? Aren't you doing some of the same things? And aren't your plans to offer a system package bundling, too?

Goodman, jocularly calling the IBMers "brainwashed" and "misguided," rapidly tried to make his case, telling them that if he had an hour he could change their minds. "I felt the same way you do when I was at IBM, and Remington Rand sued," but the fact is that IBM's practices are illegal because it is a monopoly, which

"we are not." What would it be like, he pushed on, if General Motors declared Avis, an auto lessor, to be a competitor, and then proceeded to make it hard for Avis to purchase equipment and obtain some of the services it's entitled to after the first person rents the car and returns it?

The firing went on, questioning his self-interest in this action, the motives. Goodman admitted, naturally, self-interest, stating "leasing companies are considered bargain-basement companies, and we'd like to be a premium firm."

We all walked away from the meeting, and several were muttering about agreeing with the DPF&G allegations, but not liking "why they are doing it," doubting that Goodman could really have been sincere about his stockholders, about not being interested in the money, about creating an environment for creative people, equating it with a "God, motherhood, and the pill" speech. The concern for motives was paramount. What it really came down to is that the leasing industry has never really been integrated into the computer field, merely tolerated.

## COMMERCE SECRETARY DENIES PRIVACY INVASION CHARGES

Cries of "invasion of privacy" were met head on by Commerce Secretary Maurice Stans when he testified recently before the Joint Economic Committee. Charges that the Census Bureau is probing too deeply into citizens' lives are "synthetic," he said. The new Secretary of Commerce believes that modern government's need for accurate information constitutes "a basis for reaching economic and social judgments."

"It is easy to understand why there should be a certain amount of annoyance over being asked to fill out questionnaires," said Stans. "Nevertheless, it is unfortunate that this is contended to be an invasion of privacy."

The cabinet official is concerned about several efforts in Congress to enact privacy-protection legislation. Rep. Edward L. Koch, of New York, wants to keep some 20 federal agencies, presently collecting information about individuals, from violating their privacy. His bill would require the federal agency to tell the individual it was collecting personal data, and would restrict the agency's freedom to disclose it.

## POTTER SUES CDC FOR PATENT INFRINGEMENT

In a suit filed March 5 in the U.S. District Court, southern district of Indiana, Potter Instrument Co., Inc., Plainview, N.Y., charged Control Data Corp. with patent infringement. Potter, a manufacturer of peripherals, charged that CDC disc and tape drives utilize apparatus covered under Potter patents. According to Potter, damages, if awarded, could amount to "more than 2.5 million dollars." At press time, CDC stated that they had not received a copy of the complaint, and therefore could not make a statement concerning the suit.

John T. Potter, president of the firm, commented that "it is interesting and a little ironic to note that CDC is suing IBM for unfair competition, yet IBM has paid us for the use of one of the very patents being violated by CDC."

The patents in question are No. 2,674,728, issued in the name of John T. Potter for an apparatus used to position magnetic transducers with respect to the magnetic information storage tracks on exchangeable disc memory devices; and No. 3, 263,223, issued to George E. Zenzefilis for an apparatus used to correct static skew in magnetic tape recording. Both patents are assigned to the Potter Instrument Co.

## NEW FOREIGN INVESTMENT RULES TO BE READY SOON

Liberalized foreign investment rules were on the verge of being adopted by the Commerce Department as we went to press. The rules, drafted by the Office of Foreign Direct Investment, allow firms to invest up to 35% of a year's foreign earnings overseas. This proportion—reflecting a new approach labeled the "earnings concept" —has been held down to 20%. A computer industry source commented that "any modification of tight controls over foreign investment is always welcome."

Commerce Department sources say Secretary Maurice Stans will try to end foreign investment controls completely next year. Until then, there will be "a little relaxation here and there." The impending rule change is one example. Also, small firms are no longer required to fill out the detailed reports required under the Johnson Administration.

Stans admitted recently to the Joint Economic Committee that foreign investment controls don't alleviate balance of payments problems in the long run, but he insisted that controls had short-term value. And that is apparently Stans' chief concern at the moment. He predicted a "significant" balance of payments deficit this year.

## ACM DISSOLUTION OF SICSIC PROTESTED BY MEMBERS

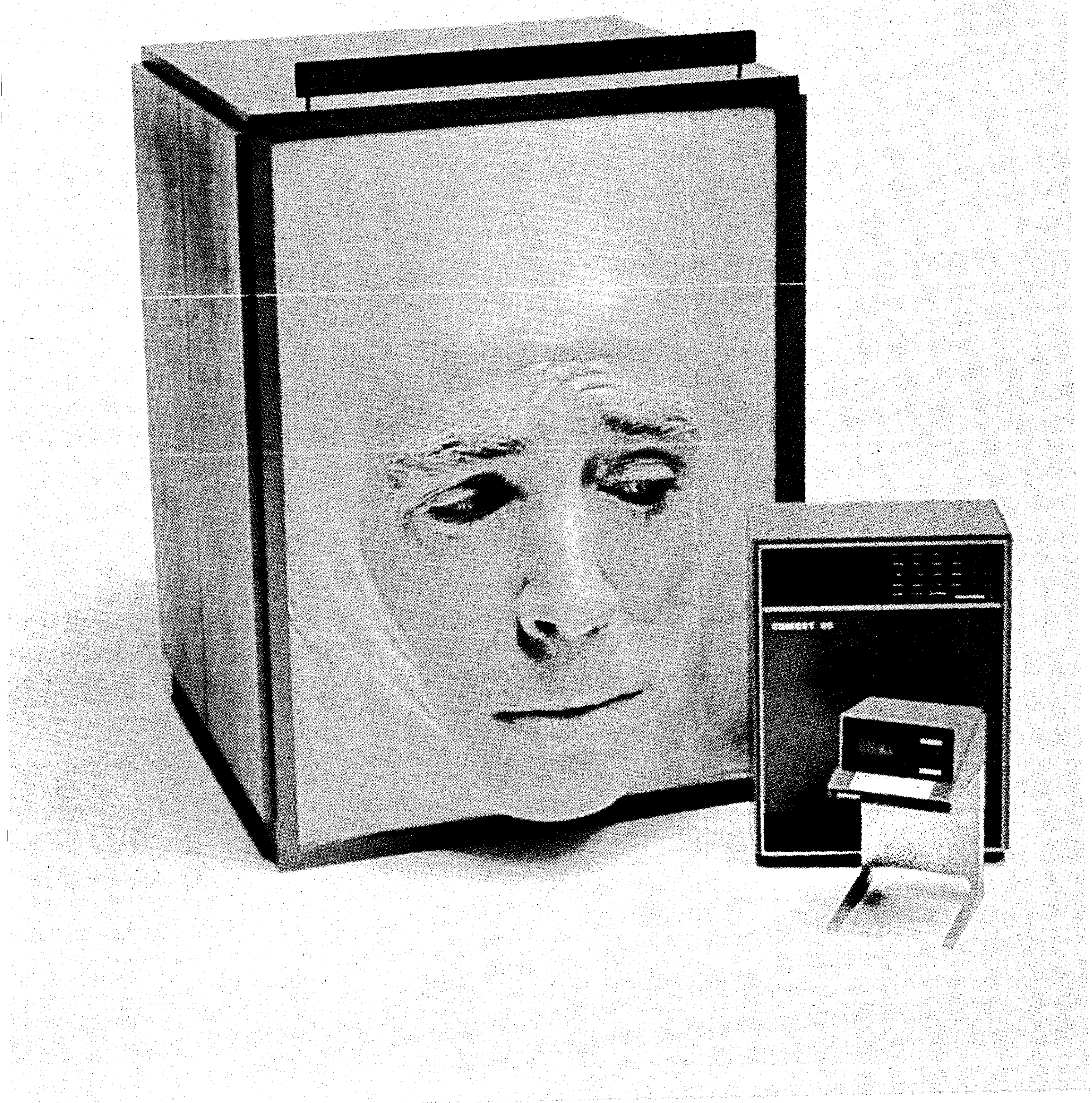
The dissolution of ACM's Special Interest Committee on Social Implication of Computation ($SIC^2$) on the recommendation of Jean Sammet, chairman of the ACM Committee on Special Interest Committees and Groups, has stimulated dissenting reactions from the secretary of $SIC^2$, Robert M. Shapiro, and from a group of ACM members and friends with more than a casual interest in the subject.

In a letter to Dr. Bernard A. Galler, president of the ACM, Shapiro objected strongly to ACM dissolving the Committee without his having been informed, and asserted that an article that appeared in a weekly computer newspaper based on an interview with Jean Sammet was "distasteful and misleading." In reply to an assertion in the article that $SIC^2$ has no mailing list, Shapiro stated that as secretary of the Committee, he had never been contacted about a mailing list by Miss Sammet or anyone else and, in fact, that there is a mailing list of over 100 members. Shapiro also denied the implication that $SIC^2$ had done nothing by stating that the Committee had organized "round table discussions at various meetings," and "is at this very moment active in the New York area." He formally requested that $SIC^2$ be reinstated immediately and that ACM take steps to "undo the impression created by the publicity of the dissolution of the group—an impression to the effect that computer people are not concerned with social or political issues."

Shapiro enclosed with his letter a paper "On the Social Implications of Computers" advancing the unarguable thesis that there are social implications of computers, and containing a $SIC^2$ resolution opposing the war in Vietnam, discrimination in the computer field, the establishment of mass data banks, and "the economic exploitation of the uninformed by unscrupulous computer schools." The resolution supported the implementation of accrediting standards for the computer educational field, and the constructive application of computers in the solution of social problems. He asked that the entire report be published in *Communications of the ACM*, stating that it deserved at least as much space as had been devoted to the "Code of Ethics" issue.

In another letter, this one directed to M. Stuart Lynn, editor of *Commu-*
*(Continued on page 189)*

# Announcing the only communications system that can solve your on-line computer's two biggest problems.



# Because it was never really designed to cope with it, your on-line computer is being buried alive under its own communications load.

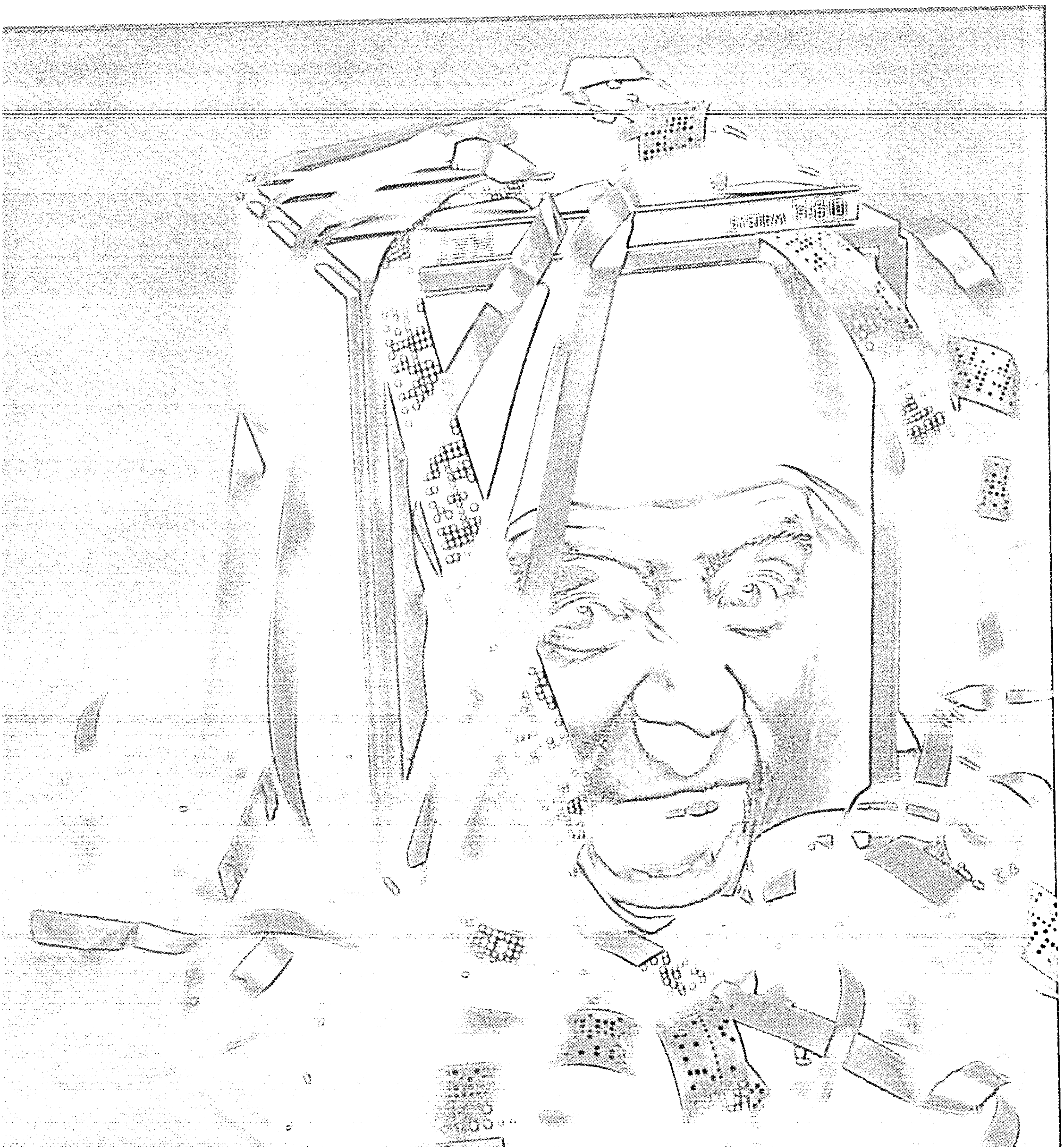
Third-generation computers were supposed to take care of second-generation problems as well as their own systems communications needs. And they do, up to a point.

But as the number and variety of terminals in a system go up, your computer's ability to deliver on that promise goes down.

Depending on the number and type of terminals you have, as much as half of your processor's compute power and memory gets tied up in strictly communications tasks. The result is degraded system performance.

Many computer owners report their third-generation machines are nearing capacity years before they anticipated, or that their costs are double or triple what they had expected.

Little wonder that many organizations have turned to special software, and jury-rigged "front end" computers to head off that inevitable day when their only alternative is to convert again or to add another enormously expensive central processor.



## But Comcet Computer Communications Systems take over most of that load to restore the full thru-put power you paid for.

Comcet Systems are the only new, fresh, and economical approach to the communications problem.

Because Comcet Systems have their own processor, queuing memory, and supporting software—designed specifically to handle communications as a separate systems activity—they can take almost all of the communications load off the back of your central processor and increase its available capacity by 25 to 50 per cent.

By eliminating the need for a larger or second central processor, a Comcet System offers considerable cost savings. And because it eliminates the need for multiplexors and other conventional line termination equipment, it offers a significant price performance advantage over present systems.

The Comcet 60 is designed for use with computers in the size range of the IBM System 360/50, 360/65, 360/85, and the Univac 1108.

A family of smaller and larger Comcet Systems will be made available in upcoming months.


IBM

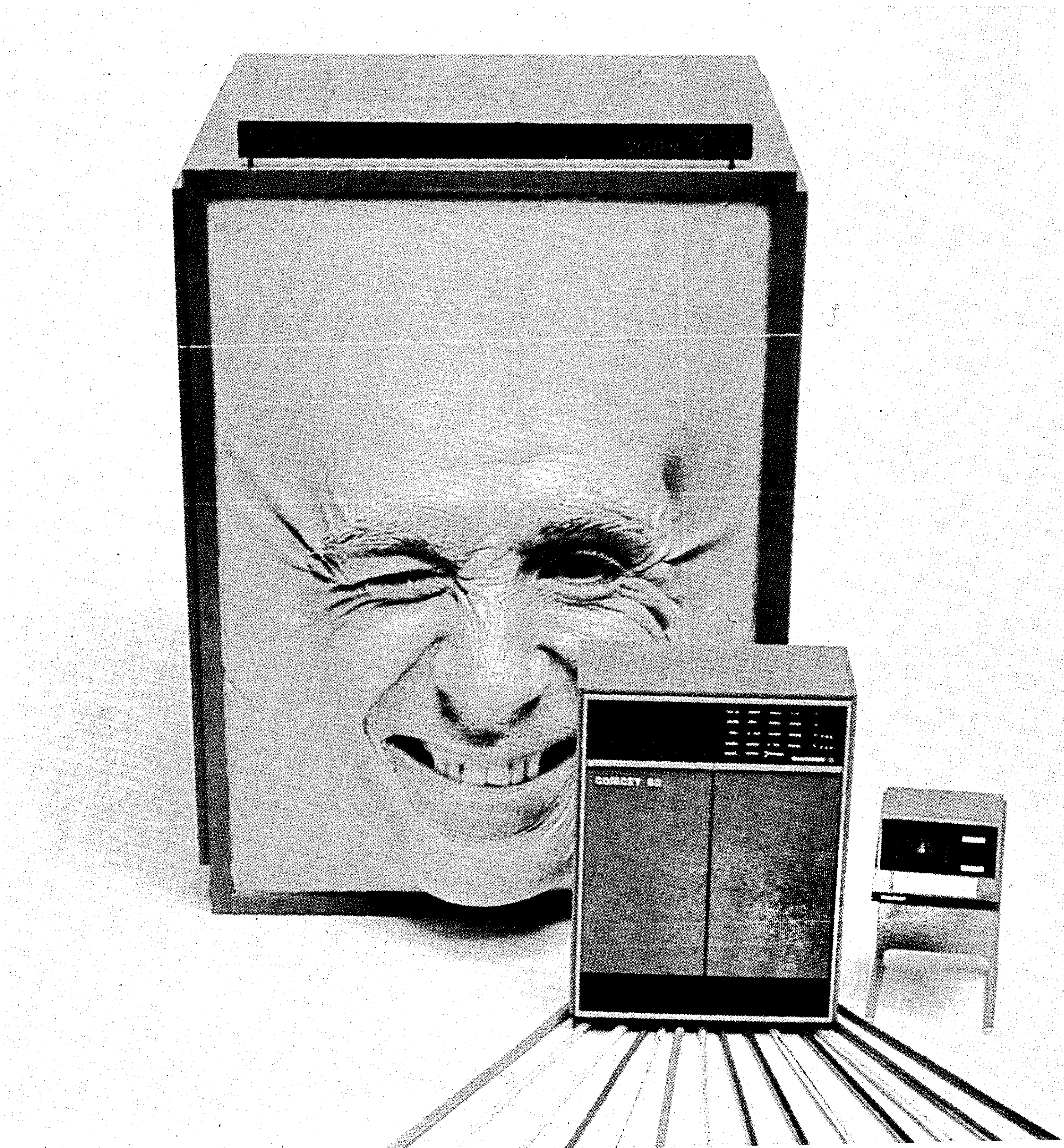
## But Comcet Computer Communications Systems let you pick the best terminal for your needs, without concern for who makes it.

Comcet Systems provide modular hardware and software to interface most remote terminals now on the market. Comcet lets you blend your terminal requirements on a cost-performance basis, independent of the manufacturer of your central processor; independent of the terminals used elsewhere.

The total number of terminals that the Comcet 60 can handle is unlimited, too—its 64 "all speed" communications channels can be further expanded to handle up to 2,048 low speed lines.

Another outstanding and innovative feature of all Comcet Systems is SAM, the System Activity Monitor. SAM monitors, displays, and records activity levels as sensed at 144 points in your system. These points include the wait state, worker state, and interrupt state in the processor; storage activity; 12 points in channel activity; and 128 points in line activity.

As many as 32 points can be displayed simultaneously. All data displayed is updated every 5 seconds and stored for subsequent traffic profile analysis.



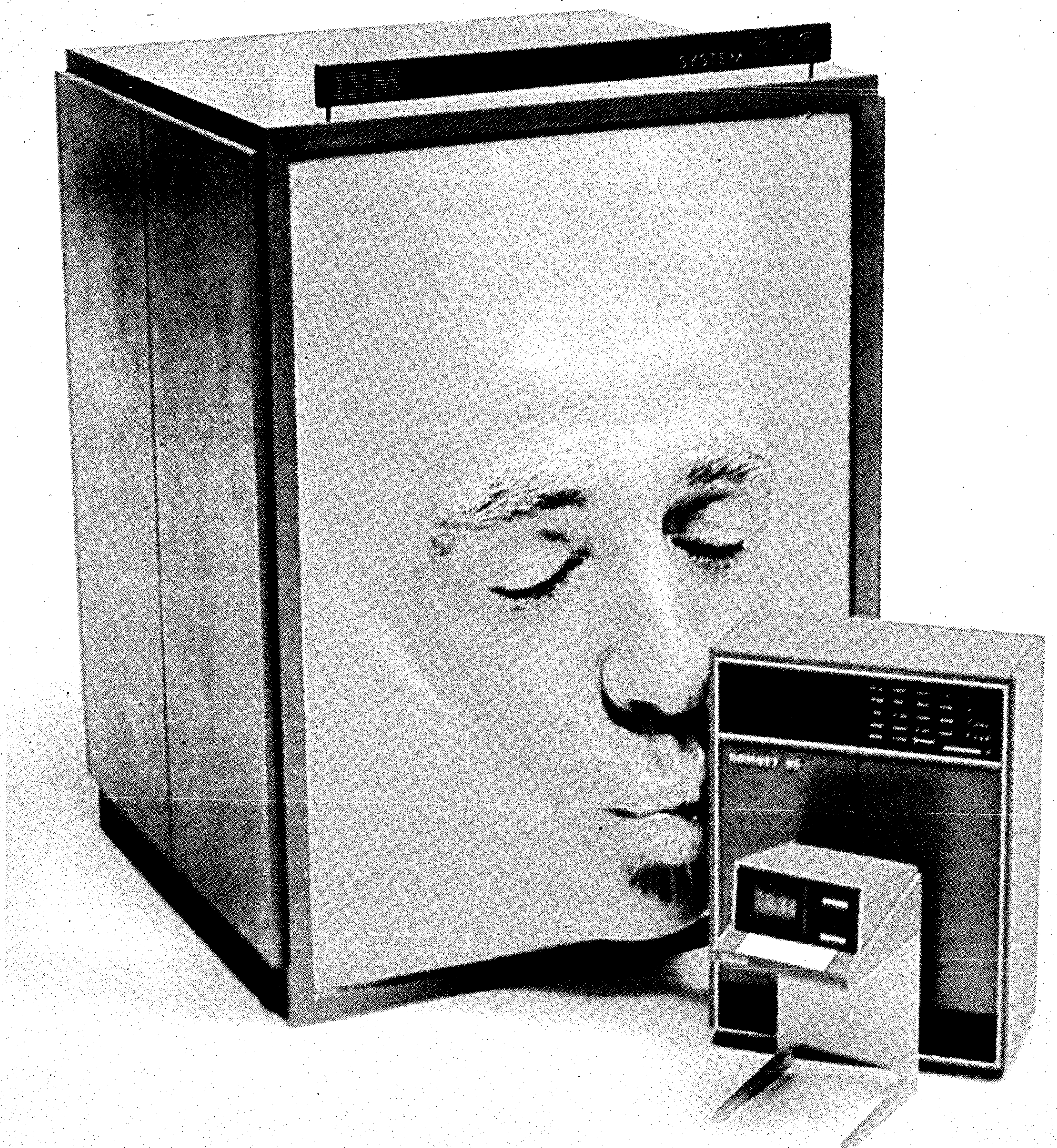
# Add a Comcet Computer Communications System to your installation, now. Your computer will love it.

The Comcet 60 System is available now, a complete ready to install system with all basic software.

The Comcet 60 features a 32-bit parallel processor with a 900 nanosecond memory, expandable from 32,768 bytes to 131,072 bytes. It has 16 high-speed, general purpose registers, 4 general purpose I/O channels, and 64 independent communications channels which handle any type of line service at speeds ranging from 2,000 bits per second to 230,400 bits per second—or even faster when higher speed modems become available. The instantaneous communications hardware transfer rate is 1,800,000 bps.

For full detailed information, write us describing your present or planned on-line system. Or if you would like to discuss the Comcet System in a technical seminar meeting at your offices, followed by a demonstration at Comcet, just let us know.

Write or call Comcet, Inc. at #2 Research Court, Rt. 70-S and Shady Grove, Rockville, Maryland 20850. Phone (301) 948-8700. **COMCET**



*nications of the ACM,* a group of ACM members and interested nonmembers also protested the dissolution of SIC², and emphasized the growing importance of computers in the fabric of human affairs. The letter stated, "ACM's image as a professional organization is not helped by shutting down the only open-ended group it has which is concerned with how computers affect our citizenry." The group stated that it is starting a petition to reactivate the Committee and asked for those who wish to cooperate to contact Robert Bigelow, 39 Grove St., Winchester, Mass. The signers of this letter were Paul Armer, Robert P. Bigelow, Michael A. Duggan, Roy N. Freed, Herbert R. J. Grosch, Patrick J. McGovern, Anthony G. Oettinger, Donn B. Parker, and Stanley E. Rothman.

## UNIVAC NABS $35 MILLION AIR TRAFFIC CONTROL JOB

Univac's Federal Systems Div. has won a $35.4 million contract from the Federal Aviation Administration for the ARTS-III (Automated Radar Terminal Systems) to be used in high density airport terminal areas. A total of 64 systems will be installed within four years.

The purpose of the systems is to display aircraft identity, altitude, and other flight information next to the radar echo of a plane that appears on the air traffic controller's screen. To do this, a beacon tracking device is used that triggers a response from a transponder in each aircraft. Bearing and distance data are derived from the time delay and the ground antenna orientation; this is then processed by ARTS. The pilot installation in Atlanta uses two Univac 1218's for the job. But Univac said (at the time this was written) that the FAA would not allow them to release any information on the computers to be used in the systems.

As prime contractor, Univac is responsible for system management, hardware, software, tests, installation and check-out, initial maintenance and training, and system documentation. Two major subcontractors are Burroughs, supplying the data acquisition subsystem, and Texas Instruments for the data entry and display units.

## TRS SIGNS THE DODGERS, COMPUTICKET GETS BIRDS

The battle between the two major entertainment ticket reservation systems, Computicket and Ticket Reservation Systems, Inc., to sign up attractions and stadia is waxing warm. TRS recently announced that reserved seat tickets for all home games of the Los Angeles Dodgers will be sold through its more than 130 electronic box offices in Los Angeles and throughout the country. TRS also handles the remote ticketing for the New York Yankees, the Pittsburgh Pirates, the Chicago White Sox and the Montreal Expos. It has exclusive ticketing rights to all events held at the Los Angeles Forum, which houses the Los Angeles Lakers of the NBL and the Los Angeles Kings of the NHL.

Computicket has countered with a recent announcement that it has completed negotiations to handle ticketing for the Baltimore Orioles, with outlets at the six Hochschild, Kohn department stores in the area, including one in York, Pa., and at the branches of the Maryland National Bank. Computicket also has reached agreement to establish its boxoffices in the First National City Banks in New York, its first eastern outlets. Another recent announcement disclosed that the firm will handle the ticketing for all events held at the Spectrum in Philadelphia, which is home to the Philadelphia 76ers of the NBL and the Philadelphia Flyers of the NHL. And Computicket just about wraps up the City of Brotherly Love with the news that it will also do the ticketing for the Phillies in baseball and the Eagles of the NFL.

There are a few differences in the two systems, although both offer the same result—a bona fide reserved seat ticket printed on the spot. TRS operates with duplexed CDC 1700's in New York and L.A. and Computicket uses duplexed 360/40's in the same locations. TRS uses a paper tape printout terminal to receive available ticket information, while Computicket's is displayed on a crt. And TRS charges 25¢ a ticket, Computicket, 35¢.

A complaint that has been leveled at both systems is that promotors of some attractions have withheld the best tickets from sale through the electronic boxoffices, keeping the first few rows of each price level to dispense themselves. Admittedly, this has happened in a few instances, according to one source, in the efforts to get started. A Computicket spokesman stated, however, that it has rejected several such proposals, and that there would not and could not be any deals of that sort in the future or neither company would succeed. Both firms, he said, must be able to back up their claim of being able to offer the best available seat in a price range. It was also his opinion that only New York and Los Angeles could support both systems. The struggle now is for the rest of the major cities, a market for which TRS currently holds the lead, with ticket offices in six states.

## DISCS SLIP INTO THE NEWS

One "news" story recently published in the trade press was "news" to its principal characters, too. Supposedly, Control Data Corp. announced that it would ban its disc drive customers from using other vendor's disc packs. The penalty for a violation of this edict was to be an immediate revocation of the drive's warranty. In response to this "announcement," one of CDC's customer / distributors, International Computers, Ltd., of England, raised its maintenance charges a full 50% on machines on which nonapproved disc packs were used.

The 50% extra may look good to ICL, but it, and the announcement, were a surprise to CDC. The CDC warranty, in existence since Day One (April 23, 1968, in this case), specifies that in the case that a bad disc destroys a read/write head on a CDC drive, the head is not covered under the warranty. A similar clause will be found in IBM's warranty, and probably in that of every other supplier. To hold any vendor responsible for destruction of its equipment that can be directly traced to another manufacturer's gear would be roughly equivalent to suing General Motors for damage done to a Chevy by a falling tree.

CDC has offered to certify other vendor's pack for unquestioned use on CDC drives, but the certification is expensive—something in the neighborhood of $25K to $30K—and probably will be considered unnecessary since CDC will cover damages that are not caused by bad discs, and the chances of drive damage from faulty disc packs are considered remote.

## ADAPSO SICS JUSTICE ON IBM, TOO, AGAIN?

The Justice Department indicated to a group of leaders from the Association of Data Processing Service Organizations in January that it would investigate the transfer of IBM's time-sharing services group to Service Bureau Corp. According to a report made by Dr. Herbert Robinson to ADAPSO at its Las Vegas conference in February, the question is whether the development within IBM of Information Marketing Department and its time-sharing services, Quiktran and Call/360, were in violation of the '56 Consent Decree, which caused service bureau activity to be separated into the Service Bu-


Now plug into Ultramation and reduce time-sharing costs as much as 88%
Plug into the new Honeywell Series 16 Time-Sharing System — H1648 — and get one step closer to ultimate efficiency. That's Ultramation.
The H1648 can supply up to 48 simultaneous users with state-of-the-art conversational computer-sharing capability for the lowest cost in its class.
As a dedicated, problem-solving system, the H1648 delivers proven software, thorough documentation and training, quick response (2 to 5 seconds), and a choice of popular languages. That's Ultramation.
The H1648 is easy to use, too. Fifteen fundamental commands are all you need to compose, test and execute solutions. The system is all I/C, has a 960-nanosecond memory cycle time, and an unmatched data base.
For an in-plant demonstration or literature, write to Honeywell, Computer Control Division, Dept. 14, Old Connecticut Path, Framingham, Mass. 01701.
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reau Corp. The question is certainly not new, but it was presumed that the Justice Department had been satisfied by IBM's voluntary transferral of the department to SBC. The ADAPSO meeting with the Justice Department occurred before the government antitrust suit was filed against IBM, which did not contain mention of this as a violation.

The association also asked the JD about the legality of manufacturers entering the service bureau business, but department spokesmen apparently thought any private suits against them would not stand much chance of success in the courts.

On a government "tour," the ADAPSO entourage went from agency to agency, encouraging the use of outside service bureaus. The Defense Department, said Robinson, is extremely interested in local and regional time-sharing centers, and the Budget Bureau is pushing the government to set up service center operations. In both instances, Robinson indicated ADAPSO thought private firms could do the job better.

The ADAPSO meeting also indicated the hope that its new Time-Sharing Section would provide the model for additional "subsections," meaning particularly that the software firms, now with their own association, would join with ADAPSO instead.

A report on the ADAPSO Operating Ratios Survey was made, much to the amusement of the audience. It appears that the survey, meant to provide data on the revenues of the industry, received 115 responses. Of these 84 were usable, 60 of them containing addition errors. Only 45 of the 223 ADAPSO members responded, the rest being non-members, who, incidentally, showed a higher average gross than ADAPSO members. A thorough analysis of the reports is being done, but, jibed the ADAPSO committeeman, "Based on the input you described, I can hardly wait to make big decisions."

## BURROUGHS TO BEGIN B3500 DELIVERIES TO AIR FORCE

The Air Force has authorized Burroughs Corp. to begin delivery of its B3500 computer systems on the $60 million contract won by Burroughs in December, 1967, after a Honeywell protest to the General Accounting Office forced the Air Force to reconsider an earlier decision to give the contract to IBM, which had bid $114 million for the job. At the time of the award of the contract to Burroughs, the Air Force announced that the firm had received "the highest evaluation in meeting the Air Force requirements of the program"—exactly the same phrase used when IBM had been picked the previous April.

The B3500 systems have successfully undergone evaluation by the Air Force director of data automation at the Tactical Air Command, Langley Air Force Base, Virginia, and four other systems were installed during 1968 at Bolling Air Force Base in Washington, D.C., Randolph Air Force Base in San Antonio, Texas, and two at Sheppard Air Force Base in Wichita Falls, Texas. Approximately 150 systems will be installed by 1971 in Air Force bases around the world and will be used to manage Air Force logistics at the base level.

## CSC SELLS 51% OF ITS CANADIAN SUBSIDIARY

In a move calculated to promote a real takeoff by Computer Sciences Canada, Ltd., Computer Sciences Corp. has sold 25.5% of its subsidiary to Canadian National Railways, a government-owned organization, and 25.5% to Canadian Pacific, a privately owned firm that began as a railroad but is now a powerful conglomerate with interests in airlines, broadcasting and telephone communications. Canadian National and Canadian Pacific each operates a network of telecommunications services throughout Canada, and together provide a broadband exchange service for voice communication and high-speed data transmission. It is this capability that prompted the sale and will enable CSCanada to offer computer-communications time-sharing services to commercial operations and for engineering and scientific applications.

CSCanada began operations in August '67 and according to M. G. Goudge, who will continue as president of the organization, has since become the leading Canadian firm in the field of computer software and information services. CSCanada expects that its 49% majority holdings will still give it the largest voice in the proceedings, because Canadian National and Canadian Pacific, although closely intertwined in some operations, don't always see eye-to-eye. Under the new arrangement, CSC will continue to work closely with the Canadian group.

## SIX-PACK PRICES STILL FALLING

Disc pack users with packs produced by Control Data Corp. have received a pleasant surprise. It seems that the disc pack market has not yet quieted down from the stir caused when the upstart Athana Corporation announced a price of $300 per pack last year. At the time of that announcement, disc pack prices were settled in the range of over-$425 to over-$500. Since that time, pack prices had fallen considerably, but things had calmed down until CDC announced its new price structure in February listing $450 packs at $360 (plus discounts for quantity purchases).

The $360 price, which falls to $295 in quantities of 100 or more, is very much in line with those charged by 3M ($360 unit price, $300 in quantities of 50 or more), and by Memorex (same figures). Some other manufacturers are not on the same bandwagon.

Mac Panel, for instance, will quote pack for pack at the same prices asked by Athana ($300 for one, negotiate for quantities). Caelus Memories, on the other hand, claims that its CM-6 six-disc packs have met good market acceptance at $450, although "there is always some resistance from those looking only for low price."

## TRAVELERS MEDICAL NETWORK REAPPEARS, READY TO GO

Back in 1967, The Travelers Corp. and the Institute of Living, a psychiatric hospital in Hartford, Conn., announced a cooperative effort to develop a "total information system" for the hospital. (The Institute had already been working on it for three years under government grant.) This package, said Travelers, would provide the basis for a nationwide on-line service network. Skeptics, noting the struggles of GE-Medinet with a similar effort, viewed the plan with doubt.

Late this February, Travelers came on the scene again, showing a host of operational programs and backing up its service network plan with a promise to invest up to $50 million. The firm says that its new information services subsidiary, TravCom, Inc., Hartford, will be $100 million/year firm by 1974.

Starting this summer with a Univac 494 and the Institute as its first client, TravCom, headed by Dr. Thomas Malone, will provide direct on-line and remote batch services to the medical and health care field. Ultimately, with faith in the cross-industry applicability of the system and its software, it will expand into state and local government, education, and business and industry.

A slow, careful beginning is indicated, since TravCom notes it will be selective in putting its first clients on

## news briefs

the system. Each new hospital will require about six months to a year to be fully operational. (Cost is generally estimated at about $.25–$2.00 per patient per day.)

Whatever the firm ultimately becomes, the major, tangible accomplishment is that TravCom now has applications and support packages that are tried and operational, said to make up a fairly complete hospital system. (Other programs are under development.) The Institute's doctors have used them, on-line, on the hospital IBM 1440. The software includes applications packages involving patient, personnel, and other hospital records; a file management system; and a computer language, NOVEL, for specifying syntactical and format rules for displaying data.

Dr. Bernard Glueck, research director for the hospital, said that in addition to day-to-day administration, the "institute considers the system an integral part of its clinical evaluation process." A number of programs permit data reduction in order to detect unusual changes or significant departures in a patient's behavior from the average, as well as to furnish measurements of ward behavior and show day-to-day changes of groups.

Most of the application packages, while ready, will require about 10% modification for use by different hospitals. These packages allow for a combination of remote batch input of punched cards via a Univac DCT-2000 terminal, on- or off-line keyboard input through the programmable Burroughs TC-500 terminal, and on-line input through a mod 35 Teletype or Bunker Ramo 2000 series crt. Data storage and retrieval and report generation software will be available for the following applications: admissions, patient transfer, discharge and visits, administration (reports on daily census, bed utilization, financial summaries, etc.), personnel assignments and scheduling, patient assignments, medication orders and transactions, computer-aided education for hospital training programs, payroll (including on-line updating), patient billing, order processing and inventory control, and budgetary control and expense management.

The clinical procedures being programmed are nursing notes, occupational therapy notes, patient diagnoses, admissions physical exam, mental status, and physician's progress notes. Output ranges from narrative reports to graphic interpretation of data—on demand or in routine reports.

The recording, maintenance, manipulation, and retrieval of data—all kept in one massive file on a drum—is done through an information (network) processor, developed by Ken Prescott, formerly with United Aircraft. The program puts no restrictions on data size, content, or format. "This capability is accomplished through a network data structure consisting of members or records whose number may be infinite and a list of items or attributes within each member whose number is finite. Once the user identifies the name or kinds of information to be kept for each member and the means for ordering items (i.e., numeric, alpha, historical, etc.) the data file is initiated along with pointers to properly link all items and members specified." The user can ask the system for an answer involving any combination of information, such as, say, the number of male patients who are schizophrenic and who come from New York City. Response times vary from seconds to a few minutes.

Another interesting facet of the system is the way textual data is input and retrieved. The nursing-notes form the Institute is using is a mark-sense form containing lists of phrases describing patient behavior. The proper phrases are marked and the form read by an IBM 1232 optical reader, which outputs the marks onto a punched card; the data is then transmitted to the computer. The location of the marks is coded and stored in the file. The NOVEL language, which comes with a dictionary, is able to translate these codes back into text, so that an output of the nursing notes comes out in sentences—as is required by the hospital. This same method is used with other hospital forms, such as the Minnesota-Hartford Personality Assay.

Security measures have also been built into the system. For example, each individual using it has a unique three-character code that establishes his level of access to the data. A payroll number further verifies identity. TravCom is now investigating other means of personal identification.

The first 494 is now being installed. The system will include a 128K cpu with up to 24 I/O channels, each handling up to 64 communications lines; Univac 880, 432, 1782, and Fastrand II drums; and Univac 8C mag tape units. The actual capacity of this system will depend on the types and numbers of terminals and the applications. Generally, the 400-bed Institute of Living will ultimately have over 25 terminals of various kinds and the system could conceivably handle 10-20 similar hospitals. TravCom is also expecting to do a small pilot system for the Connecticut Nursing Home Assn.

**RCA SYSTEM UTILIZED FOR SELECTIVE TEXTBOOKS**

The Encyclopaedia Brittanica's new Annals of America set of original historical documents is a 20-volume, 2,200 article collection from which a teacher can select any material he desires—down to a single paragraph—and have it combined in a textbook for his particular use. This is done by means of an electronic composition system developed by RCA utilizing its Videocomp 70/830 typesetter that can set pages at an average rate of one every 25 seconds.

The complete text of the Annals is stored in a Spectra 70/45. When a school district or system determines which information from the Annals it wants, it sends an order to the Brittanica's Chicago office for processing. The order is checked and then keypunched into the 70/45, which sorts the desired information to a master mag tape for typesetting. At the printer's, formats and composition controls are incorporated into the tape and the Videocomp makes the page proofs, which are checked by Annals editors. The Videocomp then writes each page on film for platemaking and, finally the press. A 400-page book can be composed in less than a day.

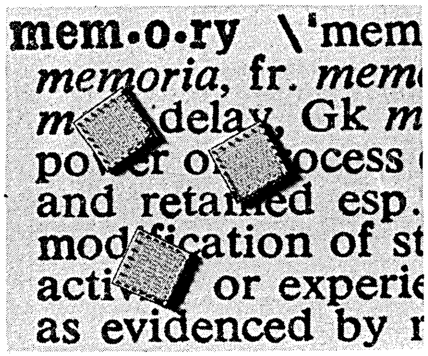
The software used in the system is a new language called PAGE 1 (PAge GEnerator), which is applicable only to printing. It has 78 commands, that can describe any format, type size, face, column width, and other page demands.

Brittanica will keep the Annals of America updated on a periodic basis as yet undetermined, and is now looking toward making its 54-volume Great Books of the Western World electronically retrievable. The firm will concentrate on education in the Humanities, but a spokesman for RCA stated that the system can be used for any course subject.

**IBM RETURNS TO THE WORLD OF LILLIPUT**

Funny how little we change through the centuries. Even today we are still debating "how many somethings can dance on the head of a pin." Or at least that is how one of IBM's latest announcements was phrased . . . but the question, when stated in terms of microcircuit components, is still interesting.

IBM has developed a bipolar monolithic IC buffer memory for use on the 360/85 that is faster than any they have previously introduced. Access time to the entire contents of the 2K by 72-bit memory is 40 nsec. The buffer memory is constructed of half-inch square building blocks composed of two silicon chips and their leads and insulation. Each of the chips measures less than an eighth of a square inch and contains 664 components (transistors, diodes, and resistors). Each chip provides 64 distinct but intercon-



nected storage cells. The components involved are so minute that 53,000 can fit into a one square inch area.

The significance of the microminiaturization is of course little related to "how many of what fit where." What IBM gains from this construction is a circuit speed—demonstrated on some experimental chips—that is as fast as 750 picoseconds (trillionths of a second).

The speed of the buffer memory (which at one time was to be called a "cache", but that term has apparently been dropped) is not down to the 750 pisec figure, but a 7 nsec/chip read and a 12 nsec/chip write speed isn't bad.

**IBM RELEASING PL/I TIME-SHARING PACKAGE**

IBM will offer its customers, beginning this month, a programming package having the same systems capability as Call/360:PL/I. Release of Call/360: BASIC, announced earlier, will occur simultaneously.

The latest IBM announcement follows SBC's unveiling, in February, of Call/360: PL/I time-sharing service to supplement its BASIC version.

IBM customers can obtain the PL/I package "only on an 'as-is' basis," said a company announcement. "IBM will not provide technical, installation, or maintenance support. Alterations and program maintenance will be the responsibility of the user." These same conditions apply to Call/360:BASIC and the Call/360:Datatext—another, previously-announced release.

The BASIC-PL/I package will be released only to "qualified" users—those having a 360/50 with 500K core and the following peripherals: one 2314 direct access disc drive; 26 Mod 2316 disc packs; 2 Mod 2401 tape units; a 1401 printer, and a 2540 card reader-punch.

The reason for releasing Call/360 software seems fairly clear: IBM is faced with three antitrust suits at the moment and apparently wants to avoid any appearance of trying to rig the service bureau market in SBC's favor.

It was unclear from the recent IBM announcement whether the BASIC portion of the package would have the same systems capability as SBC's Call/360:BASIC offering. An IBM spokesman implied they were the same but refused to be quoted.

SBC is charging the same for Call/360: PL/I as for the BASIC version—i.e., a minimum of $100/month, which can be applied at the rate of $11/hour of terminal connect time, $7/minute of cpu use, and $1.10/month for each 3400 bytes of disc storage. PL/I service is being provided from time-sharing centers in Chicago, Cleveland, New York, Philadelphia, and San Francisco, through 29 other cities.

An SBC spokesman was asked whether, and how much, his company had paid IBM for the Call/360:PL/I software. He declined to comment.

The language set used in SBC's new service is "fully compatible with the OS/360 version of PL/I developed by IBM," said SBC. The langauge set "incorporates all the major features and advantages of the full language set. Although multi-programming, fixed-length record input-output, compile time facilities, and similar features are not implemented—since they're not applicable to remote terminal usage—the programming set in Call/360: PL/I is fully 'upward compatible' with the current level of the full language."

Other t-s service bureau operators welcomed SBC's announcement. Some felt the chief effect on the dp industry, as a whole, would be to increase the popularity of PL/I. Support for this view was provided by an SBC spokesman's statement that the new offering includes a BASIC and FORTRAN module "designed to make it easy for those users to pick up PL/I."

A number of commercial service bureaus offer modified versions of IBM operating software and/or utilize programs based on modified versions of PL/I. They say that, as a result, they can offer users the full range of capabilities in the PL/I language, particularly file manipulation. SBC, it was said, can compete only for a small segment of this business with the package it has announced. It is expected, however, that SBC will enlarge its Call/360:PL/I software capability.

*(Continued on page 194)*

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## RESERVATIONS WORLD/RCA NATIONAL SYSTEM

RCA and Reservations World, a subsidiary of Diners' Club, Inc., has launched a computerized reservation system available to the entire hotel-motel industry. The $2 million computer system, built around two Spectra 70/45 computers, permits travelers or travel agents to make a single toll-free phone call and get a confirmed hotel, motel, or car rental reservation anywhere in the U.S. "within seconds." Plans call for eventually extending coverage to include Europe and the "entire world," as well as airline reservations and "other travel-oriented services."

When a traveler calls the Reservations World number of his locality, he is connected by private phone lines to one of five communications centers located in Los Angeles, Chicago, Springfield, Ill., Jackson, Miss., and Ft. Lee, N.J. He tells a trained reservationist where he is going, when, and the type of accommodations preferred. The customer may specify a hotel or request a recommendation. The reservationist types the request on an RCA Video Data Terminal that then transmits the information to one of the two computers in New York City. The computer memory is searched and if an available room is located, "confirmed" is displayed on the VDT. The reservationist informs the traveler, then telephones the hotel to report the reservation. If the request accommodation is not available, the VDT displays the two "next best" choices, based on the class and price of the room requested.

Confirmed reservations are stored in memory until the traveler registers at the hotel or until the reservation is altered or canceled. Available inventories are supplied by the hotels and motels on a periodic basis; by calling the reservationist, the hotel manager can make changes in the number and types of rooms available. Fees charged to the hotels for booking rooms are varied and depend upon "service provided." The computer generates monthly bills for all referrals made through the system.

Plans call for opening eight more offices during the year, and conducting an advertising campaign in national magazines.

## TWO FORD COMPUTER EXECS TO FORM SOFTWARE FIRM

According to scuttlebutt, several Ford engineering computer executives are spinning off an independent company that will probably be located in Ann Arbor, to be called Cyphernetics Corp. Chuck Missler, manager, computer applications at Ford, and Ken Lochner, in charge of Ford's advanced systems and formerly associate director at Dartmouth during the GE time-sharing experiment, are said to be involved in the formation of the proprietary advanced software and computer services company, which will be nationwide in scope. The firm will be well funded by private sources. The move will leave Ford's engineering computer department headless until replacements can be found.

## CALIFORNIA DMV NEEDS STILL-FASTER INPUT METHOD

Californians are great buyers, sellers, and drivers of cars—and one result of this, besides spectacular freeway crashes, is spectacular input and inquiry problems at the Department of Motor Vehicles. Like 13 million active records on vehicles, 3 to 5 million driver licenses issued per year, and some 20 million inquiries.

The massive RCA installation (DATAMATION, May '67) was supposed to take care of all this but the department is now shopping for other methods. They have more than 140 6051 video terminals for data entry, but it's still not enough; the machines work all right, but this many still can't handle the volume. Rather than buy still more, and hire even more operators, the DMV sent out 135 letters to manufacturers of input units (yes, there really are that many), got back about 60 eager responses. The number of potential vendors is down to 14 or 15 now and tests are underway to see if typists can go fast enough to make OCR worth trying. The key-to-tape makers are in the running, too, with a decision expected in three to four months.

## CSI HOPES FOR CREDITABLE RETURNS

When the Bank of America bought an interest in Credit Systems, Inc., last December, the company gained more than mere money. The bank is proprietor of the world's largest charge-card system. Its Bankamericard is distributed by some 600 commercial lending institutions, honored by more than 200,000 merchants, and used by more than 8 million consumers. CSI, which manufacturers an on-line credit verification system, regards Bankamericard and similar operations as a prime market.

So far, the company has concentrated on department stores. Its Credit-Chek system is currently operating in four, and CSI sales vp Jay Frank expects to sign a contract with the fifth—a major Manhattan department store—"any minute now." The four systems already installed are located at Chappell's and E. W. Edwards, in Syracuse, N.Y.; Malley's Department Store, in New Haven, Conn., and J. C. Penny's Treasure Island Stores, Atlanta.

The Credit-Chek system consists essentially of charge card imprinters at each store sales counter, a centrally located drum memory, and an "authorizer unit" in the credit department. This component enables a credit clerk to analyze a questionable account in real-time and decide whether to allow additional purchases.

Credit-Chek rents for $12/month/terminal, plus $95/month for a system communications controller, plus $1430/month for the central configuration—drum memory, authorizer unit, and tab card or paper tape reader-printer. The whole system can be purchased outright for 40 times its monthly rental.

CSI was organized in 1967. Steven Pribis, Jr., is president. He was previously manufacturing vp for Narco Scientific Industries, an aircraft radio manufacturer. Before that, Pribis managed engineering for the military products division of General Dynamics, and before that was in charge of manufacturing programming for GE's defense systems department. Another CSI principal is Donald Fleischer, a Leeds and Northrup alumnus, who is electrical engineering vp. Jared McGowan, formerly with American Electrical Laboratories, is mechanical engineering vp. Sales vp Jay Frank was previously eastern sales manager for Ultronics.

Two banks are now actively investigating the Credit-Chek system for use in their credit card operations, Frank reports. A number of department stores are doing likewise. The company's goal, he adds, is to have 10 systems operating by the end of this year. "We'll turn profitable if we reach that goal."

The company is developing an acoustic-coupled terminal, capable of interfacing with a standard telephone set, and a simplified credit card imprinter, which could rent for as little as $6/month. These two products would, says Frank, expand CSI's market to include smaller retail establishments, like gasoline service stations and specialty stores, which can't justify the expense of the present system.

## DPMA PLANS EXPANSION OF 1970 CDP TEST

Those taking the 1970 Data Processing Management Assn. Certificate in Data Processing examination will find the going a little rougher than did their 17,197 predecessors. A fifth test category—data processing and general management skills—will be added to the test, and the four areas presently covered will be broadened. DPMA is in the process of releasing a letter to existing CDP holders requesting that questions be submitted for consideration and possible inclusion in the 1970 exam. Further, the 1970 candidates will have to successfully complete all five sections of the test to receive the CDP. This February the examination was also given in the Philippines, the first time it has been administered outside the U.S. and Canada. A European site is expected to be included for the 1970 test.

## STOCK MARKETS SEEK SYSTEMS APPROACH

In a move to prevent paperwork headaches in the future, the New York and American Stock Exchanges have hired Rand Corp. in an effort to establish a systems approach to help cope with ever-increasing trading volumes. The Rand study will be conducted under a $1 million contract, and is expected to take about a year.

The securities industry is presently mired in a slough of paperwork problems, despite no fewer than 27 separate industry-wide measures taken during 1968 in an effort to alleviate the murky situation.

The systems approach, rather than dealing with isolated steps in the trading process, will set priorities for a whole range of steps, ultimately leading to a system called the "locked-in" trade. This system would feed data directly from the floors of the exchanges to the clearing facilities, bypassing steps involving the sending of trading slips to member firms, then sending them back to the exchanges. Long range goals include three broad areas: Reorganization of the means by which stock and bond transactions are processed and ownership of securities is transferred; finding speedy solutions to current bottlenecks; and developing a program to aid member brokers in evaluating performance of their back offices in handling paperwork and to spot and correct potential problems.

In a related move, the American Stock Exchange has retained North American Rockwell Corp. to analyze present operational methods, seeking short range improvements. This study is scheduled for completion in less than six months. Both Rand and North American Rockwell began their assignments in February.

Also in February, the New York Stock Exchange's Central Certificate Service, a computerized system for delivering securities among brokers which began implementation in May, 1968, became fully operational when Zurn Industries, Inc., was added to the system, completing the alphabetical phasing-in of more than 1200 NYSE stocks. The system contains about 500 million shares, worth about $25 billion, making it the largest concentration of stock held anywhere in the world. However, a report in the *Wall Street Journal* indicated that the system had encountered computer problems and was understaffed, necessitating a one-week shutdown in March.

## MAGNETIC MARK CARDS NEXT YEAR FROM POTTER

A replacement for the ancient and venerable Hollerith card may be in the offing. Potter Instrument Co., Inc., Plainview, N.Y., has designed a new card, the same size as a punch card, but which uses alphanumeric characters on its face, and mirror-image characters together with magnetic encoding on the reverse, making it both man- and machine-readable. Each mirror-image character may have up to four magnetic bars both above and below it, providing eight bits per character, for a capability of differentiating 64 characters. At a density of 70 characters per inch on a six-line card, this provides 420 characters per card, or better than a five-to-one improvement over an 80-characer punch card. The magnetic cards, having no holes, are also expected to wear more slowly than punch cards.

Sometime next year, the magnetic cards will become part of a system that will be priced "significantly" below "comparable" OCR or MICR equipment. Cards will be automatically prepared by a modified Potter printer, operating as an off-line print station. It will also be possible to prepare the cards manually, using modified electric typewriters; this method will be demonstrated at the SJCC next month. A magnetic mark card reader will be able to read 300 cards per minute. Initial use for the magnetic mark card is expected to be as a turn-around document, such as a utility bill.

## ON-LINE FREIGHT BILLING SERVICE SLATED FOR EAST

"COSMA," an on-line freight billing system for trucking companies, is sched-

*(Continued on page 199)*

# The Peripheral People offer an exceptionally reliable 3000 lpm Line Printer

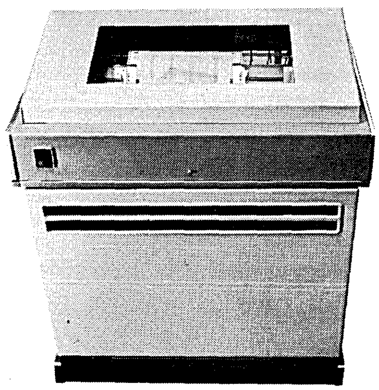
## EM-C5 High-Speed Line Printer

Up to 3000 lpm (1500 alpha-numeric)! "Swing-away" typedrum speeds paper loading, makes ribbon and code disc & typedrum replacement a snap. Magnetic particle brake and clutch require no adjustments for machine life. An excellent value in a reliable high-speed printer.

### Specifications & Features

Cabinet Dimensions:
- Mechanism: 53" H. x 58" W. x 36" D.
- Electronics: 42" H. x 41" W. x 27" D.

No. of copies .. Up to 10 part forms.
Horizontal Spacing: 10 col. per inch.
Vertical Spacing: 6 or 8 lines per inch.



### EM-C3 Low-Speed Line Printer

If you don't need blinding speed, this rugged line printer delivers 450 lpm alpha-numeric or 900 lpm numeric only. Includes most of the 3rd generation features of the C5. Ask for EM-C3 spec sheet.

Slew Time:
- 10 ms for single line at 6 lpi.
- 8.6 ms for single line at 8 lpi.
- 30 ips (2-5 lines).
- 90 ips (6 or more lines).

Columns ............... 132 or 160.
Characters:
- Standard ............ 64 numeric.
- Optional ........ double-numeric (13 repeated characters).

Speed ... 1500 lpm, alpha-numeric. 3000 lpm, double-numeric.
Power AC: 208 volts, 3 phase, 4 wire, 60 ± 1 Hz or 50 ± 1 Hz.

For more information, write for EM-C5 spec sheet.

NCR

THE PERIPHERAL PEOPLE

Random Access Devices • Mass Storage Devices • Magnetic Tape Units • Printing Mechanisms • Line Printers • Card Readers • Tape Readers • MICR Readers • Card Punches • Tape Punches • Digital Printers • Keyboards

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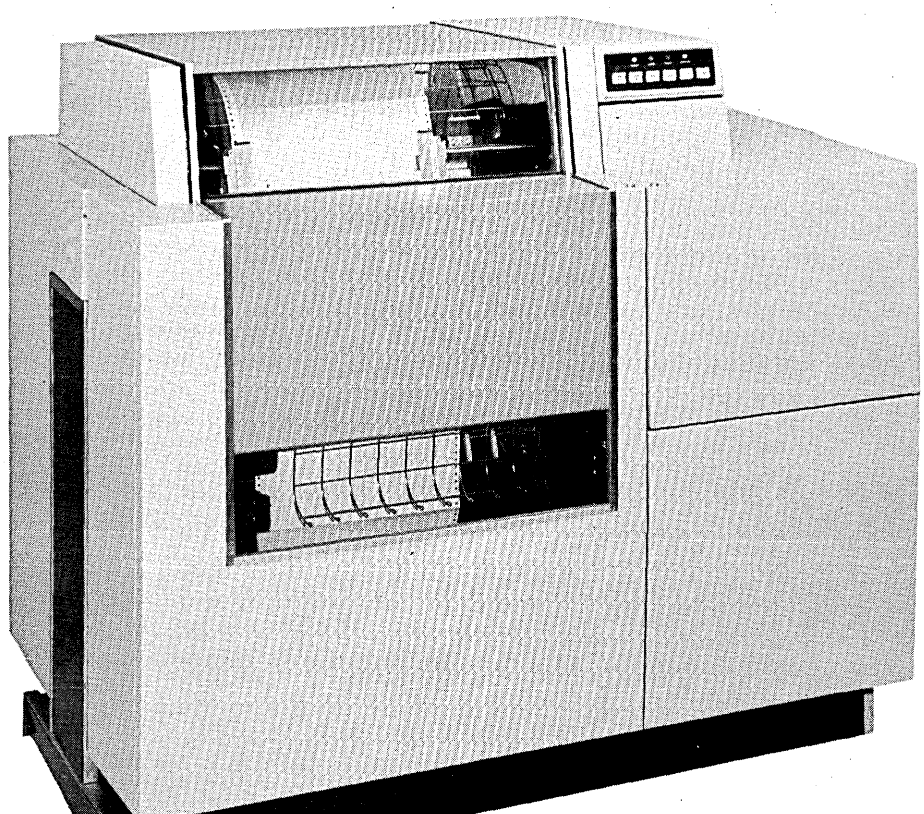


CIRCLE 179 ON READER CARD

uled to go into operation next September. Reportedly, it's the first such system to encompass an entire geographical region. The developer and operator is Universal Systems, Inc., Bethesda. COSMA stands for Computer Services for Motor Freight Activities.

The system will be driven by an SDS Sigma 5 computer, equipped with a 32K, 32-bit word core, eight discs, and four tapes. It will be linked to user terminals—low-speed and high-speed teletypewriters—via "several" voice-grade communication lines. They'll interface with the computer through a communications processor developed by University Systems, and an SCC DCT-32 concentrator.

The system inputs billing data from the terminal dispatching a freight shipment and outputs the printed bill at the destination terminal. This allows trucks to leave as soon as they're loaded, explains marketing vp Jim Brubaker, and results in big savings for the operator. COSMA will also provide a number of summary reports needed by a trucking company's operating and financial managers.

Universal plans to charge its customers a flat rate per billing transaction. The cost, says Brubaker, will be about half of what the typical trucker pays now to do the job with his own people. The teletypewriter keyboard used with the system is identical to the one installed on a standard electric typewriter, so training reportedly will not be a big problem.

COSMA will be operated from a computer center in Gaithersburg, Md., near Bethesda. Universal expects to install two Sigma 5's at this facility; one will provide backup capability for the other. Initially, the company will service only those trucking firms who belong to the Mid-Atlantic Conference; this group sets freight rates within an area stretching from Maine southward to Virginia and west to Buffalo, N.Y. The membership totals about 1100 trucking firms. Other conference rate schedules will be added later.

Besides Brubaker, Universal's principals include Ralph Notto, president, and Stanley E. Narusiewicz, financial vp. All three came from Univac. Brubaker designed real-time and message-handling systems for Univac large and medium scale computers; Notto was an analyst-programmer who specialized in naval surveillance systems; and Narusiewicz was a programmer, system analyst, and senior mathematician.

## STUDENT GETS LESSON IN PROGRAMMING . . . OR DOES HE?

A student taking a correspondence course in managerial data processing conducted by a major state university recently received the following note from his instructor:

I'm sorry to say that we have had a mixup on your lessons 5, 6, and 7. Lesson 6 has been straightened out and you will receive that to debug and rerun.

My records show your lesson 5 to be an "incomplete," but you should have credit for it. Therefore, if you have not received a grade on lesson 5, please resubmit something for formality so I can give you credit. Your computer results for lesson 5 are returned here in lesson 7. If I still have your envelope on lesson 5 it has been misplaced.

Your program for lesson 7 was lost by the computer section and I'm afraid the only remedy is for you to reprogram it. It was lost along with lesson 6, but fortunately the girls found lesson 6 misfiled. Lesson 7 still hasn't been found. To ease your burden, I am sending a solution to lesson 7 which you should *not* copy too closely but only inspect to assure you that you have the right idea on this lesson.

After sending the above, you should resubmit lesson 8.

Thanks for your patience. Computer processing is very slow here lately so continue to allow two weeks for grading.

## IBM BOLSTERS SMALL SYSTEM SUPPORT CENTERS

IBM is strengthening its organization for support services for small computer systems and electronic accounting machines—a move intended to improve IBM's image with the small businessman. It is also a step that could help ease any transition problems should separate pricing become a reality.

Until the February announcement, IBM's Field Installation Centers, servicing the 360/20 and 1130 computers, the 6400 series of accounting machines, and punched card equipment, were "informal," without a "dedicated, permanent staff" of systems engineers and customer engineers. These 22 centers, whose name has been changed to Basic Systems Center, have been made part of a "formal" organization within the Data Processing Division, with a headquarters office in Boca Raton, Fla. Fifty more such offices will be opened this year and all will have a permanent staff.

Each center has the equipment serviced, providing the customer with the opportunity to write and test programs and wire accounting machine control panels. Personnel will provide installation planning guidance, software and hardware maintenance, and specialized workshops "when a local need arises."

IBM's 17 Field Systems Centers, for models 25 and up, are already established in this way, as are its seven Data Acquisition Systems Centers for the model 1800 computers.

This formal structuring of the small system organization should put IBM in a better position with manpower and management should it separate the pricing of any of its services: education, maintenance, software, planning guidance. Most particularly, if it somehow puts a price tag on systems and customer engineers, say providing them on a per diem basis rather than "free" with the price of the machine, it will now have a permanent pool of people in each office.

## SURVEY SHOWS COBOL USE INCREASING

A recent Navy-sponsored survey of 724 COBOL users, mostly non-government, concludes that the popularity of the language is growing relatively as well as absolutely. It also suggests that Honeywell has the best COBOL compiler and manuals: 10% of the respondents acquired their systems from "the other computer maker," a far higher proportion than Honeywell's share of the computer market.

The survey, based on a mail questionnaire, was conducted last Fall by Auerbach Corp. A basic purpose was to discover ways of making COBOL more appealing to users. CODASYL, which would have to initiate any such changes, is now examining the results.

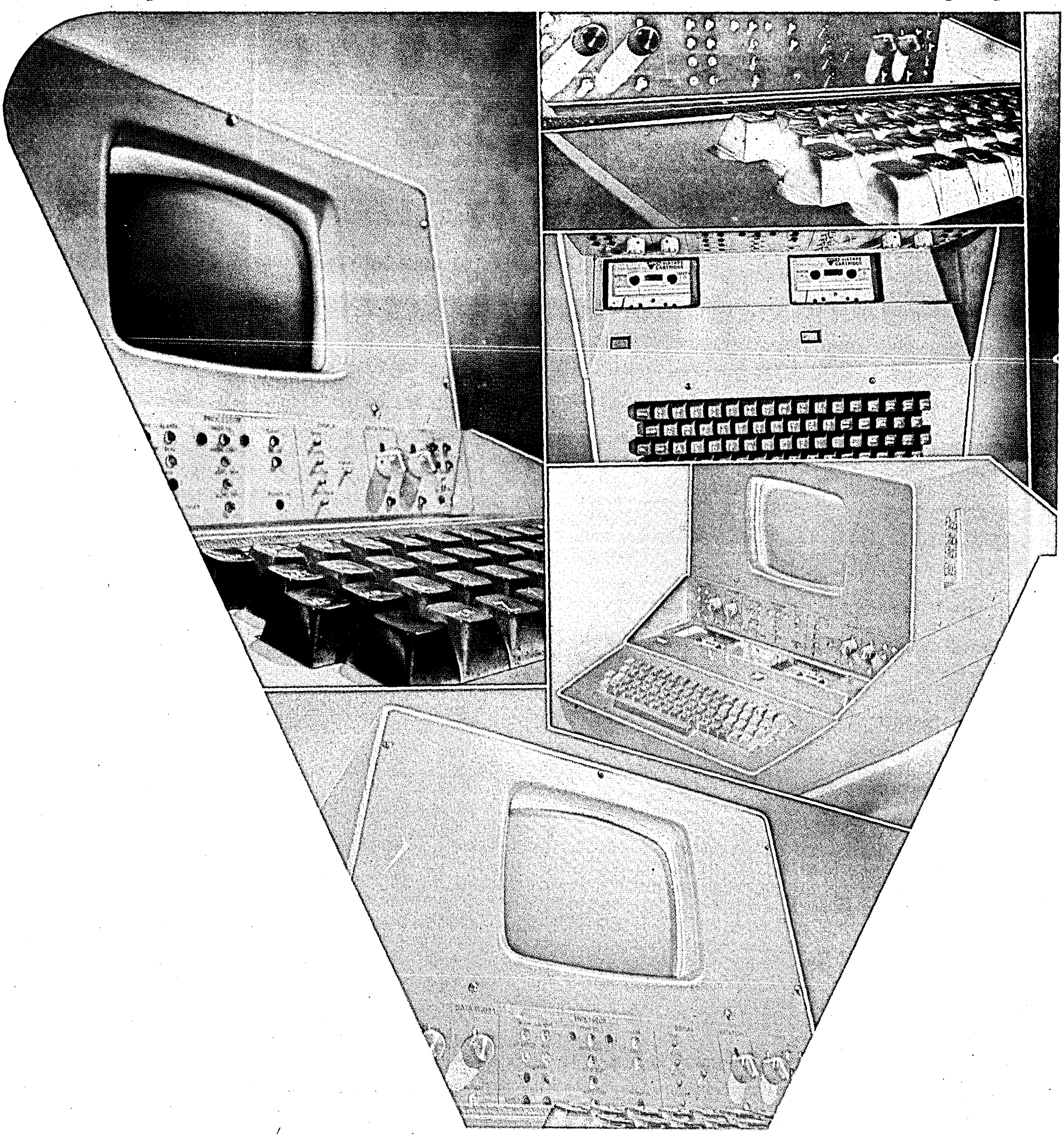
About 560 of the 724 respondents who answered the questionnaire rated COBOL's popularity. Of this subset, 65% said their use of the language was increasing.

The predominant reasons for not using the language more, according to the survey report, are: lack of bit manipulation capability; excessive memory requirements, excessive coding, excessive run time; and lack of data communication capability.

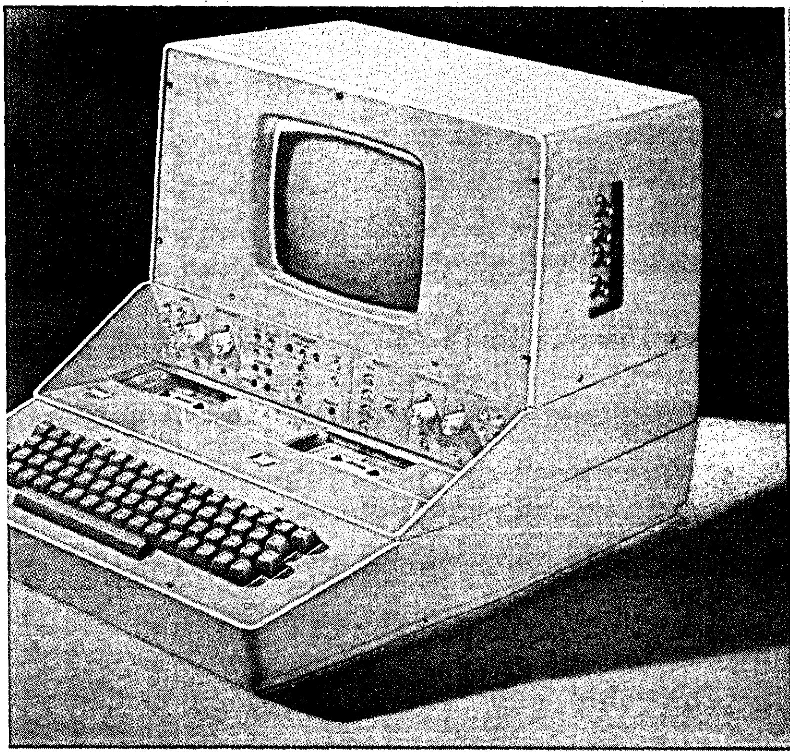
Auerbach found that a standard version of COBOL was used by more than 50% of the respondents, and that COBOL is used more than twice as often as assembly language for the following applications: financial accounting, inventory control, purchase record keeping, manufacturing control, marketing and sales analysis, demand deposit bookkeeping, distribution analyses, and order/billing.

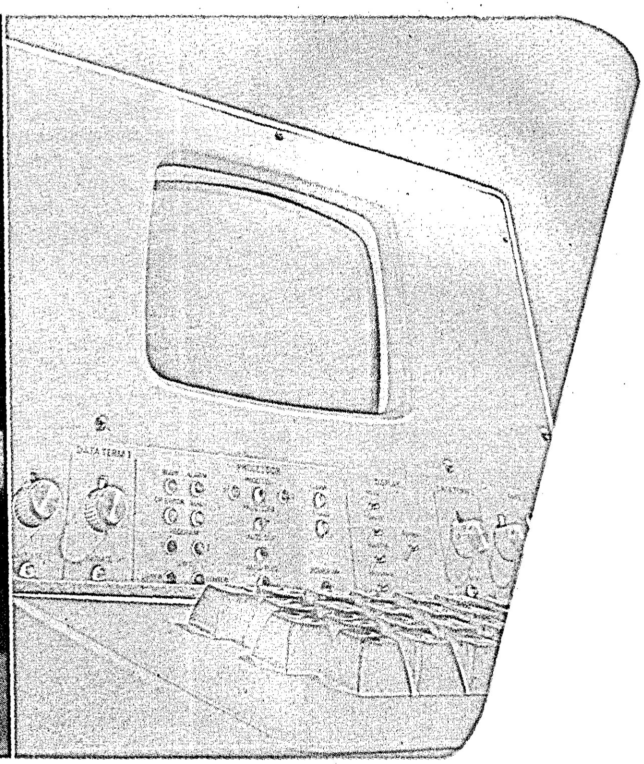
Respondents were also asked which

# Two-way Communications/Remote Job Entry/Remote Display



Visit our booth at the S.J.C.C.





# Add a communications adapter to a System 21 input station and you will have new capabilities

System 21 will have teletype, remote job entry and on-line computer terminal capabilities.

That's flexibility.

It's economy, too. Instead of having a lot of highly specialized equipment to do different specialized jobs, one unit will do it all. You'll have an easy-to-use standard keyboard. A video display for fill-in-the-blanks formating. Preprogrammed microprocessor with all the logic needed to record, edit, format, display and retrieve data on reusable VIATAPE cartridges.

Once data is on VIATAPE it can be sent over telephone lines to another System 21 station, to any teletype station, directly to an on-line computer, or be automatically translated to either punched cards or 800 b.p.i., 7- or 9-track computer tape.

A System 21 communications adapter will give you automatic turnaround as well as batch transmission and batch receipt.

It's a communications system that will provide everyone with access to your computer. No capital expenditures are required. No long-term lease agreements. The VIATRON rental agreement will contain a 30-day cancellation clause. For more information write VIATRON Computer Systems Corporation, Dept. D - 5, Burlington Road, Bedford, Mass. 01730 today.

VIATRON
SYSTEM 21

**VIATRON System 21 puts the logic where the problem is**

of the following languages—FORTRAN, PL/I, RPG, assembly language, or COBOL—they "usually" employed for card, tape, and disc/drum applications. COBOL was the most popular choice in all three categories; it was selected by 38% of the respondents with card applications, 54% of those with tape jobs, and 41.2% of the disc/drum users.

Respondents were also asked which language they would use "predominantly" if faced with a need to program random access, tape, or on-line inquiry application. COBOL was chosen in the first two cases—by 56% and 62% of the respondents, respectively—while COBOL and assembly language were about equally popular for the random access job. Here, 38.1% of the respondents chose COBOL, and 38.5% picked assembly language.

An analysis of respondents by make of system showed that two-thirds used IBM equipment; Honeywell was next, with 10%. Most COBOL users, judging from the survey, have small, third-generation systems. They employ 10 or less programmers who have at least two years' experience, write about half of their programs in COBOL, and use assembly language for most of the others. The survey also indicated that the typical COBOL programmer was using assembly language predominantly three years ago; three years from now, 62% of the users felt their programmers would still be using COBOL, while 11% said the preferred codes would be FORTRAN and/or assembly language.

### TYMSHARE TO PROVIDE TRW ON-SITE SERVICE

TRW Inc., one of the "big guns" in the world of software, has released two seemingly contradictory statements. On the one hand, the Redondo Beach, Calif., firm has formed a major new division, the Software and Information Systems Div., for the purpose of consolidating its 1,600 persons who are involved in the support of the company's $75 million software business. The division will also control TRW's score of large-scale computers, except for one. And that's the second story. It seems that TRW has been buying time from Tymshare, Inc., a Los Angeles firm, to back up its 60-terminal SDS 940 time-share system and to get the use of Tymshare's software. Now TRW's legal staff is busy grinding out a contract to legitimatize Tymshare's operation of TRW's 940. (And it's our guess that that contract will exceed $500K in the first year.) Tymshare will provide an operating and programming and maintenance staff, plus that apparently desirable software, and lease it, along with TRW's own 940—which is still located on the TRW premises—back to TRW.

### RCA TO EXPAND WALL STREET DATA CENTER

If the brokerage house paperwork tangle never gets straightened out, it won't be from lack of effort by the manufacturers. RCA is the latest to volunteer its services with the announcement of an $11 million expansion of its Wall Street Data Center and the resounding statement that this move is "the first step in a nationwide computerized service for brokers."

A new facility is being set up, at 4 New York Plaza, and five Spectra 70/45's will be installed—for a fivefold increase in capacity; the center now handles 30,000 trades a day. Later this year, a 70/46 will be brought in to start a pilot operation leading to remote batch services for brokers.

Besides handling market transactions, the center will offer brokers such special services as order matching, online transmission of market data, and information retrieval for bond houses, investment bankers, and commission brokers.

### COMPUTERIZED TWA TIMETABLE

TWA is improving the content and speed of preparation of its bimonthly Worldwide System Timetable by using an RCA Spectra 70/35 and RCA Videocomp phototypesetting equipment to prepare the schedule. TWA provides the scheduling data and parameters to Michigan Typesetting Co., Detroit, which does the actual preparation work, producing film that is forwarded to Smith-Grieves Co., Kansas City, Mo., for actual printing.

The first automated timetable, published in January, was based on data covering more than 50,000 interline connecting flights. The computer utilized these data to produce around 2,000 "ideal" connections based upon minimum time and mileage. This represents 96% of TWA's passenger miles in the U.S. and 94% overseas. The timetable lists cities served by TWA alphabetically, not geographically in column form as on previous timetables. For example, a passenger may immediately determine that there are three nonstop flights daily from Albuquerque to Amarillo.

The timetable data is updated monthly by incorporating TWA and other airline schedule changes into the master file, reflecting all pertinent city pairs. This file is passed through a validation program to detect illogical input errors. The file is then sorted by city pairs and processed through a program that develops connecting flights and calculates elapsed time.

### NOW THE OILMAN HAS HIS PICC

The Parmian Information and Computing Center Corp. PICC is not a new data processing venture in the oil rich lands of the middle east—it's a new data processing venture in the oil rich lands of West Texas based upon a Control Data 6600 recently installed at PICC facilities in Midland. (Parmian derives from the geological description of the lands around Midland as the "Parmian Basin.") The giant installation is the boldest attempt yet to cash in on the booming market for computer services in the Texas oil fields which is estimated to exceed $100 million annually.

PICC is a subsidiary of Information and Computing Center Corp. (ICCC) a new firm which went public only in January. Its founder and president, Ed Dillon, is an ex-petroleum geologist who saw a need for large scale computer services on the part of corporate and independent oil prospectors who consider two productive wells out of a hundred sunk a good average. PICC will make available to them a packet of sophisticated seismic programs designed to take some of the chance out of their work. The 6600 will also have $1 million plus in specialized peripheral equipment for the oil trade, including items like a very high precision plotter and special TV-like seismic data displays.

To help build a work load on the 6600 equal to its capacity, PICC will also place and service a number of remote batch terminals, initially in Dallas and Midland and then elsewhere through the Southwest. Some 20 CDC 200 User Terminals are now on order by PICC, with additional fleet orders contemplated. PICC's hope is to develop a general as well as an oil industry clientele, and also handle overflow 6600 work for government and military agencies, in order to keep their data-pulverizing computer productive and paying for itself.

### WESTINGHOUSE TELECOMPUTER SERVICE CENTER OPENS

The first of what will be a chain of Tele-Computer Service Centers was recently opened by Westinghouse

Electric in Chicago. The center is primarily a sales office for the services to manufacturers (t-s, remote batch, and preparation of numerical control tapes) and user terminals such as teletypewriters and IBM 1050's. At the center an 1130 has tie lines to a 360/75 ASP system, a /50 for I/O, and RCA 70/46 in Pittsburgh. Peripherals available at the center include high speed printers, tape punches, card readers, and two-axis plotters.

The initial offerings of the center are for numerical control: aid in the preparation of parts program for N/C machine tools. Westinghouse hardware and software are being offered to reduce tape production time and costs, and to increase N/C machine tool productivity. Parts programmers will be able to get computer-aided machine programming assistance, including the proprietory CAMP services which reduce lead time in preparing error-free tapes. Subscribing users can have these services in their own plants via terminals.

Later Westinghouse will offer its extensive programs and computer time for scientific/engineering problem solving.

Westinghouse entered the computer service business in May 1968 and established its Manufacturing Information Services Dept. (MISD). Now MISD headquarters in Pittsburgh has a staff of 100.

**AUSTRIAN EDP MARKET OPENING UP**

The U.S. Dept. of Commerce has recently released information concerning edp markets in Austria, Eastern Europe, and Japan. Reports are optimistic in each of these areas.

*Overseas Business Reports* number 68-98 describes the edp market in Austria as improving for U.S. suppliers during 1967, with an unprecedented 225% increase in value of edp equipment imported from the U.S., while overall edp imports for the year actually decreased about 13%. Value of total U.S. edp equipment imported was $2,303,000. The *Reports* notes, however, that "the sudden increase of U.S. exports in this field may be due to the fact that newly developed equipment, sold for the first time in Austria in 1967, is not available from the European plants of American concerns." The U.S. share of total edp imports was 30%, making it the largest supplier.

A great potential market exists in Austria, as evidenced by the fact that "more than 60% of the edp equipment installed in Austria is used for calculation work formerly performed by bookkeeping machines," showing that

## news briefs

Austrians have not yet learned to adequately realize the benefits of computers. In the spring of 1968, there were 274 large and medium-sized computers operating in Austria, and "experts estimate that about 600 Austrian business enterprises can be computerized," indicating that the market is quite fertile.

### U.S. EDP EXHIBITIONS IN THAILAND, SWEDEN

The Bureau of International Commerce of the U.S. Dept. of Commerce will sponsor an edp sales exhibition and seminar at the U.S. Trade Center in Bangkok, Thailand, June 23-27. A similar exhibition will be held at the Trade Center in Stockholm, June 11-17.

The Bangkok exhibition will include both hardware and software services. Equipment, films, graphics, and mock-up models designed to improve understanding of edp and its applications will be on display. The seminar will run concurrently with the exhibit, and will cover topics suggested by Asian businessmen in a recent BIC survey of 300 firms and government offices in 12 nations. Emphasis will be on workshop sessions and small discussion groups.

The BIC survey indicated "a widespread desire for more information about data processing techniques and applications." The Dept. of Commerce states that Asian countries are "about to enter the computer age" and represent "a large potential market" as edp comes into growing demand in order to keep pace with economic and industrial expansion.

The Swedish exhibition will be aimed at helping U.S. manufacturers of dp equipment to increase sales in Sweden, Denmark, Finland, and Norway. The market is expected to reach $100 million this year, with BIC predicting a "surge in sales of small computers as well as increased demand for computer peripheral equipment. Best sales prospects are reported in the rapidly opening peripheral equipment market for devices used in input operations, data transmission systems, and equipment facilitating efficient utilization of data output."

"According to BIC research and informed Scandinavian trade sources, American industry has supplied over 70% of computer equipment already installed in the four-country area and accounts for an even greater portion of computer and peripheral equipment on order. U.S. exports of related equipment to the Nordic countries totaled $13.4 million in 1967. However, more U.S. equipment is actually in use in the region, since the bulk of Nordic imports is supplied by European-based American manufacturing and assembly plants making American designed or manufactured equipment."

BIC points with pride to its past record of successful trade shows, noting that "Sixteen participants in a compact computer show at the London Trade Center in January 1968 earned $80,000 in off-the-floor sales and predicted one-year sales of nearly $2.7 million."

Firms wishing to participate in the Bangkok exhibition may obtain additional information by writing the U.S. Dept. of Commerce (BIC-918), Washington, D.C. 20230 (telephone 202-967-5148), or from any Commerce field office. Those interested in the Stockholm show, write to the above address with code BIC-946, phone 202-967-3713, or contact a field office.

### COMPUTER PURCHASES TO BE UP DOWN UNDER

The Australian Government is expected to move into big systems in a big way in 1969, with several large purchases by various agencies in the offing. The Post Office is planning an expansion of its computer facilities, and the Department of Civil Aviation will order $2 million (Australian) worth of additional equipment this year.

But the orders that are of most interest in the industry are those that are expected from the Bureau of Census and the Commonwealth Scientific and Industrial Research Organization, two of the biggest and most sophisticated user groups in Australia. Both are planning an extensive upgrading of their equipment and the question is whether the Bureau and the CSIRO will continue to patronize Control Data, and the Post Office continue with Honeywell, or will the agencies diversify their buying. The multimillion dollar contracts awarded by the Commonwealth to Control Data and Honeywell gave them their first firm foothold in the Australian market in the early 1960's, and their powerful hold since has left little for rival companies. IBM had to wait until 1967 to make its first breakthrough with a twin-system order from the Department of Social Sciences.

Other big-system installations in prospect include the State Public Service Board and the Sydney County Council in New South Wales, and the Brisbane City Council.

*(Continued on page 208)*

# Amelia Auricle's Computer Dating Bureau

## When a fellow sets his sights too low, Miss Auricle sets him right.

"One day this positively *hand*some young executive came into my office. Said he wanted a date with a 360/25. Heard they were very popular. Imagine!

"Well, really—during our little chat I found out *all* about him, and I was *flab*bergasted! Look, my dear, I told him, a 360/25 is really *not* your kind of computer. I hesitate to say this, but not in your class at all.

"*You* should be dating a Spectra 70/35. Really, I mean, you could do 2½ *times* as many read full words a second. You'd have three I/O, channels, not just one. Why, you've grown up with *16 disc drives*. Would you be happy with a 360/25's meager four? Never. A 70/35 is literally twice as good in so many ways. It's almost like a generation gap.

"'Well,' he said, 'I'd heard that the processors cost the same, and I suppose we'd be compatible.'

"Of course, 70/35 software is compatible with other Spectras and with 360's. But there's really *much* more to life than that, I said, rather severely I'm afraid. Take my advice. I know many 70/35's, really *fine* ones, in important positions all over the country. They really are more your speed.

"Well—the upshot was, he agreed, and I take credit for the really *fine* way he and his 70/35 run a really *fine* insurance business up in Hartford now. *Really!*"

For a date with a 70/35, or more information write RCA Information Systems, Cherry Hill, N.J. 08034. Phone 609-424-2385. Really.

RCA
Information Systems

CIRCLE 137 ON READER CARD

## news briefs

### FEDS LOCK OUT PROGRAMMING STUDENTS

The big bug struck the Am-Tec Training Centers Inc., Hicksville, N.Y., when U.S. Treasury agents suddenly closed the school last January for nonpayment of taxes. Although this may have been a handy way for the federal government to solve its fiscal problem, it didn't do much for the nearly 1,000 unfortunate programming students at Am-Tec's six schools in Long Island, Brooklyn, and Manhattan. But the State of New York came to the rescue.

Many of the students began complaining to the State's Bureau of Consumer Frauds and Protection, causing Assistant Attorney General Stephen Mindell to arrange a meeting with attorneys and representatives of Am-Tec and Credit Department Inc., a New York finance company to which many installment obligations executed by the students had been assigned. The meeting resulted in a reprieve for those students who would once again attempt to learn programming: Students who reenroll in one of several other programming schools arranged for by the finance company will be given credit for payments made to Am-Tec and continue making payments on the outstanding balance. Students who had already paid the full balance due will be allowed to complete their courses in the new schools without further payment.

Now if none of *these* schools are shut down, and the graduates can manage to find jobs. . . .

### EMPLOYMENT SKILLS RETRIEVAL SERVICE

Employment Systems, Inc., New York, a wholly owned subsidiary of National Manpower Register, is providing a remote-access edp system designed specifically for skills retrieval. Applications of the service include use by large firms to keep track of in-house brain power, as well as use by employment agencies and government employment offices.

Users store data on ESI's dedicated 360/40 located in Detroit, accessing the system through specially designed portable terminals manufactured by Reporting Terminals, Inc., New York. The terminal includes function switches for such descriptors as skills, industries, salary levels, experience, education, geographical locations/preferences, etc. A built-in acoustic coupler permits attachment to standard telephones. Each user has his own data base, which his terminals

# For those of you who bought a new disc memory yesterday, we're sorry.

Today Century Data introduces the new One Eleven disc memory.

And what a memory it is.

The One Eleven incorporates a new electromechanical positioner. For easy maintenance and unsurpassed reliability.

It features an average access time of less than 50 milliseconds. Faster than comparable IBM units.

It stores 7.25 million bytes. With easy conversion to higher capacities.

And best of all, the One Eleven is directly interchangeable with the IBM 2311. Just plug it in and go to work.

Price? The One Eleven can definitely save you money.

And as for service, you are surrounded by 24 convenient service centers throughout the country. (Century Data may be a new name in the field. But it's an affiliate of service-oriented CalComp.)

So if you picked yesterday to buy your new disc memory, gosh, we're sorry. But an announcement like this was bound to break somebody's heart.

**Century Data**

For further information, write Century Data Systems, 1630 South State College Boulevard, Anaheim, Calif. 92806 or call 714-772-7080.
See us at booth CC-1 at the Spring Joint Computer Conference.

CIRCLE 140 ON READER CARD

alone can access. Fee for the service is \$200/mo. plus additional charges depending on lengths of records and the number stored by the user (a "record" is defined as either a resumé or a job description).

The service began in January, and 160 terminals are now in use. Of these, 140 are being used by National Personnel Associates, a chain of private, independent employment agencies which formerly exchanged information among its members by mail. Another user is the Industrial Manpower Center, Antioch, Calif. A potential user at press time was a foreign government which wanted to maintain an inventory of skills of its nationals studying in U.S. graduate schools.

### PATIENTS AND STUDENTS COMPUTERMATED AT UCLA

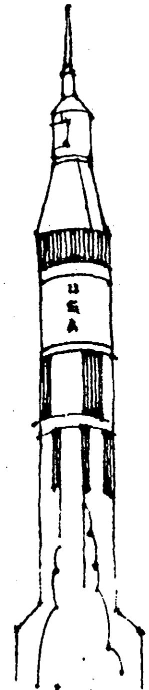
Dental patients with need for a particular treatment and student dentists at a stage of clinic education development to fill that need are being matched up by the UCLA School of Dentistry's 360/40. This precludes the possibility of a patient who needs a gold inlay being put into the chair of a student who has been concentrating on extractions, and ensures the student, in his final two years of study, an opportunity to perform the complete range of dental procedures.

UCLA has 15,000 outpatients on record and, currently, 400 students in attendance. A data file on a patient's problems and treatment plan is kept from the time he first enters the clinic and it is kept up to date for both patient and student reference, and for future medical research reference. Now in its fifth year, the School of Dentistry graduated its first class of dentists last summer. They're on their own.

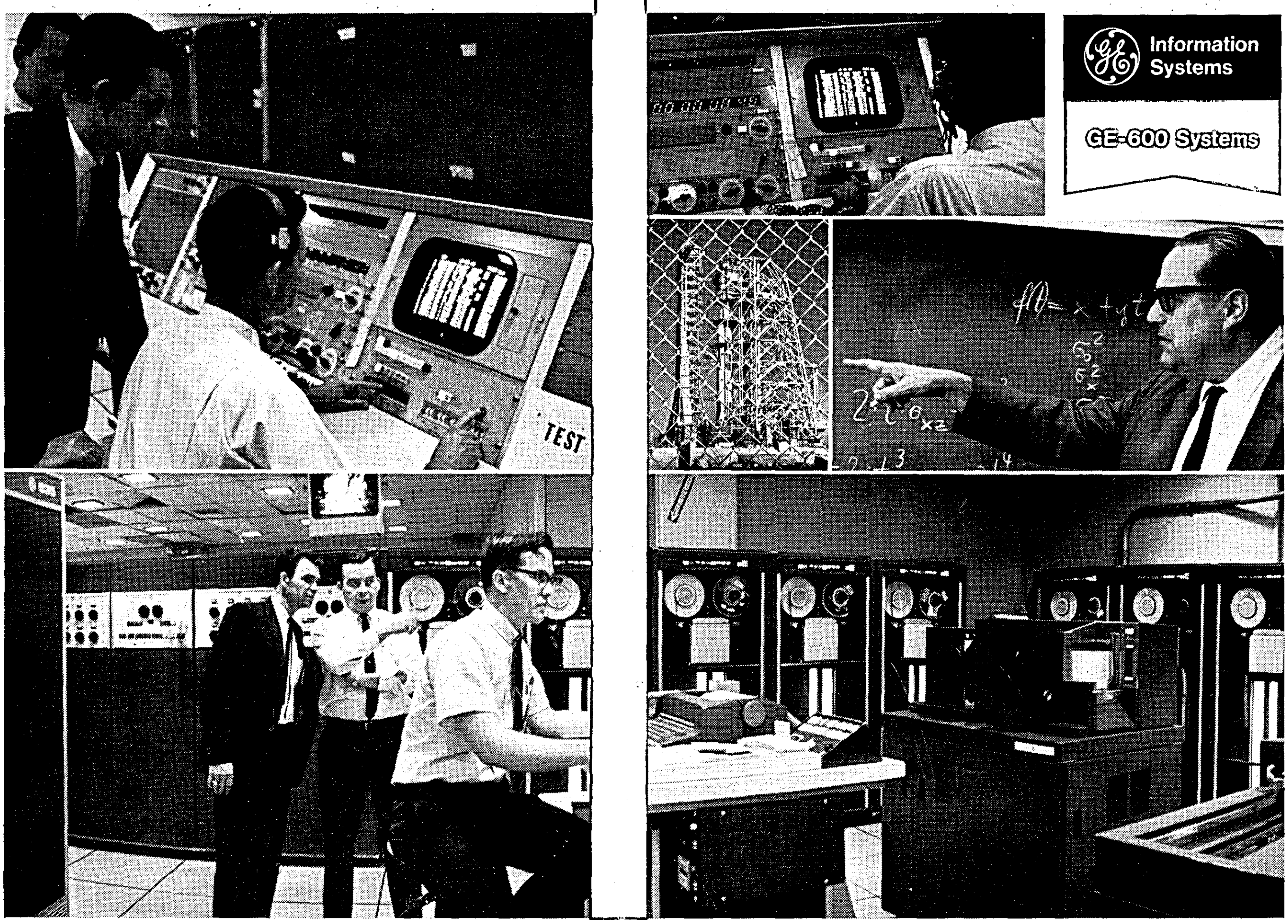
## new companies, mergers, acquisitions . . .

The boards of directors of **Scientific Data Systems** and **Xerox** have both approved the proposed acquisition of SDS by Xerox. Stockholders of both companies vote May 15. . . . **Time-Zero Corp.** has been formed through the purchase of the **Marshall Laboratories** subsidiary of Marshall Industries by a group of the company's management personnel and outside investors. Major objectives of the new company are to maintain its space instrumentation business and to utilize the advanced

*(Continued on page 214)*



# A GE-635 handles the Apollo launches.




Information Systems

GE-600 Systems

# But it has other things on its mind.

The same things you worry about every day: printing the payroll, engineering calculations, accounting...

"The GE-635 is the only information system anywhere that could perform the real-time data processing for the Apollo launch — and handle other necessary processing at the same time," says Dr. R. H. Bruns, chief of the Data Systems Division at Kennedy Space Center. "It is beyond compare."

Credit the people at NASA for a cost-saving decision. Rather than buy individual computers for specialized jobs, they chose a single information system with the ability to handle many programs concurrently — a GE-635 system.

**The 3-Dimensional Information System**

This same ability could be important to you. Because of it, a single GE-635 can operate in 3 dimensions, all at the same time:

1. **Local processing.** Replace your duplicate computers and their duplicate staffs with a powerful, central GE-635 system. You'll be able to handle dozens of jobs concurrently, so you'll get more work out faster.

2. **Remote processing.** Inexpensive input/output computers link directly with the central GE-635. This gives your satellite operations the full power of the GE-635 from any distance.

3. **Time-sharing.** Easy-to-use time-sharing terminals give your key people instant access to vital information, speed up their calculating ability.

That's why we call the GE-635 the world's only 3-Dimensional Information System. The Apollo launches have proved that it works successfully. Let us prove it to you. Call your GE Information Systems Sales Representative. Or write General Electric, Section 290-27, 1 River Road, Schenectady, N. Y. 12305.

*Computer marketing representatives—we're expanding our sales force to represent advanced products like this. Call R. C. Lonergan collect at (602) 941-3860 or write him at 3500 N. Central, Phoenix, Ariz. 85012.*

**GENERAL ELECTRIC**

technology to enter the industrial computer products business. . . . **University Computing Co.** has acquired **James A. Lewis Engineering, Inc.**, a Dallas-based consulting firm to the petroleum industry, and its Canadian affiliate. UCC has also announced an agreement in principle with **Automation Center International** of Zurich, Switzerland, for a consolidation of the two companies. Automation Center operates 10 computer centers in six European countries. . . . **Cubic Corp.**, San Diego, has agreed to acquire **G. S. Parsons Co.** and its subsidiary, **Parsons Medical**, for an undisclosed amount of Cubic common stock. Cubic expects the acquisition to add more than $3 million in 1969 sales and to lead the company into the area of medical electronics. . . . **Bowne & Co., Inc.**, of New York City, and **Computer Task Group, Inc.**, of Buffalo, have agreed to form **Bowne Time-Sharing, Inc.**, a new company which will develop and market specialized computer time-sharing services for financial and legal markets. . . . **Graphic Transmission Systems, Inc.**, an affiliate of EG&G, has opened a plant in East Hanover, N.J., and will develop and manufacture a line of graphic, computer and data acquisition systems. . . . **Leasco Data Processing Equipment Corp.** has acquired all of the capital stock of **Werner Assoc., Inc.**, an international management consulting firm. . . . Agreement in principle on terms by which **Atlantic Microfilm Corp.**, Spring Valley, N.Y., will be merged into **Arcata National Corp.**, Menlo Park, Calif., has been announced. . . . **Sterling Electronics** of Houston is at it again. They've entered into an agreement in principle to acquire **Kaysons International, Ltd.**, Los Angeles electronics and premium sales company, and have completed the acquisition of **Meridian Electronics, Inc.**, Richmond, Va. . . . **Computer Time-Sharing**, Palo Alto, has announced an agreement in principle to acquire the Lewistown Div. of **The Singer Co.**, which has been operated by Singer's **Friden Div.** The manufacturing facility is expected to give CTC the capability to supply special electromechanical and electronic hardware in support of the company's overall data processing systems. . . . Shareholders of **RF Communications Inc.** have approved a merger with **Harris-Intertype Corp.** in which RF Communications will operate as a decentralized subsidiary of Harris, under present management. . . . **ANTEKNA, Inc.**, specializing in the Quick-Reaction Capability (QRC) design and development of data retrieval systems and microwave subsystems, test instruments and synthesizers, has been formed in Palo Alto by a team of four men all formerly with the Applied Technology division of Itek. The company's first two products are test instruments for use in the development and check-out of overall systems. Plans call for a new product to be announced each month during the first year of operation. . . . Agreement has been reached for the purchase of **Frank W. Cole Engineering**, specialists in simulation modeling, by **Chilton Computer Co.** Both firms are headquartered in Dallas. . . . **Aero Data, Inc.**, has been formed in Syosset, N.Y., as a turnkey operation specializing in aircraft systems engineering. . . . Agreement in principle has been reached for **URS Systems Corp.**, San Mateo, Calif., software services firm, to acquire **Ken R. White Co.**, a Denver-based consulting engineering-architectural organization. . . . **Boothe Resources International, Inc.**, a new consulting and services firm, has been formed as a subsidiary of **Boothe Computer Corp.**, San Francisco. Boothe Computer is also involved in a three-company transaction that has resulted in the organization of a new firm, **Compterm Corp.**, which will be headquartered in the Phoenix area. Others in the establishment of the peripheral equipment company are **Panoil Co.** of Dallas, which has invested 45% of the more than $1 million capital, as has Boothe, and **Interactive Computing Corp.** of Santa Ana, Calif., which has committed 10% and in which Panoil has an interest. . . . **Wyomissing Corp.**, Reading, Pa., has entered the computer services field with the formation of **Datacomp Systems, Inc.**, which will offer both batch processing and on-line services. . . . **Electronic Memories, Inc.**, and **Indiana General Corp.**, have announced that the directors of both companies have approved in principle a consolidation of the two firms. . . . **Analysts International Corp.**, Minneapolis-based consulting company, has acquired **United Capital Investors Corp.**, whose assets are expected to increase AIC's opportunities through the establishment of a broad financial base. . . . **Information Interscience Inc.**, Philadelphia, which offers information services in the biomedical and other scientific and technical fields, has acquired the **Diagnostic Center Hospital** of Houston and the **Southeastern Medical Research Corp.** of North Miami Beach, Fla. In January 3i announced plans to acquire seven other firms, most in the medical field. . . . **Maryatt Industries**, Seattle, has formed a new division called **Data Processing Consultants, Inc.**, which will be headed by Gary A. McLean, former manager of dp consulting activities for Touche, Ross, Bailey & Smart in Seattle. . . . **Taxon Corp.** has been formed in Sunnyvale, Calif., to specialize in communications-oriented, computer-based systems for commercial and industrial users. President Robert C. Stender was president of Data Pathing for the past two years. . . . **EDP Learning Systems, Inc.**, New York City company which is developing and marketing computer training courses recorded on magnetic tape cassettes with accompanying study books, has acquired **Data-Tec Diversified Industries, Inc.**, NYC, also in the computer training business. . . . **Magnetic Resources, Inc.**, has been formed as a wholly owned subsidiary of **Computer Resources, Inc.**, Cleveland, a disc pack leasing firm. MRI is scheduled to begin operation next month of a disc pack testing and recertification service. This will include cleaning, balancing, and replacement of discs as necessary to bring disc packs back to optimal standards. According to CRI, owners and users previously had only the original manufacturer to turn to when disc packs began providing substandard performance levels. . . . **Cyber-Tronics, Inc.**, New Hyde Park, N.Y., dp and leasing organization, will acquire **Hackett Corp.** of Chicago, a manufacturer of edp punch cards and distributor of other suppliers for the industry, subject to approval of the directors of both companies and the stockholders of Hackett Corp. . . . **Optics Technology, Inc.**, Palo Alto manufacturer of CW and pulsed laser and laser systems, medical instrument and optical measurement instruments, has acquired **Metavac, Inc.**, of Flushing, N.Y., an optical thin film manufacturer. . . . **E.P.G. Computer Services, Inc.**, New York, has organized a wholly owned subsidiary, **E.P.G. Computer Centers Corp.**, a service bureau offering software services. . . . Majority interest in **Miller-Ellis Computer Systems, Inc.**, a Los Altos, Calif., software house, has been acquired by **Budget Industries, Inc.**, of Los Angeles. . . **Systems Associated**, a software services firm located in Long Beach, has agreed to acquire **Water Resources Engineers, Inc.**, Walnut Creek, Calif., which will operate as a wholly owned subsidiary under present management. . . . **Source Data Automation, Inc.**, a New York-based systems and peripheral equipment marketing firm established in February, has acquired the assets of **Record-A-Punch Corp.**, an affiliate of Marketscope Research Co., Inc., New York. SDA will market patented data acquisition equipment acquired in the merger that permits "unskilled individuals to communicate directly with the computer."

*(Continued on page 216)*

## news briefs

● Univac has opened a service center in Oak Brook, Ill., which it claims to be the largest in the midwest. The facility utilizes a Univac 1108 system, and is one of a chain of new service centers being established by the Information Services Div. throughout the U.S. A similar center was opened in San Francisco in December, and another will be opening in Phoenix shortly. The Midwestern Computer Center will be connected to all of the ISD Centers, including two in downtown Chicago. Equipment at Oak Brook includes a Univac 418 cpu, ten memory drums, twenty mag tape units, two Fastrand mass memory storage units, and three Univac 1004 systems.

● Victor Comptometer is easing into the computer services field. They have very subtly changed the name of their Better Business Services group to the Victor Business Services Div., which operates in the fields of temporary office help, business schools and data centers. Keypunch courses at the business schools have been revised and expanded, and additional computer-oriented courses are to be announced soon. The new data centers have begun preparing keypunch, paper tape and similar forms of input for computerized data systems. The division's expansion into these activities parallels Victor's entry into the computer market with its Series 800 line.

● Last fall, Continental Assurance Co. introduced Comp-U-Term, a tailored insurance concept. Since then more than $13 million in Comp-U-Term coverage has been applied for. Said to be the first of its kind in the industry, the program was developed so that term insurance buyers can fashion a policy to fit their needs rather than bend those needs to fit the limits of "packaged" policies. An agent can specify for each prospective buyer some 25 variable factors which he may adjust in designing a customized policy. The data is sent to the company computer center on a special proposal request form. Continental's 360/50 can produce a proposal in about 15 seconds. In one instance the company made 20 separate proposals to a client in one week; without Comp U-Term it would have taken months to prepare the same proposals.

● Burroughs Corp. has realigned its manufacturing and engineering operations with the establishment of a new operating unit, the Components Group. The new organization has responsibility for the development and manufacture of components, subassemblies and subsystems for use in Burroughs computer systems and business equipment products. J. I. Miller, previously assistant to exec vp Paul S. Mirabito, has been appointed general manager of the group, which will be headquartered in Detroit.

● The Electronic Industries Assn. has outlined to the FCC six subject areas for discussion at engineering and technical conferences to be set up by the FCC with telephone industry representatives: performance and availability of communications common carrier facilities; design flexibility and network signalling; competitive opportunities and constraints; interconnection of public and private services; tariff definition clarifications; and the changing nature of the switched network. EIA disagrees strongly with the telephone company contentions that signalling units be provided only by the telephone company.

● Bell System is offering free to high school science programs an education aid entitled "Understanding Computers," which features a cardboard computer with the heartwarming name of CARDIAC (CARDboard Illustrative Aid to Computation). It simulates most of the equivalent parts of an actual computer—accumulator, instruction register, memory cells and I/O system—and has a repertoire of 10 instructions. Designed to help a student understand the basic workings of a computer and to aid in an introduction to programming, CARDIAC comes with a 53-page manual that relates it to faster, larger computers and leads the student through 10 programs, from simple addition to game playing.

● In an effort to determine the extent and effects of CAI, the Office of Education is sponsoring a critical evaluation of current technology, applications, costs, effectiveness and trends for uses of computers in instruction. The project is under the direction of Dr. Karl L. Zinn at the Center for Research on Learning and Teaching, Univ. of Michigan, and is nationwide in scope. All persons currently engaged in research, development or operational use of computers in instruction are invited to send reports, sample materials, projected plans and other related information to Dr. Zinn at 1315 Hill St., Ann Arbor, Michigan.

● The Rand Corp. will also conduct a study of the uses of computers in instruction in higher education under a one-year contract with the Carnegie Commission on the Future of Higher Education. The Commission will publish the findings of the study, scheduled to be completed in January '70, and will distribute them as one in a series of reports to academic leaders, legislators and the public. The study will be concerned not merely with page-turning techniques but with all uses of the computer in CAI, including problem solving, the generation of automated films, and the simulation of laboratory operations. The project is headed by Dr. Roger Levien, chief of Rand's System Sciences Dept., who will cooperate and be in communication with Dr. Karl Zinn, Univ. of Michigan, and his team, which is conducting a related study (above). Dr. Levien will research the potential of CAI, as well as its current status and effect.

● Traffic analysis by an IBM 360-30 hopefully will give the department of safety, Akron, O., an insight into automobile accident causes. Source documents will include traffic citations, accident reports, etc., to determine accident frequency patterns. The city officials hope that by analyzing this they will be able to lessen the 1968 record: 13,000 accidents on the city's 900 miles of streets which claimed 49 lives. Under consideration will be such things as the time of day, weather, speed, and traffic congestion at accident sites. This may lead to some conclusions about reducing speed limits, patrolling in high traffic areas, or adding traffic signs and signals. The computer, which also serves the departments of finance, service, and planning through 2260 display terminals, is soon to add the health department. The police will also be using terminals for information on traffic accidents, arrests, criminal records, and administrative matters.

● Michigan Blue Shield continues the race in converting items for computer entry—the number jumped to 178,000 last January and has required increasing Data Recorders to 144 from 96, plus two outside service bureaus. Now MBS has added ocr in a contract with a new bureau setting up in De-

# news briefs

troit, Corporation S, a subsidiary of Recognition Equipment. On May 1—target operational date of the Electronic Retina Computing Reader that was delivered at the end of March—MBS will be using ocr for 80,000 items a day on prescription drugs. Costs of conversion by MBS are: 5½-6¢ item keypunched, 3½-4¢ by recorder internally, 1½¢ by ocr direct read and 3½-4¢ where items must first be typed before used in ocr. A $1 million savings by ocr use is expected in two years. The Detroit bureau will be one of 12 to be made operational this year across the country by Corporation S.

● PROBLEMATICS, Inc., Waltham, Mass., is a newly established firm that will develop, manufacture and market turnkey computer systems to commercial and industrial users, focusing on industry-wide areas of application rather than the highly specialized user. Emphasis will be placed on those applications in which the measuring equipment can be under the control of the computer being used to digitize and format the data, and petroleum operations would seem to be a likely market. The company intends to purchase most major components, including the computers, and will itself develop the programs and interfaces necessary to a system. President of PROBLEMATICS, Inc., is Dr. Joseph D. Grandine, formerly vp at Adage, Inc.; vp's are Frederick E. Booth, Jr., for engineering, Dr. Steven T. Polyak, for software, and Morgan R. Walker, for marketing. Vincent A. vanPraag is a founder and a member of the board and will serve as a consultant to the firm with responsibilities in financing and market research and development.

● After nearly six years of litigation, Dave Ferguson, president of Programmatics, has won in the California Supreme Court in his suit against Computer Sciences Corp. It was alleged that CSC had given him a $10,000 secret bonus agreement and then later attempted to recover $6,000 of it. Ferguson counter-sued for unpaid vacation and profit sharing he said was owed to him. He won and CSC lost on both counts two years ago. CSC has since lost appeals to two higher courts, most recently to the state Supreme Court, which denied the company a hearing.

● Four former members of the NCR staff that developed the Century Series have established a new firm, Q-Data Corp., Hawthorne, Calif., to provide generalized proprietary software packages and systems support for Century users. President of Q-Data is Isador Pardo, quondam director of systems planning at NCR headquarters in Dayton, Ohio; exec vp is Martin F. Berman, who directed the systems software activities for the Century. Other vp's are James N. Tomblin and Daniel J. Marro. Charles Crandall, formerly with CSC, has also joined the staff. The company, which is financed by Drew National Leasing Corp., New York, also offers hardware capability but will do no manufacturing.

● Programming Methods, Inc., New York software firm, will design and install a computerized sales authorization program for the Eastern States Bankcard Association, a group of banks sponsoring the Master Charge program in New York and surrounding states. The system will permit merchants in the eastern states to phone toll free to a Master Charge sales authorization center and obtain immediate credit authorization for transactions exceeding normal credit card limits. The central computer at ESBA's New York headquarters will contain up-to-date account information on each cardholder, or will communicate directly with a computer at the cardholder's own bank if the account file is maintained there.

● A "packaged" dp service designed to bring the advantages of the computer to smaller retailers has been developed by NCR. The service is available through the 31 NCR dp centers and includes monthly accounts receivable processing, sales analysis, and clerk activity reports. The retailer may prepare his own input by using an NCR adding machine especially designed for use with the service, or he may simply send sales slips to the nearest NCR data center. In the latter case, data center personnel encode the sales data for entry into the computer. The adding machine is furnished in two models, offering either ten or fourteen rows of keys. Prices start at $760, or $35/mo. The data center fee will range upward of $60/mo., depending on volume for those users who prepare their input by adding machine.

● The USASI X3.4.3 FORTRAN Working Group has resolved to begin consideration of standardizing FORTRAN programming language extensions. Inquiries and suggestions should be made to the X3 Secretary, BEMA, 235 W. 42nd St., New York, N.Y. 10017.

● The Access Floor Manufacturers Association was organized in Baltimore on February 25th by nine manufacturers, with the major goal "to encourage wider use of access floors," including computer-room and other applications. The group, which claims its membership includes over 90% of all the national firms manufacturing access floors, intends to establish policies, procedures, and manufacturing standards within the industry.

● Greyhound Computer Corp. has signed an agreement to purchase the entire stock capital of Management Dynamics, Ltd., London, and its subsidiary companies. The agreement, made with current owner Brooke Bond Liebeg, Ltd., is subject to final approval of U.K. and U.S. government agencies. Management Dynamics is a 670-man firm engaged in computer service centers, data preparation, management consulting, and dp personnel placement. Unaudited figures for the 28 weeks ending Jan. 12, 1969 showed Management Dynamics after-tax profits of $190K, with each of the four dp areas profitable. Purchase price is about $6.5 million cash, financing to be arranged in Europe.

● National Information Systems Corp. has been formed as a subsidiary of National Liberty Corp., Valley Forge, Pa., a holding company that was formerly an insurance firm of the same name. The new corporation has taken all of National Liberty's hardware and edp personnel, a total of 43 people and two 360/30's, in conjunction with a long-term facility management contract. In addition to facility management, NIS intends to engage in software development in the areas of insurance, mutual funds, information retrieval, and product development, including eventual manufacture of specialized hardware, such as special-purpose terminals. Head of the new firm is Carl G. Sempier, formerly asst. vp in charge of business systems and information services for the Penn Central. Joseph A. Gattuso, formerly of the Micro-Electronics Div. of General Instrument Corp., Hicksville, N.Y., is vp of business research and planning. William K. Klemens, vp information

*(Continued on page 223)*

we invite you to

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your window for seeing "what if?"
*Dialog by computer light.* The investigator speaks with a light pen . . . the computer screen replies and queries him in return. Images change; data evolves. Through their electronic window, man and computer interact, simulate real events, telescope time . . . come up with completely unforeseen possibilities.
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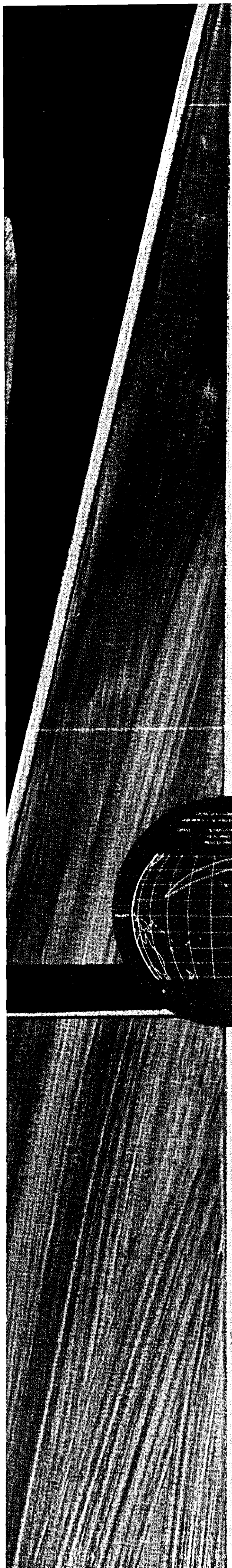
*He could in fact be you.*



## FOR DESIGNERS

A CONTROL DATA DIGIGRAPHIC® System equips you to create and analyze new concepts in far less time. Multiplies your effectiveness. *Interacts with you* in the closest marriage of man and computer ever achieved. Few potential users have had the first-hand opportunity to discover the meaning of this innovation, but in numerical control alone it already is saving untold time and dollars.

## FOR EXECUTIVES

CONTROL DATA Interactive Graphics is the most effective way by far to determine *"what if?"* Think of the potential to explore economic, market and manufacturing alternatives in a direct running dialog with your computer — *without any need for computer expertise.* Financial and business problems can be more precisely assessed. Probable consequences of decisions can be evaluated on-the-spot. Here is an unprecedented tool for sales forecasting and planning . . . for generating bar charts, sales curves, percent-to-sales figures, on demand. A powerful, creative way to reinforce your decision making.

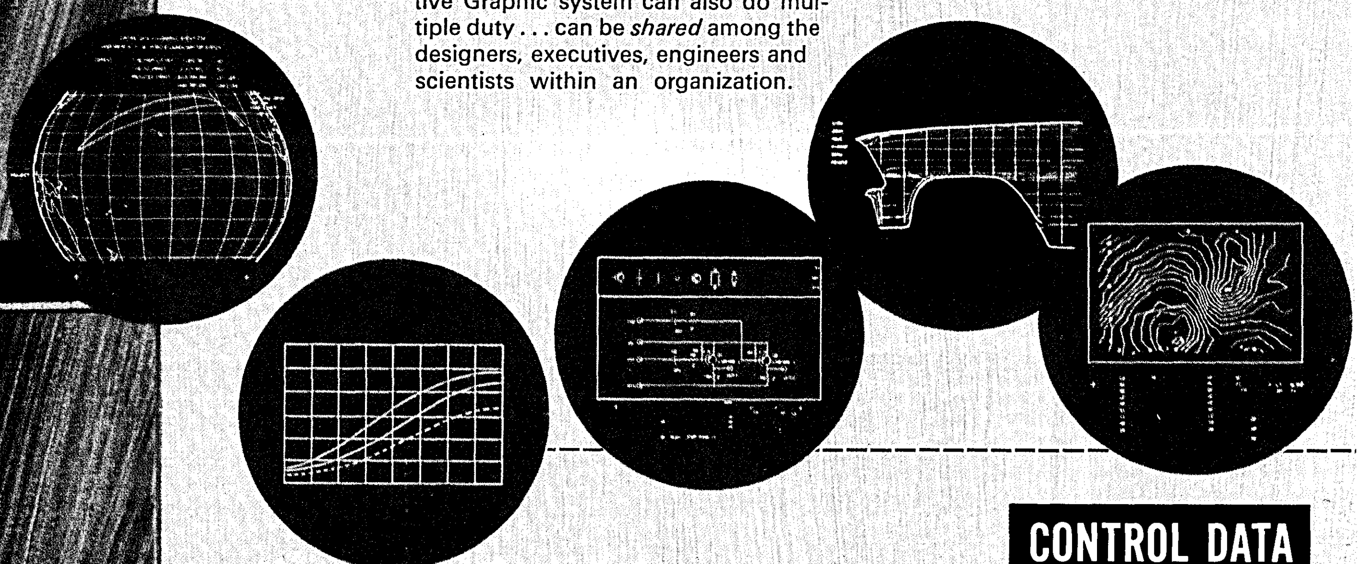
## FOR ENGINEERS

. . . call it creativity amplification. *"What if"* can be probed and visualized in a flowing dialog, with the computer doing the tedious housekeeping, formulation, data retrieval, graphic rendering. A number of leading engineers are deep into computer graphics already (few are willing to reveal the specifics, for competitive reasons). Here as in other applications, a hard copy of graphic results can be extracted or graphic images can be retained on magnetic tape, for future visual recall.

## FOR SCIENTISTS

Interactive graphics offers a highly creative working environment . . . iterative interaction of incalculable value to disciplines as far ranging as physiology and nuclear physics. You can hash and re-hash complex problems rapidly . . . mull over mountains of possibilities. Simulate, compute, evaluate . . . in continual communion with the computer. Control Data offers the finest hardware and software in the industry for graphics. The largest addressable display area. Buffer memory for off-line refreshment of images.

• A single CONTROL DATA Interactive Graphic system can also do multiple duty . . . can be *shared* among the designers, executives, engineers and scientists within an organization.



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**CORPORATION**

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*and a demonstration*

Indicate your interest:

☐ Send brochure on Digigraphic Systems ☐ Have representative call

☐ We wish to view your demonstration film ☐ Other (describe)

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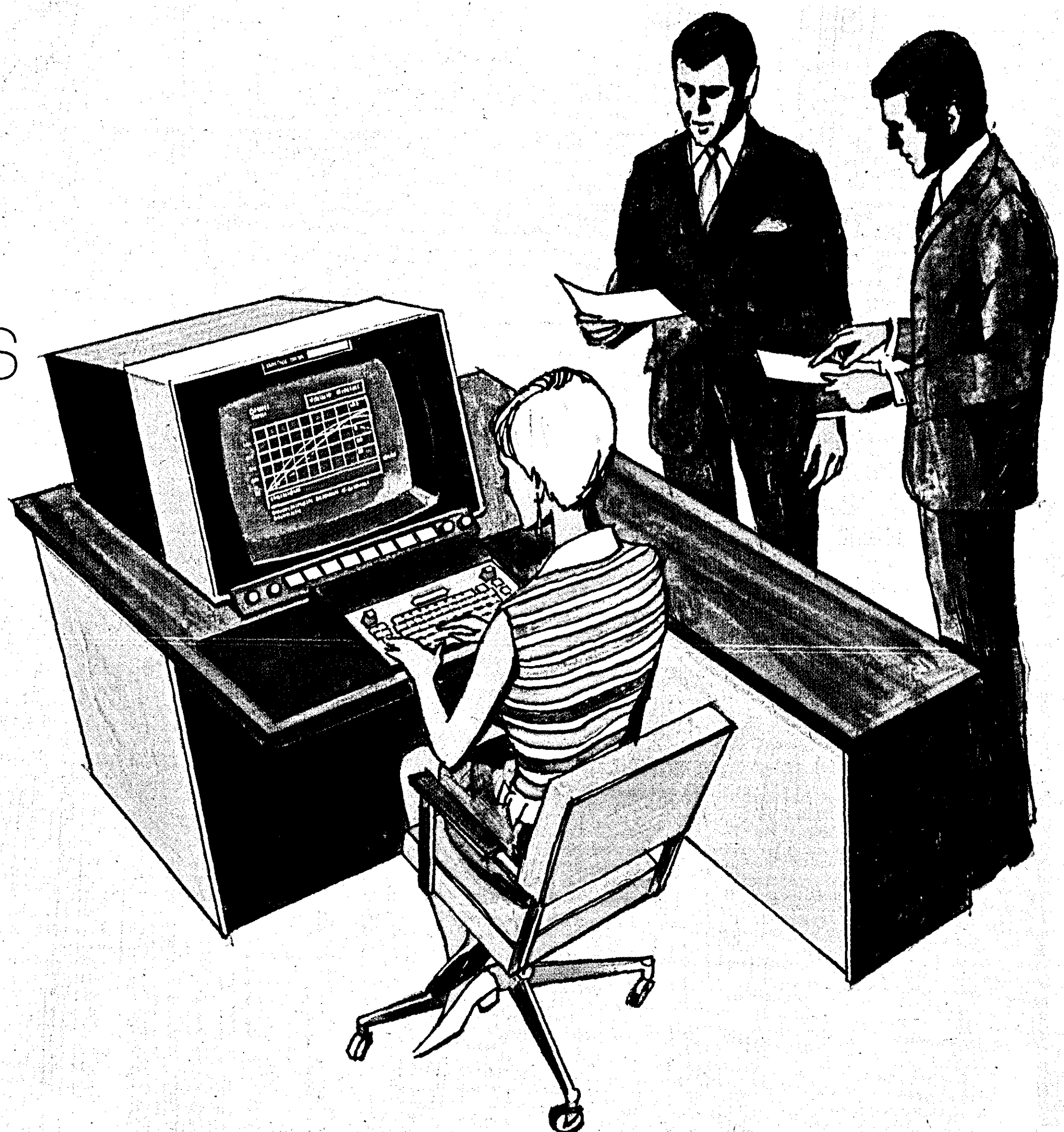
NATURE OF WORK________________

COMPANY________________ DEPT.________

ADDRESS________________

TELEPHONE________________

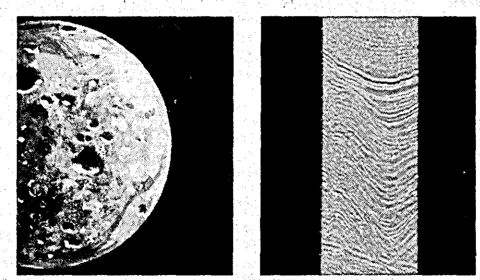
# picture your own graphics terminal



Imagine a CONTROL DATA Interactive Graphic System at your fingertips. The potentials for on-the-spot evaluations, fact finding, visualization of business factors, sales curves, bar charts. Graphics can be the tool of anyone with the imagination to exploit it.

Control Data will gladly work with you to develop special remote access systems. Special software and support are the finest in the industry. Customized terminals such as the one shown can supplement light pen consoles . . . allow you to input questions alpha-numerically from a distance, and obtain answers in graphic form, via ordinary telephone lines.

The place to start your planning is with your Control Data representative. We can put you in touch with him and help arrange a demonstration.



## image processing capabilities

Image scanning, and tonal presentations of data are also being accomplished with CONTROL DATA Graphic Systems.

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CORPORATION

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Minneapolis, MN 55440

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Litho in U

services, was formerly vp of field programs at Management Assistance, Inc.

● The Financial Computer Center of Eastern New York, Inc., a dp cooperative jointly owned by 12 banks with assets over three-quarters of a billion dollars, has installed a second $1.5 million GE-415 system. The center processes some 300,000 items daily on its two GE 415's, using three shifts five days a week. Processing includes 85,000 savings accounts, 130,000 checking accounts, 60,000 installment loan accounts, Christmas and vacation club accounting, full account reconciliations and dividend accounting. Additional services are offered to bank customers through member banks for payrolls, account reconciliations, and other special applications. Eventually, time-sharing facilities are expected to be implemented, with terminals in each member bank. The cooperative approach to edp is said to permit smaller banks to effectively compete with larger banks.

● Adage, Inc., Boston, Mass., has reduced prices 10% to 15% across the board on its VT-Series of A/D converters and accessories designed for use in systems involving high data rates, such as signal analysis, radar, and hybrid computer linkage. The firm stated that reductions were made possible by "manufacturing cost reductions resulting from increased production runs and a new manufacturing technique for internal wiring."

● Fourteen-months old Data Usage Corp., Ft. Lee, N.J., developers of Documatic, an automatic program documentation package for IBM 360 RPG programs, is expanding to include service bureau facilities. Called Data Usage Data Services, the s-b will concentrate on assisting companies who find their current dp work unacceptable. The 11-man firm will provide a consulting service to assist customers in re-evaluating their dp requirements, a programming staff to implement applications, and, when necessary, use of the company's Univac 9300 to process data.

● Honeywell is having a nine-story office building erected in Southfield

(*Continued on page 224*)

## news briefs

and expects its various divisions to occupy four floors when the building is completed in early fall. This is part of a stepped up drive to put more of Honeywell's computers and instruments into the Detroit automobile plants—Honeywell already has $45-50 million worth of computers installed in auto companies. This percentage is higher than its across the board computer business, according to James H. Binger, Honeywell's board chairman who came down from Minneapolis to a press conference in Detroit to announce the building. Binger said that his company expected to double its business with the auto companies both in computers and instrumentation within the next five years.

● Gay Togs Inc., New York maker of women's and children's sportswear, is installing an NCR Century 100 which will coordinate cutting room activities with demands of the marketplace. The system will at first be applied to a two-phase inventory problem. A weekly cut-and-sold report will enable the Gay Togs factory at Inwood to accurately adjust production to requirements, as reflected in incoming orders from representatives throughout the country. The ability to control the finished-garment inventory down to details of color, style, and size is expected to virtually eliminate unsold stocks at the end of a season. Another phase of the inventory applications will involve up-to-date data on pieces-on-hand, or the supply of uncut material in stock at the factory. The Century 100 system also is to handle billing, receivables, and payroll for the firm.

**shortlines . . .**
Demand for the Century Series computers, says NCR, has necessitated another major expansion of their Electronics Div. San Diego facilities. The division manufacturers the principal units of the family of computers. . . . Lockheed-California Co. has ordered a high-speed data acquisition system valued in excess of $1,225,000 from Astrodata. . . . Standard Computer Corp. has announced a new sales policy which offers small- to medium-scale commercial and scientific computer users savings "up to 41%." The most "revolutionary" phase of the new policy is said to be the 30% discount to lease clients needing only 100 hours per month. . . . A new satellite communications telex link that will enable the exchange of printed messages between the U.S. and Brazil has been opened by ITT World Communications. . . . Computer Sciences Corp. has

## news briefs

been awarded a three year contract to operate a large-scale remote computing center at Las Vegas for the AEC. Funding for the first year of the contract has been set at $890K. . . . UCLA has received final approval for the new School of Engineering and Applied Sciences that will offer campus-wide courses in the computer sciences and generalized systems analysis to accomplish the interaction between engineering, the behavioral sciences, and the humanities. . . . Release 8 of Informatics' Mark IV file management system is now installed at more than 100 installations throughout the world. . . . Rice Univ. has received a $400K NSF grant for expansion of its computer facilities. . . . Boole & Babbage, Inc., has announced a policy of providing educational institutions with a 25% discount on the purchase price of all systems measurement software products. The company is considering the development of a text book to be used in teaching the techniques and methods of computer systems measurement at the college level and invites interested parties to correspond regarding their ideas on the need and contents of the courses of this nature: 1121 San Antonio Rd., Palo Alto, Calif. 94303. . . . Com-Share Inc. has ordered an SDS Sigma 7 time-sharing computing system valued at over $2 million. . . . Dallas-based Information and Computing Centers Corp. has accepted its CDC 6600 system following extensive checkout at Control Data's Minneapolis facilities. . . . A misguided public relations man, perhaps motivated by tales of debugging woes, phoned to ask if DATAMATION would like to attend a press luncheon announcing a new pesticide. . . . Leasco Data Processing Equipment Corp. has agreed to purchase a 20% interest in SEMA (Metra International), parent company of the Metra Group, Europe's largest management and computer service organization, with 1968 revenues of $33 million. The Group operates service centers in Paris and London, each equipped with CDC 6600 systems. Maximum purchase price to be paid by Leasco is $12.2 million, with the exact amount to be based on Metra's earnings through 1973. . . . Salt Lake City service bureau BMA developed an on-line inventory control package for the Burroughs 300. But would Burroughs buy it? No, so SDS did, for its Sigma 5. . . . A New Jersey service bureau feels that IBM prices unfairly; the firm received a computer-prepared bill from the gray fortress which included New Mexico state sales tax. . . . Since Jan. 1, Digital Equipment Corp. has shipped five PDP-10 computer systems to customers abroad: the French Atomic Energy Commission; the Univ. of Munich; Rolls Royce, Ltd.; Oxford Univ.; and Chalk River Nuclear Laboratories, Ontario, Canada. . . . Univac has received a contract from Sanyo Electric Co. Ltd., Osaka, Japan, a manufacturer of electrical appliances, to supply a $3.4 million Univac 1108 system, including two Fastrand mass storage units, each capable of holding 132 million characters, plus eight memory drums and ten mag tape units. . . . Applied Logic Corp., Princeton, N.J., has appointed Direct Research, Inc., New York business software house, as AL/COM time-sharing network Associate for the New York City area. . . . Telemax Corp., Fairfield, N.J., will provide computerized reservation service for the new chain of franchised Marriott inns. . . . Mohawk Data Sciences Corp. has received orders in excess of $2 million from Digital Equipment Corp. for page printers and card handling equipment to be used with DEC's PDP-9 and PDP-10 computer lines. . . . Observers along Route 128, the "electronics highway" near Boston, report up to six light planes trailing banners and sky-writing messages urging job-hoppers to "Go Honeywell." Origin of the overflights was traced to the Computer Control Div. . . . Randolph Computer Corp., New York, has completed a $14 million Eurodollar financing arrangement with a consortium of U.S. and European banks. These funds will be used to expand the firm's U.S. and Canadian operations. A spokesman for the firm stated that "tight money" in the U.S. had made Eurodollars more attractive than domestic financing.

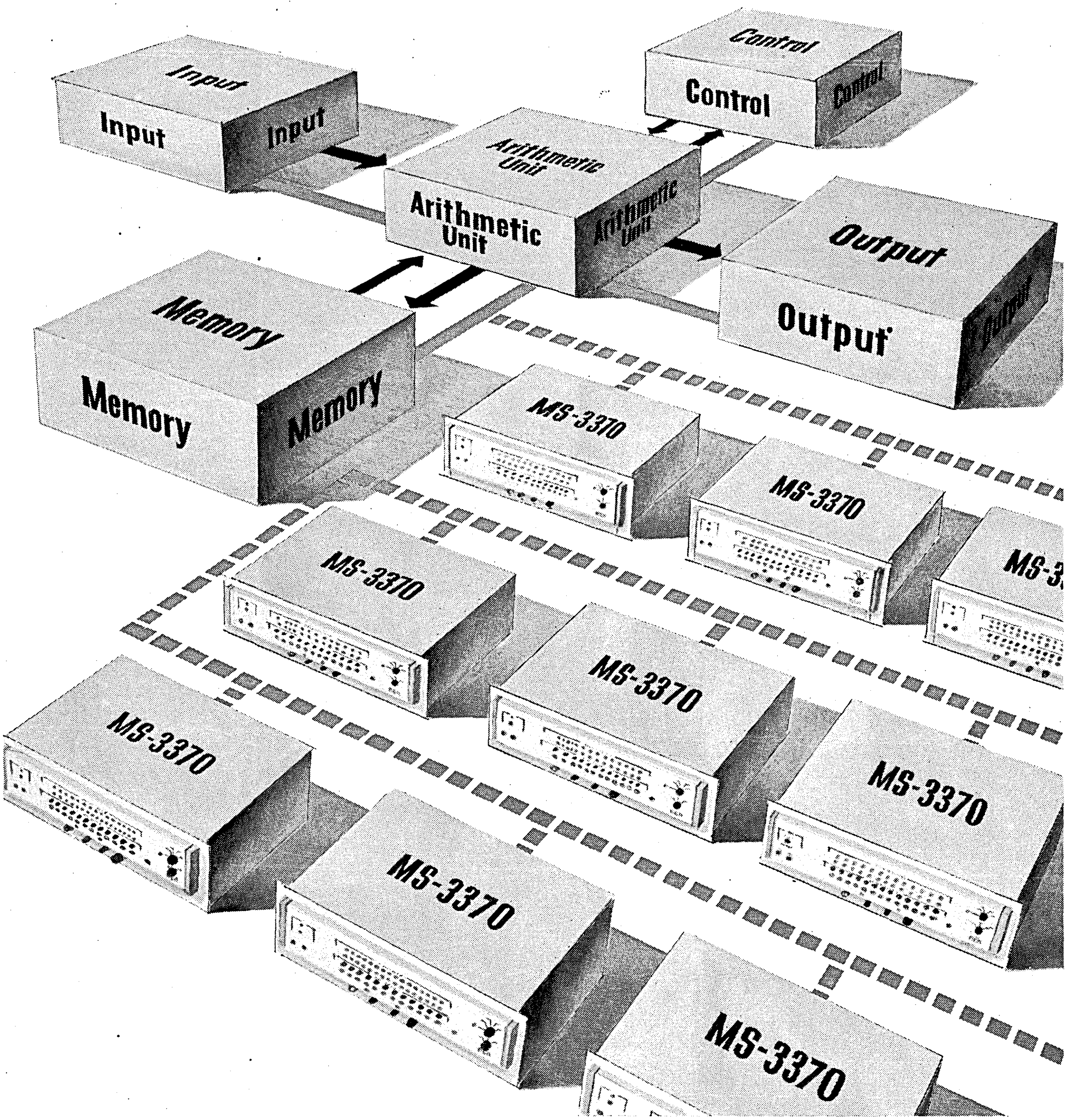
### call for papers . . .

**25th National Electronics Conference,** Chicago, Ill., Dec. 8-10. Tutorial papers, research papers and reports on new engineering applications are requested. The latter may include components, devices, design techniques, applications and management. Papers dealing with microelectronics and applications of computers to modern engineering problems are of particular interest. Prospective authors are asked to submit 15 copies of a 75-word abstract, suitable for use in the program announcements, and 15 copies of a 700-word summary by April 26 to Dr. J. Robert Betten, Dept. of Electrical Engineering, Univ. of Missouri, Rolla, Mo. 65401. Final manuscripts will be due August 15 and will be published in the conference **Proceedings.**

*(Continued on page 230)*

# Is your computer ready for memory expansion?





# You may not need all that the TS-1130A can do.

# Then consider the 1130B.

**One or the other offers the complete tape system for your needs — let our man guide you to the model which delivers the most for your money.**

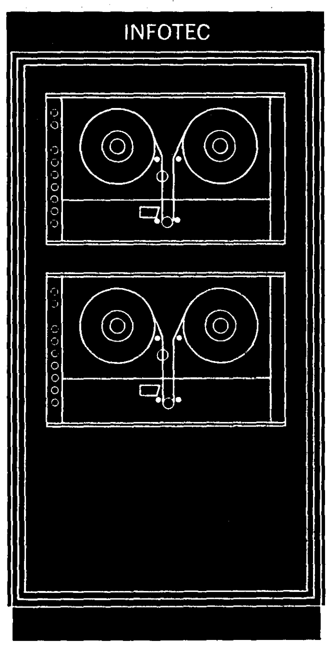
We here at INFOTEC take great pride in the fact that ours is an organization offering *complete systems,* not just pieces of equipment. Our expertise is a combination of creative engineering talent and in-depth data processing know how.

We fully realize the capabilities of our equipment. We know what our unique TS-1130A can do. And we know that in some cases it's just too much system for some needs. We don't hesitate to say so and to recommend the low-price TS-1130B. If we feel that you don't even need 1130B we'll say so too and even inform you of another firm's equipment if we think it might be the best thing for your particular needs.

INFOTEC built its excellent reputation on the corner stones of complete service, hardware and software and maintenance for both. The day our men leave your establishment you are completely set up and ready to operate. No further hardware or software is needed.

1130B—UNIQUE IN EVERY SENSE OF THE WORD—AND ONLY $6,650.

The 1130B has no peer. It's as simple as that. There just is no other unit available today that can duplicate the functions of this unique tape system. Those




that come near are priced anywhere from 15 to 40 thousand dollars, yet INFOTEC'S 1130B, with quality components, handsome styling and high efficiency of operation may be purchased for a realistic $6,650!

TS-1130B is an umbilical to the data processing and communications world. It is used efficiently as a program library, as a driver for a plotting system in conjunction with INFOTEC supplied software and as a storage medium for historical files. Consider its virtuosity in conjunction with solving your firm's problems.

TS-1130A offers expanded capabilities over 1130B, through a more versatile controller and/or faster tape handlers.

Of course, INFOTEC supplies full software support, operating under the 1130 Disk Monitor System. This software allows access to the magnetic tape units via the ordinary read/write instructions of the FORTRAN language. This provides all the flexibility of a list and the ability to use FORMAT statements to specify the necessary code and external/internal conversions. It also allows complete physical control of the tape transports.

The INFOTEC TS-1130 systems operate via the 1130 Storage Access Channel adaptor (Sac I or Sac II).

Some important specifications for your information:
Packing Density/*200, 556 or 800 B.P.I.* • Transfer Rate/*up to 4000 C.P.S.* • Tape Speed/*5 I.P.S.* • Tape Width/*½"* • Reel Size/*6½"* No.of Tracks/*7 or 9* • Start Time/*100 ms* • Stop Time/*75 ms*

That's it. Your brief introduction to the amazingly capable, amazingly low priced INFOTEC TS family. We'd be pleased to answer your queries and help solve your business problems.

*You may contact us at:*
INFOTEC, INC., Dept. D
22 Purchase St., Rye, N.Y. 10580
(914) 967-1325

INFOTEC
Information Technology

# news briefs

**IEEE Automatic Support Systems for Advanced Maintainability National Symposium,** St. Louis, Mo., Nov. 3-5. Topics to be covered at the symposium include skills and tools applicable to automatic support system engineering, system concepts and trends, advanced testing technique involving automatic methods, computer applications in implementing automatic support and systems, hardware/software development and application techniques, fault isolation techniques, and on-board monitoring and fault detection. Deadline for abstract submittals is May 30, and all abstracts must include: complete title of proposed paper; name, title, company affiliation, including department, section and complete mailing address of the author(s); a summary of important conclusions and expected impact of subject on the field of automatic support systems; an approximately 300 word summary of material to be developed in the proposed paper. Notification of accepted papers will be given to authors by July 1. Papers accepted for publication must be received by Sept. 15. Send abstract material to Matthew F. Mayer, P.O. Box 4124 Jennings Sta., St. Louis, Mo. 63136.

**ACM Symposium on The Application of Computers to the Problems of Urban Society,** New York City, Oct. 24. Papers are solicited on computer applications and experiments in: urban information systems; urban planning and operations research; architecture; pollution, housing, transportation and welfare problems; and education. Abstracts of about 500 words in length should be mailed before June 1 to: Jessica Hellwig, Columbia Univ. Computer Center, New York, N.Y. 10027. ■


The Ossie Award
Presented by
Systems Engineering Laboratories
for displaying a deep insight into
the problems of computer evaluation.

**system spotlight**

*This is one of a series of descriptions of new computer-based systems of general interest. The equipment discussed is already installed and operational.*

*Information for this series is invited. Applications submitted should involve a computer as a controller.*

re-entry simulation

# SUPERSONIC WIND TUNNEL DATA AQUISITION SYSTEM

## Sandia Laboratories, Albuquerque, New Mexico

Space vehicles re-entering the earth's atmosphere are subjected to the same heat and pressure conditions that destroy many equally large, dense meteorites. The $2.6 million test facility at Sandia Laboratories in Albuquerque, New Mexico, was constructed to assist in creating materials and designs capable of withstanding the re-entry forces and protecting our returning astronauts.

### computer and peripherals

Honeywell DDP-116 processor 8K words of core memory, 1.7 usec cycle time
Midwestern 4000 mag tape unit
Vermont Research 108A drum
Astrodata analog/digital converter
ASR 33 teletypewriter
Moseley XY plotter
Digitronics paper tape reader

### application

The High Enthalpy Arc Tunnel (HEAT) test facility is essentially a very high temperature supersonic wind tunnel. Within its six-foot chamber, a mixture of oxygen and nitrogen gas is drawn through an electric arc which heats it to as much as 10,000°F. Three steel arms move test samples into the plasma stream created. The samples or models may be positioned under any of the plasma generator's several nozzles, subjecting them to enthalpies ranging from 2,000 to 20,000 BTU/lb. (For those who do not remember their high school physics, enthalpy is a thermodynamic unit of measurement of the specific energy level of a substance. In the case of the HEAT facility, an enthalpy of 20,000 BTU/lb. corresponds to a re-entry vehicle speed of 31,400 feet/sec or 21,400 miles/hour.)

The extremely low pressures on the downstream side of the plasma stream are produced by a five-stage ejector system driven by 550,000 pounds of steam per hour. Associated equipment includes a 300,000-gallon water storage reservoir and a cooling tower for the steam condensers.

The Sandia facility is one of several large plasma arc chambers now in use in the United States. However, it is the only one designed for use with radioactive materials, and therefore the only one capable of performing aerospace nuclear safety studies for the Atomic Energy Commission. Exhaust gases from the chamber can be isolated and filtered to remove radioactive products, and the tunnel is designed so that it may be easily washed clean of radioactive contaminants.

### hardware

The Honeywell-based computer system performs the necessary on-line and real-time control of data acquisition and recording; it also provides general off-line computation, including the reduction of previously recorded data from history tapes.

The 116 is fed by an Astrodata analog to digital converter system which accepts up to 200 channels of low-level (0-100 mv) information and 100 channels of high-level (0-5v) information through three first-rank multiplexers of 100 channels each. The resulting three signals are combined into one signal by the second-rank multiplexer. The Astrodata system scans 200 channels, polling each for 1/5,000 second. It can complete up to 10 200-channel scans per second. The signal from the second-rank multiplexer is converted to a digital 12-bit binary word (including the sign bit) by the a to d converter. The raw data, now in digital form, is fed into the computer through a Direct Access Channel (DAC).

Each channel of raw data is reduced to engineering units by a scaling program, and both the raw data and the reduced data are then stored on mag tape. Either the tty or the 300 cps Digitronics paper tape reader can be used to input the parameters needed in scaling the raw data, the specification of the calculations to be performed, the selection of the channels to be monitored on-line, and the identification of each channel of information to be recorded. In operation, eight channels of data are printed on-line on the ASR 33 as a sample real-time check on the operation of the system. Two of three calculated quantities, heat flux, pressure, and enthalpy, may also be printed.

The computer console allows the operator to monitor the input voltage or the reduced value of any channel or any calculation on a Nixie display, using a thumbwheel digiswitch to select the channel. Certain parts of the program, such as the data acquisition rate, can be modified by another set of digiswitches on the same panel.

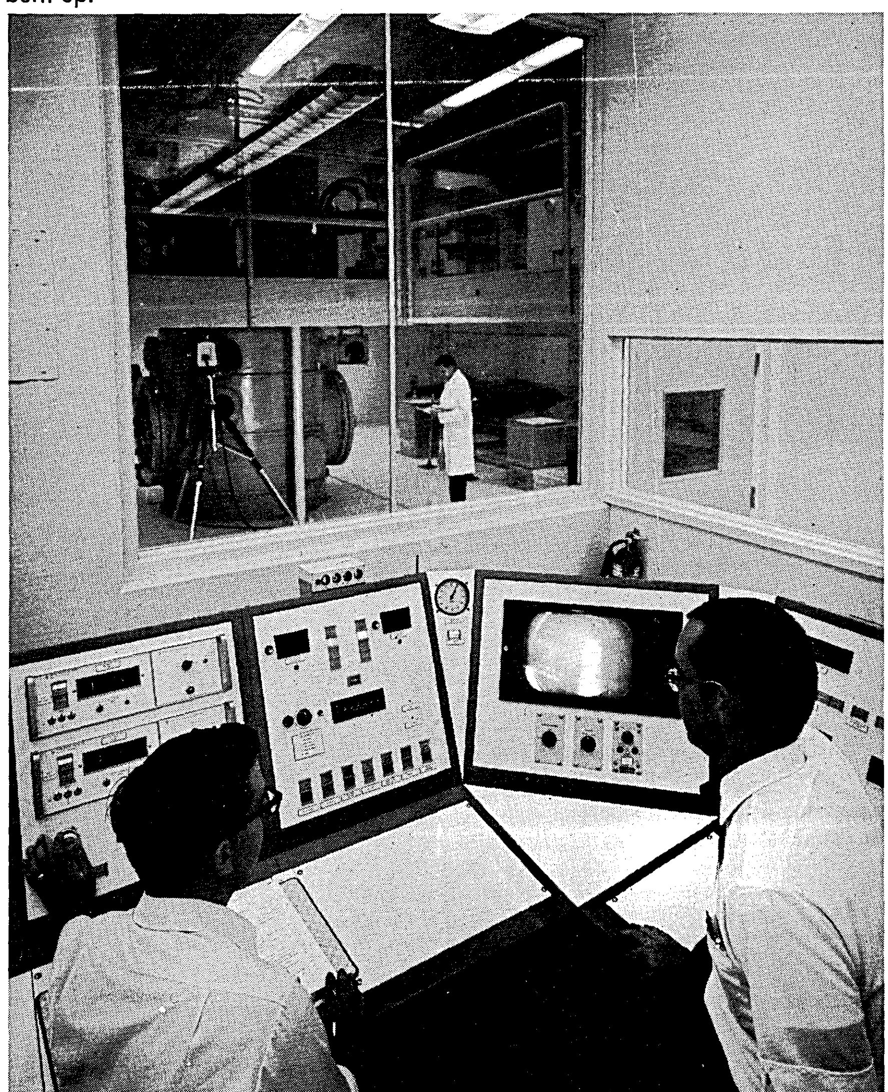
At set-up time, programs are loaded onto the 64K, 60,000 words/sec, Vermont Research drum memory from paper tape. The transfer of programs from the drum to core is effected through a DAC channel. Yet another DAC allows the cpu to control the acquisition of data through the Multiplex Control Logic Unit.

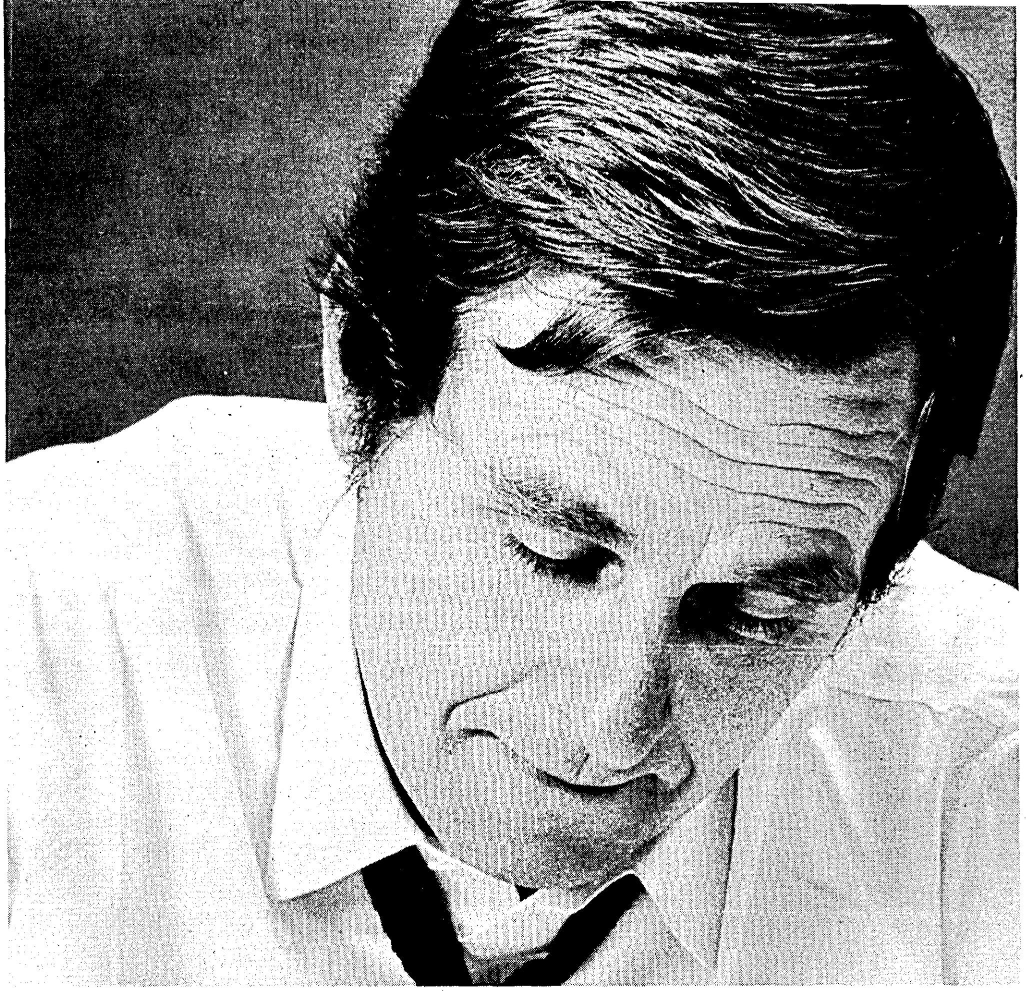
**software**

At present, all software used is written in DAP-116, Honeywell's assembly language, but plans include adding a taped, virtual core version of FORTRAN with IOCS to support a line printer and card reader. With the exception of a small utility package written at Sandia for core snaps and traces, the programming was provided with the system by Astrodata on a turnkey basis.

The system provided includes a 2K resident monitor, which handles I/O, does the scheduling, and controls core sector zero, the communications area. The acquisition program, which operates both to acquire the data originally and store it on tape and also to play back the history tapes for reduction, could occupy 6K of core if all its options were included. In practice this does not happen. When the programs are initially loaded into core at set-up time, the monitor goes through a question and answer communication with the operator to determine which options of the software are to be used for that day's testing. Finally, the diagnostic monitor provided is based on Honeywell routines for checking the mainframe and converted or specially-developed routines for checking the peripherals. ■

The High Enthalpy Arc Tunnel (HEAT) test chamber is seen over its control console. The supersonic heat tunnel uses up to five megawatts of power to simulate re-entry burn-up.



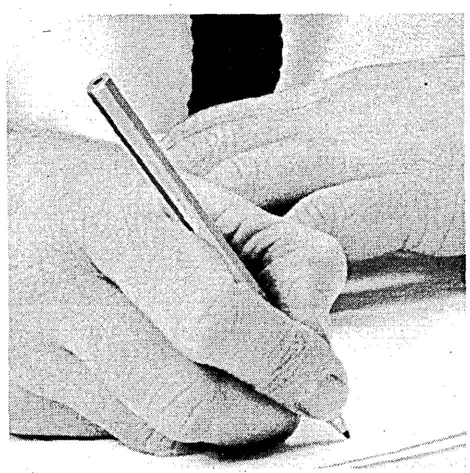


# No more fiddling with formats

There's no need any more for a programmer to re-write a program when a new print format is wanted. And when he writes a new program, he doesn't have to worry about the format of the output, he's free to concentrate on the logic.

FORMATTER looks after the format for him.

FORMATTER is a new software package —a new *kind* of software package— that prints blocks of data, handling page numbering and heading and page overflow. It will print your data in any format you want. The programmer can consider the document *as a whole*—not as a succession of lines. ***In effect, FORMATTER converts your line printer into a document printer. It's extremely simple.***



FORMATTER means more time for new work, fewer programs to write.

FORMATTER is a stand-alone program for use in COBOL and Assembler Language installations, and is also suitable for multi-programming.

FORMATTER means faster printing— and you can change your order of printing at run-time. There are only 9 operating instructions. ***It's easy to use.***

FORMATTER, in short, saves a tremendous amount of time and effort.

Hoskyns Systems Research is the software subsidiary of one of the largest consulting groups in Britain.

FORMATTER consists of 5 packs, each containing 200 punched cards, and supporting manuals. It costs $850—a small price for a big programming advantage. If you are a DOS installation, you can use FORMATTER now.

**HOSKYNS SYSTEMS RESEARCH INC.**
**61 Broadway, New York, N.Y. 10006.**
**Telephone: 212 943-4771**
I am interested in Formatter

Name ________________

Company ________________

Position in Company ________________

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Address ________________

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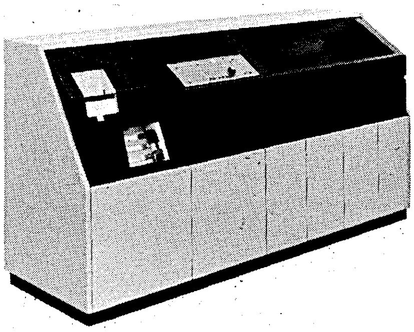
**hoskyns systems research**

CIRCLE 157 ON READER CARD

# new products

## satellite printer/reader

The manufacturer of the Mark IV Satellite Data Transmission Terminal built its system around a single design concept: 'When you build a communications terminal with a 600 lpm printer and 400 cpm card reader, the printer ought to run at 600 lpm and the card reader ought to run at 400



cpm.' The idea is straightforward, but a glance at the specifications of terminals on the market will give some appreciation of the difficulties of its implementation.

The Mark IV is not a generally-applicable machine; it was built to link to an IBM 360 series computer, or to another Mark IV. However, 360 users who can use IBM's teleprocessing software and have a 2701 interface on a mod 30 or larger are given a fast system for entering data from cards and receiving printed output over normal voice grade lines.

DLC claims that its unique data compression, buffering, and transmission techniques account for the system's speed, but the fact that the terminal is hard-wired helps a lot. Data is transmitted in EBCDIC, and may be Hollerith or binary, but binary is sent in a transparent mode . . . it is sent as it is read and not interpreted or given any check other than parity. Options include the capacity to send and receive all 256 EBCDIC characters, or to use USASCII or 6-bit transcode character sets. Other options include automatic answering, multiple record transmission, and single-line multi-station operation.

Users who needed this kind of capability in the past were offered the IBM 2780, which is rated at 240 lpm (using an 80-char. line) and at 400 cpm in its fastest configuration. In contrast, the 400 cpm figure advertised for the IV is an observed rate, and the reader is supposedly capable of 500 cpm "actual" rates when reading only 51 columns. Both systems offer an optional punch, but the specifications for the DLC unit are not yet available and early systems will not include it.

The Mark IV includes a Data-Phone interface, common peripheral controller (built around a PDP-8), the 132-character printer and 80-column card reader (both by Data Products) in its $45,000 purchase price, which is roughly the same as that of the 2780. DIGITAL LOGIC CORP., Anaheim, Calif. For information:

CIRCLE 500 ON READER CARD

## keystation system

In the case of the CMC-9, the whole is not equal to the sum of its parts. Originally designed as a key-to-disc system with a mag tape buffer, a few engineering fudge factors were used on the gear to enable operating without the disc. Result: the CMC-3, a multiple-station key-to-tape system. Part of the transition was made possible by the fact that all of the logic and control functions are built into the controller, even the buffers for the individual stations; the second factor that made the transition possible was an assumption that not every user needs to verify inputs. The resultant product allows for backspacing characters of fields to display and correct any error in the present record, but does not allow for verification or for accessing past records.

Up to 32 stations may be serviced by a single controller. Each of these can make use of dedicated programs stored in the controller's memory, or can be used to enter individual programs and data. The console display allows for programmed backlighting of

PRODUCT OF THE MONTH

## billing computer

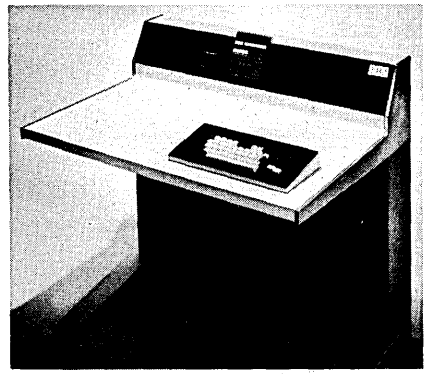
For most people the trauma of April 15 is over. Undoubtedly many small business proprietors have resolved to make their income tax calculations easier next time, to keep better and more usable records, and to clean up their billing procedures. To these people Burroughs offers its L2000.

The machine is not a wonder drug. It is not even a high-speed general purpose processor, but it is a sophisticated and flexible working office tool. A dedicated machine, its four major components—memory, logic, keyboard, and printer—are cable connected, as are any peripherals chosen. A 64-bit word is used, which can contain four program instructions, or 15 digits plus sign, or eight alpha characters, or a string of micro-instructions. The basic memory is a 40-track, head per track, 1K disc augmented by two 256-word buffers. Approximately half of the disc is devoted to application programs; the other half contains the L2000's version of firmware, something akin to the macro expansions of the command language. Access time on the disc

*(continued on page 238)*

## new products

special-purpose mylar cards to identify fields for the operator. In addition to this display, the operating mode (such as "write") and the character last en-



tered are visible. The character is shown in ½-inch alpha form.

Input records are stored on 2400-foot tape reels in 200, 556, or 800 bpi, and in 7- or 9-track format. Since the CMC-3 is designed as a keypunch replacement system, records are presently limited to 80 characters. Each record is identified with a code number

**PRODUCT OF THE MONTH**
**(Cont.)**

runs about 5 msec, and the processor can accept input at a rate of about 2,000 bps.

Application programs can be selected through 16 buttons on the keyboard (which also includes a full typewriter-style key set and a numeric key set which allows for multiple commands to be entered through a single key) or may be called in from a self-threading paper tape cartridge. The programs, in turn, can control the sequence of operations which can be performed from the keyboard.

Optional peripherals include an 80-col. card reader, card punch, paper tape and edge-punched card devices. A 20 cps printer is standard. The printer is built to take multiplex pin-fed continuous forms, but the pin-feed drive is priced separately. Also listed as options are the software packages, which include a general billing system, report preparation, automatic invoice preparation, automatic order writing, and completion billing packages. The conventional billing software runs as little as $385; other routines go for about $900. The L2000 itself sells for $11,000 to $20,000 or leases for about $285/mo. BURROUGHS CORP., Detroit Mich. For information:
CIRCLE 501 ON READER CARD

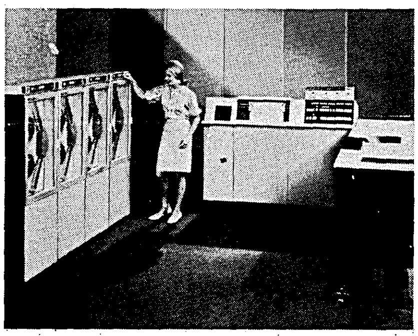
so that each operator's production can be monitored and so that inputs for separate programs can be differentiated. If desired, a system with two tape units can be ordered. (The tape decks are by Peripheral Equipment Corp.)

Purchase price for a six-station version of the system, with the controller and its operating programs, is $50,000. The CMC-3 can be leased for $600/mo. plus $75 for each station/mo. COMPUTER MACHINERY CORP., Los Angeles, Calif. For information:

CIRCLE 502 ON READER CARD

**two uni's**

Since their introduction in 1967, the Univac 9200 and 9300 have occupied rather inglorious positions at the bottom of the Univac line. Their purpose as eam equipment replacements was reflected in their speeds (104 usec and 52 usec adder times, respectively), and in their base rental prices ($1K/mo. and $1.6/K mo.) Now, with the introduction of the 9200 II and 9300



II, the series are made a little more glamorous if no faster.

Each of the new systems can be equipped with Uniservo 6C series 7- or 9-track 34 KC mag tape drives, paper tape devices, an 8411 disc subsystem capable of storing up to 58 megabytes and transmitting at 156 KC (similar to the nine-spindle IBM 4311 system), and two high-speed printers. One of the printers is rated at 1200 lpm and can do 1600 lpm with a 43-character set; the other is rated at 1100 and 900 lpm with the 43 and standard 63-character sets. In addition, the smaller 9200 II can be expanded to 32K from the old limit of 16K. A 350 KC selector channel can be added to the 9200 II to accommodate the disc system; it comes as standard on the 9300 II. A multiplexer channel is standard on both.

Software includes: the Tape (or Disc) Operating System, an assembler, report generator, COBOL, FORTRAN, utility programs, tape and disc sorts.

A "typical" 9200 II tape-based system would sell for $118,285 or lease for about $3,000/mo., depending upon the length of the contract. A disc-based configuration goes for $129,720 and leases for about $100/mo. more. A disc-based 9300 II would sell for $151,580 and lease out at about $3,600/mo. Tape systems can be delivered in about six months; disc versions will be delivered in about March of 1970. UNIVAC DIV., SPERRY RAND CORP., Philadelphia, Pa. For information:

CIRCLE 503 ON READER CARD

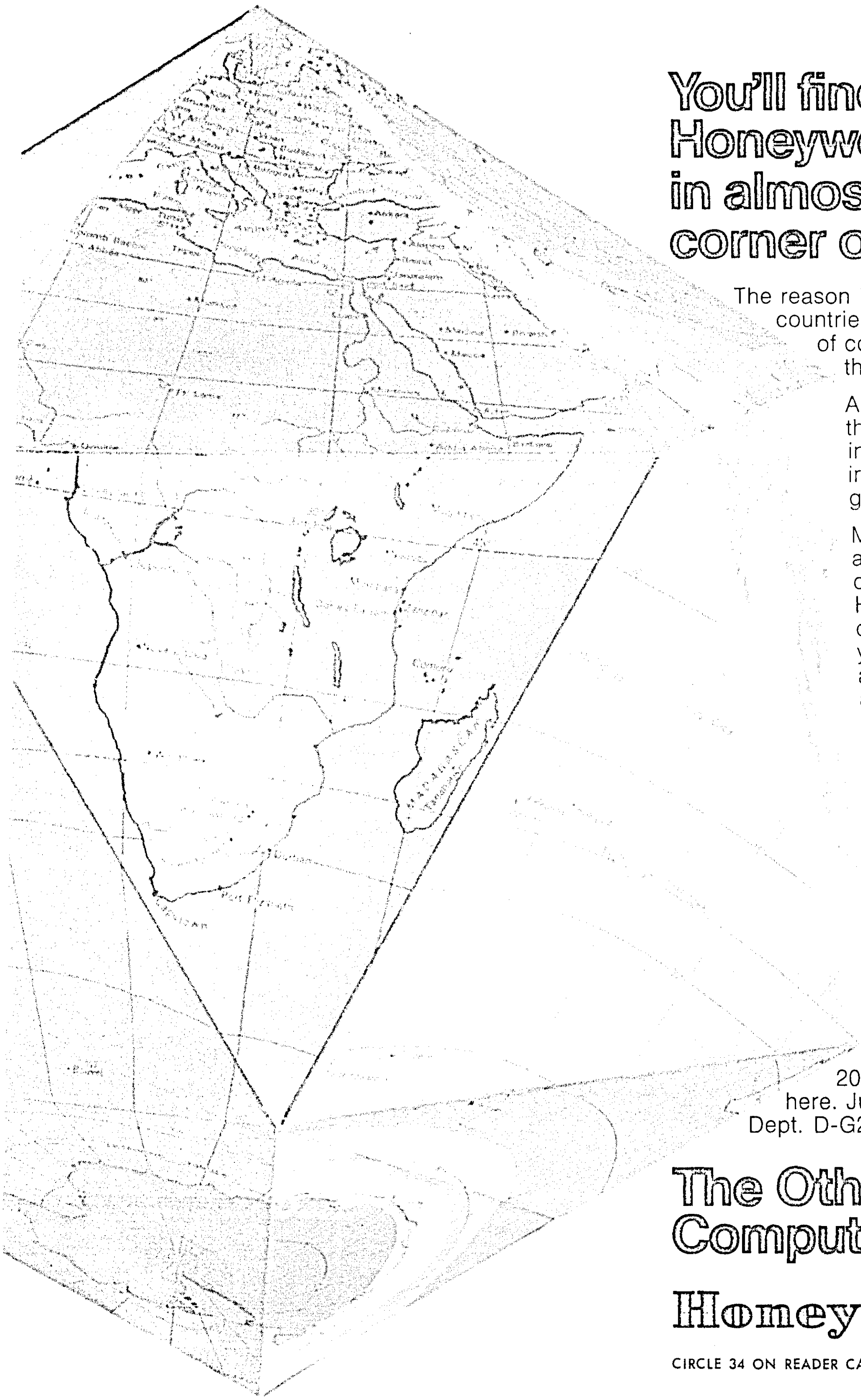
**16-bit machine**

The differences between second-and third-generation machines, and the dramatically expanding technology that those differences suggest, is sometimes vividly brought to mind in reading the specs on the newest "small" general purpose machines. For those of us who were weaned on first- or sec-

ond-generation equipment, the contrasts are striking.

For example, the Tempo I is a 16-bit gp machine being introduced by a 12-man company which has been formally in business only since December of last year. Their system is a 4-64K machine with a 900 nsec memory cycle time and a 1.8 usec adder time. (This would compare, for instance, with the IBM 7094 II, which has a 1.4 usec memory cycle time, a maximum memory size of 32K 36-bit words, and an adder time of 1.4 usec.) The Tempo I has eight standard registers—A,B, and six general purpose regs.—seven of which can be used for accumulator/index functions. These exist in scratchpad memory, and eight more are available as a hardware option. (The 94 has only seven.)

The Tempo I has full 64K single- or double-word addressing, and power fail memory protect as standard features. Hardware multiply and divide are offered as options. Data rates to 700 KC are available using the additional registers mentioned. Seven I/O channels effectively operate as direct memory access channels. Hardware interrupts are expandable from 4-16, and response times to the interrupts are



as low as 500 nsec. Up to 256 interrupts can be implemented through the software. (In comparison, old-timers, the 94 has eight interrupt lines.)

A very significant feature of the Tempo is its use of its registers. Operations can be carried out directly between registers, or directly between registers and memory. Operating in a "Table Mode," the registers are used as pointers to the next values in a matrix being processed. The manufacturer claims that this modus operandi requires half the core space and half the processing time used by a similar machine that cannot operate this way.

Software includes a one- or two-pass assembler, debug, test, and maintenance routines, and an 8K FORTRAN IV. Commercial packages are being developed.

The Tempo operates through its own control panel, with an included ASR 33 tty for I/O. Half-inch mag tape units in the 25 ips range will be almost immediately available. A disc and a 200 cpm card reader will be along later. The system is designed for multiple processors and multiple memories, but these are downstream too.

You can buy the Tempo I for as low as $15,600 and set it on a desk. Try doing that with a 94. TEMPO COMPUTERS, INC., Orange, Calif. For information:

CIRCLE 504 ON READER CARD

### process control cpu

Process control computers are often thought of as the "weak sisters" of scientific or commercial digital machines, as something you use to drive a lathe or milling machine. The PRODAC 2000, although specifically designed for process control applications, does not sound like anyone's weak sister. The machine is a 16-bit, 1.6 usec adder time cpu with up to 64K of core and a choice of random access memories. It features two index registers, 16 400-nsec scratchpad registers, hardware multiply and divide, 128 channels (64 buffered, 64 direct with 64 word addresses each), and analog input rates of 40 points/sec per converter.

Parallel binary operations implement 25 elementary and 7 compound commands; indirect addressing is available on all commands. Dual NAND logic is implemented through IC's.

Peripherals include fixed-head discs in 100K-1,000K sizes. Each fixed head disc is rated at 8 msec average access and 150KC throughput rate. Movable head discs can be added which store 2,000K words, have an access time of 100 msec, and the same 150 KC data rate. Core memory stacks come in various sizes from 4K to 65K and at cycle speeds from 3 usec to "under 1 usec." Other peripherals include a 100 cpm card punch, 100-200 cpm card reader, and a 300 lpm printer.

Analog to digital conversions are performed by a voltage-to-frequency converter and counter. Analog input accuracy is rated at plus or minus 0.05% full scale.

Up to 64 hardware interrupts can be provided; 11 are standard. Channel priorities are software-determined, and the 48v/2a I/O power package is capable of driving a good number of devices. The main power supply is sufficient to drive all of the 64K memory which can be ordered. A power failure protect feature is standard.

The base cpu, sans cabinet, is marketed for "under $10,000." Additional peripherals, memory stacks, software applications packages, or hardware features such as floating point arithmetic jack up the price to maximum of over $1 million. An assembler and FORTRAN IV come at no charge along with the monitor. WESTINGHOUSE ELECTRIC CORP., Pittsburgh, Pa. For information:

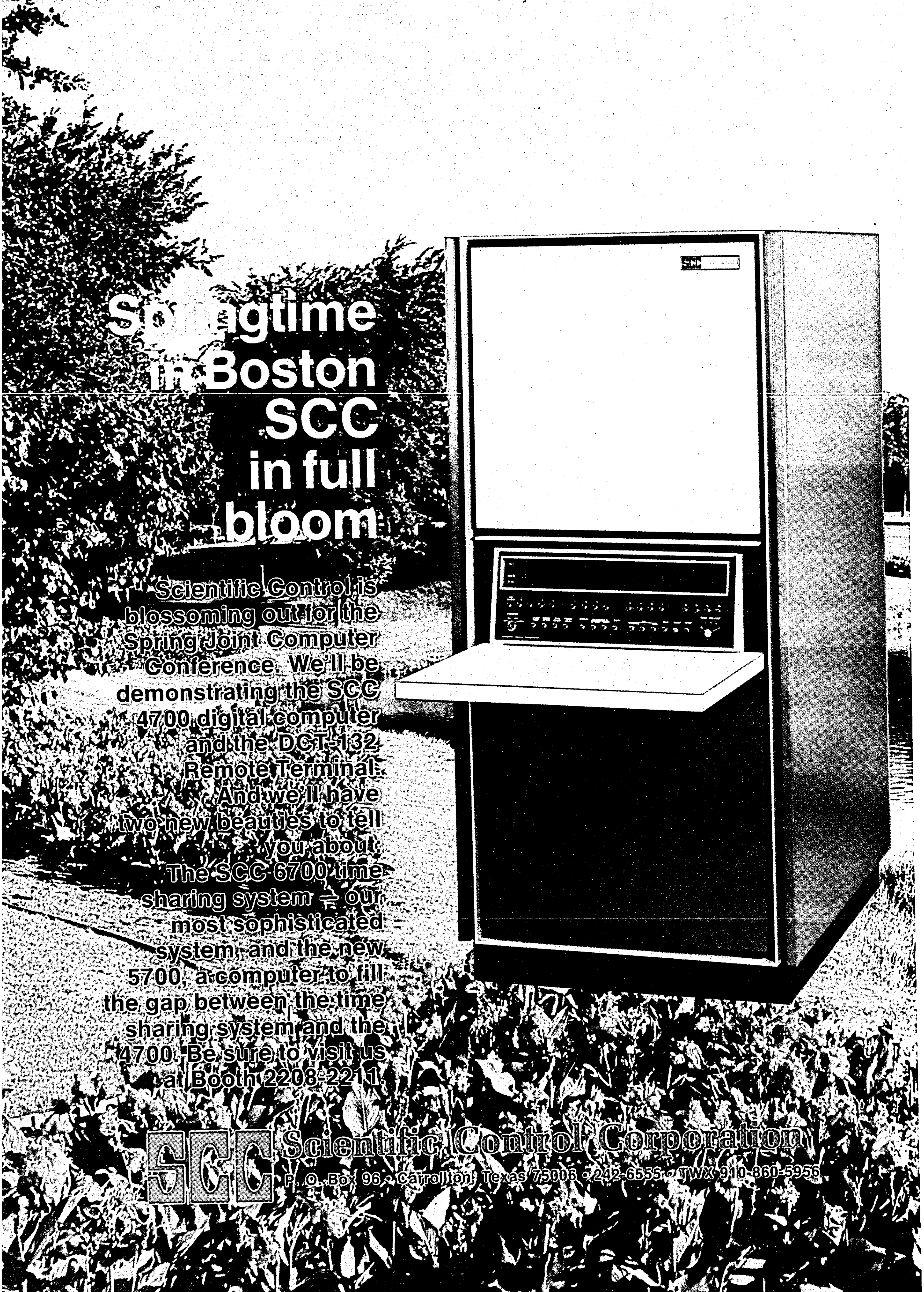
CIRCLE 505 ON READER CARD

### display terminal

Looking, from a main cpu's viewpoint, down a telephone line at an Imlac display terminal might be confusing, for the crt device can disguise itself as a model 28 tty, as an IBM 1050, or as a variety of other gear. The terminal gains this chameleon-characteristic from a mixture of hardware and software which enables part of the metamorphosis to be accomplished through coding and part to be done through a pin selection component akin to a plug board. Given this flexibility, the unit can be programmed to accept any common level of code, such as BCD or ASCII, or any common control signal for functions such as end-of-message or "break."

There are 3,600 possible character positions on the crt face, which can contain up to 1,040 characters. Since the text format is not permanently fixed, users should be able to overcome some paging problems imposed on less flexible equipment. The solid-stroke characters are refreshed at a rate of 30 frames/sec, but the flicker which might be expected at this rate is reportedly circumvented by using a line-interlacing, rather than character-interlacing, technique for stability. The display is driven by a controller with a 4-usec adder linked to a 2K by 16-bit 2 usec. memory.

One feature the system offers is a fa-


Springtime in Boston SCC in full bloom
Scientific Control is blossoming out for the Spring Joint Computer Conference. We'll be demonstrating the SCC 4700 digital computer and the DCT-132 Remote Terminal. And we'll have two new beauties to tell you about. The SCC 6700 time sharing system — our most sophisticated system, and the new 5700, a computer to fill the gap between the time sharing system and the 4700. Be sure to visit us at Booth 2208-2211.
SCC
Scientific Control Corporation
P. O. Box 96 • Carrollton, Texas 75006 • 242-6555 • TWX 910-860-5956

cility to dump the contents of the screen onto a local printer without going through the central site cpu; this can be done on an unattended basis if desired. A robot printer driver (ala North Electric or Viatron) will be added to the line in the future to further alleviate the need for access to a central site printer.

A basic version of the display terminal will sell for $6,500 or lease for about $250/mo. Altering the terminal to look like another device is a field-installed change which will run the user about $200; a sophisticated user might be able to do this for himself to save not only the cost, for example, of going from a 1050-compatible unit to another piece of gear compatible with an IBM 2260, but also to save the $200. IMLAC CORP., Watertown, Mass. For information:

CIRCLE 506 ON READER CARD

### series 500 card reader

The NCR 682-500 card reader is said to triple the card input capacity of Series 500 computer systems. The unit reads punch cards at the rate of 300 cpm. All card movement, either with single or dual reader systems, is timed with internal processing and I/O operation so that cpu time is required only while data is being transferred from the reader buffer to the cpu. Existing Series 500 installations using NCR 582 card readers can expect to increase throughput from "30 to 50%" with the 682-500. The new unit is not recommended for installations where only a "limited number" of cards are processed, however.

The 682-500 utilizes a plastic programming card which is pre-stamped with 80 positions representing those on punch cards. Any pointed object may be used to punch out a round hole which fixes the end-of-word column for each field. The plastic card is then inserted in the reader and locked in place, establishing the program. Programs may be instantly changed by merely changing plastic cards. Price of the 682-500 card reader and the 581-3 buffered card-read controller with which it is used is $5,050, or $110/mo. rental. NCR, Dayton, Ohio. For information:

CIRCLE 507 ON READER CARD

### animated graphics

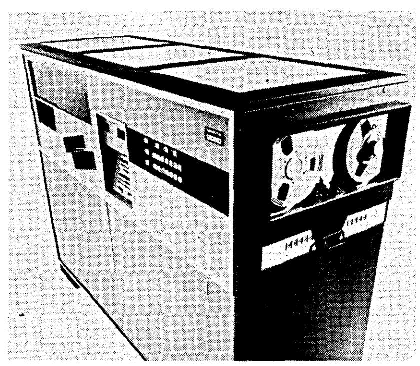
Graphics, whether in the form of a CalComp Mona Lisa or of a flashy crt display, is a bright spot in dp. More sober-sided management types emphasize its very real functions and shudder when the topic is grouped under the heading of 'games people play with computers.' A package by the name of GUSS, for Graphic Users Support System, may give the more serious cause for real alarm, for included in its list of capabilities is the heading "animation." The basic 10K software package is based on an Integrated Graphics Software system, done for an SD 4060 microfilm recording system, which is in itself sufficiently mundane. The package will be delivered and installed on a user's machine on a lease, or purchase, or franchise basis. Although prices for the system will vary with the type of contract, the vendor did release the price of a year's maintenance, $1,000; this covers instruction, user manuals, and 48 hours of on-line consultation.

The first versions of the system will be offered to IBM 360 users. Shortly, a Univac 1108 version will also be marketed. Versions for other hardware will be completed as soon as the demand is noted. Wonder who will be the first to create a "Crusader Computer" series to be shown at lunch hour. VISUAL COMPUTING CORP., Culver City, Calif. For information:

CIRCLE 508 ON READER CARD

### optical page reader

The Farrington 3050 is claimed to be the "lowest cost alphanumeric optical page reader in history." It reads typed or printed alphanumeric information from documents up to 8½ x 14 inches with either Farrington 12L or USASCSOCR type fonts, at speeds up to 400 cps. The 3050 is designed for ap-



plications using input data in "similar" formats. Capabilities of the basic unit include on-line crt character insertion, rescan, document counting and marking. A built-in magnetic tape drive is included, with the entire system enclosed in a single cabinet. Five-year rental is $2,495/mo., or $120K purchase. FARRINGTON MANUFACTURING CO., Springfield, Va. for information:

CIRCLE 509 ON READER CARD

*(continued on page 244)*

# new products

## video disc file

Up to 300 images may be stored on the 16-inch disc of the Video Disc File, and these may be either individual still images, or sequences of slow motion, normal motion, or lapsed-time recordings. Access to the stored images is either random or sequential, and a buffer track is provided for retaining one image while seeking another. The buffer works in reverse, when necessary, for constructing an image that is to be transfered to another track for storage.

A proprietary recording technique is used to produce pictures equivalent to 525 X 400 line resolution. These pictures may be used in computer aided instruction, for background tv images (grids, etc.), or for slow-scan tv transmission over communication networks, document storage and retrieval, or for recording transient phenomena (up to 4 KHz). The video store capability is priced in the range of $11,000 to $40,000, depending on options, and comes in a rack-sized package. DATA DISC INC., Palo Alto, Calif. For information:

CIRCLE 510 ON READER CARD

## graphics system

Normally, a graphics display system exists as a peripheral or as a terminal in a larger computer-based configuration. In the case of the E&S Model I, however, it is possible that the computer used would be ancillary to the graphics display system. The Model I takes data from a computer's core, manipulates it, and drives a crt display of the customer's choosing. "Manipulates" is too casual a phrase for the kind of processing performed, and a graphics system priced in the neighborhood of $100K and up cannot afford to be casual about anything. The processing done by the interactive system allows a user to dynamically display a two- or three-dimensional object in space, rotate it, back away from it, walk *into* it, or change it. The system adjusts the attitude, size, position, and field of view for the user, compensating for hidden and exposed lines and planes.

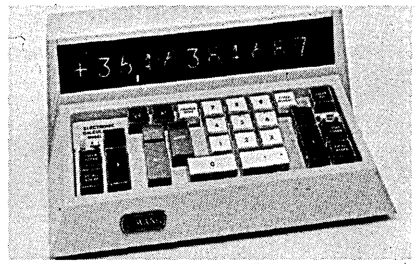
The Model I is made up of three main components: a display controller, a matrix multiplier, and a clipping divider. The controller is claimed to be the most sophisticated in the industry. It manipulates two push-down stacks and handles bookkeeping chores such as addressing and subpicture referencing. The matrix multiplier performs the projectional and rotational arithmetic, and is billed as being about 4-5 times as fast as an Univac 1108 at this job. The clipping divider decides how much of each line will be visible in the picture—what leaves the vision periphery and what is to become hidden or exposed—as a hardware function.

The Model I can be connected to machines with various word lengths, and will handle something like 165K words/sec (which is equivalent to about 5,500 words 30 times per sec. for a very complex picture being refreshed at that rate). The price for the system ranges from about $110K to $180K, including the installation, but not including the software. Potential customers must have the correct change for leases are not offered. EVANS & SUTHERLAND COMPUTER CORP., Salt Lake City, Utah. For information:

CIRCLE 511 ON READER CARD

**calculator terminal**

Although touted as an economy-line calculator, the Model 200 series of calculator terminals and remote processing units is at least several steps up from an electronic abacus. Not particularly fast, the units have a 10 msec add time, and need 250 msec for a multiply or divide. However, the machines work with a 14-digit number, plus sign and decimal, and even the bottom of the line offers four registers (two accumulators plus display and product). In addition to the basic arithmetic functions, reciprocals and penny round-off are provided as standard functions. The base unit sells for $360 for the keyboard, the arithmetic



processing unit required to service the Model 200 terminal goes for $2,000, and can handle four of the keyboard units. The top of the bottom-of-the-line series, the 250, offers four more registers, square and square root functions, and sells for $410 for the keyboard and $3,200 for the processing unit. Two intermediate machines, the 210 and the 240, are also offered. The base unit is designed to get a foot in the door where a low price counts—four units can be placed at $860 each. The 250 is designed to open another door, servicing insurance and statistical applications. WANG LABORATORIES, INC., Tewksbury, Mass. For information:

CIRCLE 512 ON READER CARD

**rack or portable mtu**

The Datavoice 110, a rack-mounted magnetic tape unit, uses ¼-inch tape and reel sizes to seven inches. Comparable to the DECtape in function, it has one-tenth the performance of the Digital Equipment Corp. unit and goes for one-quarter of the price. With its announced portable counterpart, the DV-315, it is meant to be used on any PDP-8-size computer which has only a tty but needs additional low cost I/O capability. The $1,200 110 has a data transfer rate of up to 300 cps (30 times the speed of a teletype paper tape reader and punch), read-after-write capability, and software. A typical controller for the system, handling four units, costs about $1,000. Maintenance is to be provided by the small computer's manufacturer. BETATECH, INC., Bedford, Mass. For information:

CIRCLE 513 ON READER CARD

**crt display**

For graphic simulations analysis and design, Delta Display 1130 can be linked to the IBM 1130 computer and run with the same software that operates an on-line plotter. The result is that the user, without reprogramming, can view plotter data on a scope in a few seconds.

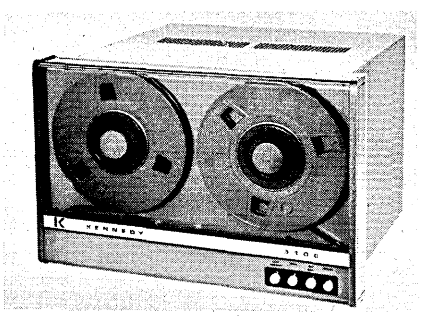
The DD 1130 uses a Techtronix

memory crt scope which has an 8¼ X 6¾ inch viewing screen, incremental speed of 40,000 steps per second, and a tube storage time of over 15 minutes. Betatech, Inc., systems supplier, has developed the controller for the unit, which "translates" data for scope viewing, and with a flick of the switch can activate hard copy printout on the plotter. System options are a 3 X 4 inch Techtronix scope with a Polaroid camera attachment for providing hard copy, a "joy stick" to work, cursor input unit, specialized keyboards, symbol and vector generators. Price for the basic unit is $12,000, said to be one-fourth the price of similar display devices available with the computer. Maintenance on the controller will be done by Betatech; Techtronix will handle the scopes. BETATECH, INC., Bedford, Mass. For information:

CIRCLE 514 ON READER CARD

### mag tape unit

A unit price of $2,600 is advertised for the Model 3100 Continuous Magnetic Recorder, a unit available in speeds from 10-25 ips and which records in 200, 556, or 800 bpi on seven or nine channels. Start-stop time on the single



capstan drive is 15 ms, and slew or rewind speed is approximately 120 ips. The small reels used accommodate 1,200 feet of tape. Read and write electronics are not included in the price, but read, write, read/write, or read-after-write controls are available. Internal parity generation is standard, as is CCRC in the nine-track versions. Control electronics are included in the $2.6K offering. KENNEDY CO., Altadena, Calif. For information:

CIRCLE 515 ON READER CARD

### os/360 release 17

Release 17 will provide OS/360 users with a new checkpoint/restart function, designed to be effective in a multiprogramming environment, allowing automatic restarts and operator or programmer deferred restarts from a

checkpoint. This capability is provided under Primary Control Program and MVT. The same capability for MFT is scheduled to be available in June. With release 17, cpu storage supplemented by 2361 auxiliary core storage can be divided into two sections, enabling users to: establish a storage hierarchy; assign parts of a program to the most appropriate storage area; acquire space in either or both areas; and load modules into either area. Release 17 also permits the use of Remote Job Entry with MFT. IBM DP DIV., White Plains, N.Y. For information:
CIRCLE 516 ON READER CARD

### source deck substitute

A long-standing controversy revolves around the question of whether the punched card is really dead. This vendor, perhaps in a compromising mood, offers a software package for doing away with at least most source deck punched cards. The product is a source file manipulation program which allows a user to enter only changes and corrections for an existing source program, regardless of the language being used. By using the package, called AWAY, a programmer can build a tape or disc library file which he then updates for following runs. Source statements are referenced by the column 1-6 sequence number, which can be added when key-punching or generated by AWAY. The source card images can be resequenced when desired, and the user has the option of listing corrections only, entire programs, entire files, or choosing not to list any statements. Similarly, the user may choose what outputs are to be punched. The SELECT card used for specifying the options can itself be altered dynamically.

Written in COBOL, AWAY should have a 32K system in which to operate, but any manufacturer's hardware can be used if it has the COBOL compiler. AWAY's $500 tag includes a user manual, system tailoring, and a five-year guarantee that the program will operate with a standard version of COBOL. TARANTO & ASSOC., San Rafael, Calif. For information:
CIRCLE 517 ON READER CARD

### cobol file display

COBOL records may be retrieved, displayed on a crt, and updated through the use of the REAL TIME COBOL package. The title of the software is perhaps a misnomer; the system is not interactive or conversational. However, response times of a few seconds are advertised. An IBM 360/40 with 128K and DOS is required to use REAL TIME COBOL. With this minimal configuration, a user is given the ability to access his COBOL files without having to build a complicated file maintenance and display system. The program is written in FASTER, a Type III IBM program, and instruction in the use of the command language is included in the installation price. The package sells for $3,250 plus $20/hour for installation and training (plus expenses). It can be leased for $200/mo., and half of the lease price applies to later purchase. Potential customers in the Chicago area will be given a free demo; more distant users can have their system simulated, and run, and receive their output through the mail. MARTENSON ASSOC., Park Forest, Ill. For information:
CIRCLE 518 ON READER CARD

### pdp-9 software

A new translator package will make it possible to adapt code written for the PDP-8 in PAL III, PAL D, or Macro-8 assembly language, to the Macro-9 assembly language used with the PDP-9. The translator is intended to "translate a major part of the source code and to indicate those parts that should be re-viewed in the light of the greater word length and more powerful instruction set of the PDP-9," rather than produce PDP-9 programs by simulating the PDP-8. A new statistics package, Statpac, is designed to operate within the PDP-9 Keyboard Monitor System in conjunction with either a PDP-9 or 9L. Written in COBOL, the package consists of five modules: control, input, descriptive statistics, stepwise linear regression, and multiple linear regression. Other modules are being considered for later addition. DIGITAL EQUIPMENT CORP., Maynard, Mass. For information:

CIRCLE 519 ON READER CARD

**mismatch**

In the February New Products pages we apparently got our hands crossed and ran a photo of Vanguard Data System's KB-600 Datascribe key-to-tape unit with the text for MAI Equipment Corp.'s Model

100 Data Transcriber key-tape unit. The photo above should have been included for the MAI 100 announcement, and we apologize for any confusion our serial shift caused.

**pdp-9 crt software**

A new interactive software system for use with the Model 339 programmed buffered crt, an option with the PDP-9 computer, eliminates direct hardware manipulation formerly required to operate the crt. The software includes a FORTRAN compiler, a Macro-9 assembler, a text editor, and tracking package. The 339 operates from command files generated by the PDP-9 and stored in the memory shared by the crt and the cpu. Users of the 339 can store material generated on the crt and obtain printed reproductions of it with the addition of a copying device or plotter. The compiler permits full communication between user and display. It includes subroutines to draw lines, display text material, and to cause images on the crt to blink. It also enables users to generate a full range of image subfiles. By its use, codes are set up to produce pictures, display them, and alter them as their creation progresses. For example, "A cartoonist might draw a person, a house, and a tree . . . These are then stored and can be called up as needed."

A 339 device handler also is incorporated into the assembler. It performs such tasks as setting up the display, permitting use of the light pen and function box, transferring information from the user programs to the crt, and synchronizing user programs with the display. The text editor simplifies the task of correcting mistakes in user programs; to make corrections users need display only the portion of a program in which an error appears. As a change is made on the display, it is made simultaneously in the central memory. The software system is offered free to present 339 users and will be included with all future purchases at no additional cost. DIGITAL EQUIPMENT CORP., Maynard, Mass. For information:

CIRCLE 520 ON READER CARD

## pdp-8 assembler

BOSS is a two-pass assembler designed for use in business applications on any of the Digital Equipment Corp. PDP-8 family of computers. BOSS is especially intended for such applications as payroll, general ledger, job costing, inventory control, accounts receivable, and accounts payable. Standard application packages are available. And, in line with the current trend toward bundling software with small computers, complete systems are available, including BOSS, (which lists for $1,000 separately), application programs, and the PDP-8/L itself. INFORMATION CONTROL SYSTEMS, INC., Ann Arbor, Mich. For information:

CIRCLE 521 ON READER CARD

## third-generation margen

MAnagement Report GENerator, previously available only for the IBM 1401, has been updated and expanded for use on System 360's with minimum 65K memory, operating under either DOS or OS. The MARGEN software package includes capabilities for file generation, file updating, file editing, and report generation, producing multiple reports in user-specified formats, utilizing information generated in a single pass of the data file, without preliminary sorting. It is designed for use by "non-technical" personnel, and is said to require a training period of less than three days. Applications are primarily in the pharmaceutical, clinical, and consumer research industries, where there are requirements for large numbers of cross tabulated reports. Cost is $10,000 for the first system, $2,500 for each additional. RANDOLPH DATA SERVICES, INC., Cincinnati, Ohio. For information:

CIRCLE 522 ON READER CARD

## push-button coupler

"SPARTAN" is an apt name for the Model 1240 FONE-TONE acoustic coupler. Its 2 X 4 X 8-inch case is built for traveling in tool boxes or glove compartments; it is not pretty, and has no frills. The pick-up unit connects to any phone with a strap much like a dog's muzzle . . . no fancy hand-rubbed walnut and formed-rubber mounting here. A 12-button touch-tone phone dial allows for transmitting the full alphabet, however, and the lightweight unit can go anywhere and fit almost anywhere. Power is provided by a transistor-radio battery. One appreciable feature is that the sound unit's construction allows for listening to the transmission without interfering with it, something that cannot be done with some of the classier units. The

vendor throws in an extra battery, too, in the $145 offering. METROPROCESSING ASSOC., White Plains, N.Y. For information:
CIRCLE 523 ON READER CARD

### pdp-8, -9, 360 assembler

A new one-pass assembler which can be adapted to any 360 system equipped with a paper tape punch, produces punched tape for use on the PDP-8 or PDP-9. Advantage of the 360 assembler is that compiling takes "a fraction of the time" required on the PDP machines. Price is $3300. INFORMATION CONTROL SYSTEMS, INC., Ann Arbor, Mich. For information:
CIRCLE 524 ON READER CARD

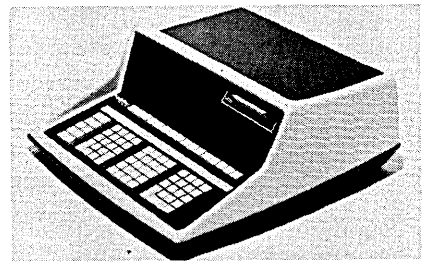
### decision table processor

IMI has been marketing a 100K version of a COBOL decision table processor called DETAP/IMI. Apparently the group discovered that not everyone has 100K to devote to such a system, for they are offering an abbreviated, 32K version of the processor called COMPACT DETAP. The program converts limited-entry tables (with up to 50 decision rules) to COBOL source code, after analyzing the tables for contradictions and completeness. The selling price for COMPACT DETAP is $9,500; this figure includes the running program, a user manual, a two-day course on decision tables and the processor, and one year of program maintenance, INFORMATION MANAGEMENT INC., San Francisco, Calif. For information:
CIRCLE 525 ON READER CARD

### calculator with core

The Model 700 might be billed as "the calculator that's trying to be a cpu." The IC-based calculator has its own built-in 8K-bit core and mag tape cassette. It can store a program of up to 960 steps in core, and access 10 similar-sized programs from the cassette. The user is denied access to a 200-step area of storage, which is generally used to store geometric and hyperbolic function routines and polar/rectangular conversion routines. This reserved space can alternatively be used to store special functions to be performed on single keystroke commands. For instance, a statistican may want to store mean, variance, and standard deviation functions.

Pushing its bid to be a cpu, the 700 boasts a 300-usec adder. Trig functions are completed in 250 msec. A floating multiply takes 3 msec and a floating divide 3.5. Its commands for



direct and indirect store and recall of data registers enable it to invert a matrix up to 10 X 10. The unit has its mag tape for some I/O, and augments this with provisions for typewriter output. A "learning" mode enables step-by-step program use or checkout. At $4,900, the price approaches that of a cpu, too. WANG LABORATORIES, INC., Tewksbury, Mass. For information:
CIRCLE 526 ON READER CARD

### tape eraser

The Weircliffe Model 9 Magnetic Tape Bulk Eraser is capable of erasing 100



CIRCLE 44 ON READER CARD



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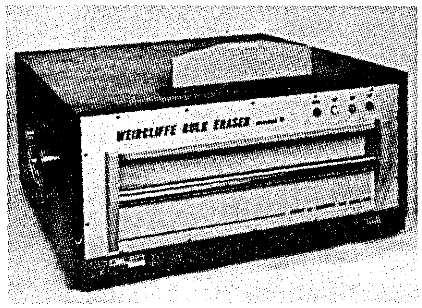
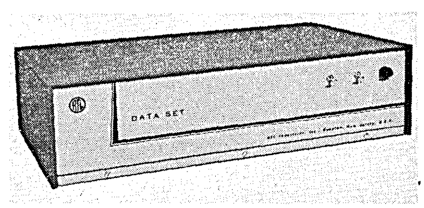
# new products



reels per hour, which is probably faster than users will be able to coerce an operator into moving. Capable of handling reels up to 1⅜ X 16 inches, the device is built to clear audio or digital tape without leaving a background hiss or hum. Applications include insuring the security of proprietary information and perfecting the medium for analog or audio recordings. The 9 is priced at $791. FERRANTI ELECTRIC, INC., Plainview, N.Y. For information:
CIRCLE 527 ON READER CARD

## desk-top data set

The series 2056 data sets are two- and three-state (they are suited to return to zero operation) and can operate at 60, 85, 110, 150, 300, 600, 1200 and 1800 baud. Digital interfaces may be



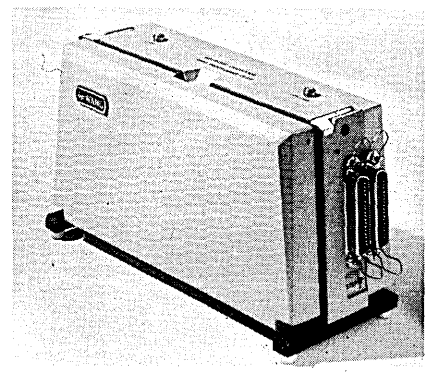

either positive, neutral, or polar (EIA/RS232B). They come housed in a 5 X 10 X 18-inch desk-top cabinet which has an indicator light and two test switches on the front panel. The switches and the light may be wired to customer specification. Prices start at $350. RFL INDUSTRIES, INC., Boonton, N.J. For information:
CIRCLE 528 ON READER CARD

## recorder logger

One way to put graphic data into machine-readable formats is to transcribe the information from a multipoint recorder of some sort (with all the interpolation that implies), and to have that transcript keypunched and verified. The Model 141 Multipoint Recorder Logger offers another solution. The logger connects directly to a recorder, digitizes the data as it is received, and punches a four-digit paper tape record of each entry in 8-level ASCII or IBM code. Logging is synchronized to the recorder, and operation is unattended. $3,950 buys the logger; recorder adapter kits and cabinets are extra. CONTROL EQUIPMENT CORP., Needham Heights, Mass. For information:
CIRCLE 529 ON READER CARD

## reader for calculator

In the drive to make calculators look and function more like computers—or at least more like terminals—typewriter output, mag tape cassettes, remote processing units, and now card readers are being added to the basic product lines. Wang's CP-2 card reader can be added to its calculator lines for entering programmed commands of up to



80 commands per card. The reader uses pre-scored tab cards (the kind that require a stylus rather than a keypunch) and breaks each card into two lines (upper and lower) of 40 6-bit commands each. The units have enough electronics built-in to do their own looping and branching. The tests used for looping and branching depend on the capabilities of the calculator used, but since the card remains in the reader until all of its commands are executed, in no case can a branch be made on a single card to a command more than 80 columns distant. However, up to three additional card readers can be wired in to allow for more program flexibility. The CP-2M Card Programmer, the master, sells for $800; its CP-2S slaves go for $600. WANG LABORATORIES, INC., Tewksbury, Mass. For information:
CIRCLE 530 ON READER CARD

## a/d interface

A high level multiplexer, a sample and hold amplifier, and a 15-bit binary analog to digital converter make up the Model 380 a/d interface system. The heart of the system is the Model 301 a to d converter, which digitizes analog inputs at a rate of 250 KHz to a resolution of 14 bits plus sign. Throughput rates for the total system are 100 KHz for the first channel and

Someday it may be possible to store the medical records of every American in the space of a cold capsule.

Or the tax records of the nation may fit in one file cabinet.

All this, and even more extraordinary things may become possible, because Univac is experimenting with a process called photochromism, a molecular phenomenon involving color changes with light.

Univac has developed a non-fatiguing photochromic material (so unique we've applied for patents on it) that can be used as a reservoir for computer information. Exposure of this material to ultraviolet light records the information.

The information can then be read with a low-intensity light beam and, when desired, erased with a high-intensity beam.

The advantages of photochromism for computer systems are multiple. Theoretically, present computer information storage space can be reduced enormously.

Some of Univac's plans for the application of photochromism may lead to color information displays that will retain images for hours, and interchangeable information cartridges that could give one computer the information diversity of fifty.

Photochromism is just one of many advanced ideas in Univac research and development laboratories.

Other advanced ideas can be found in today's UNIVAC® computer systems.

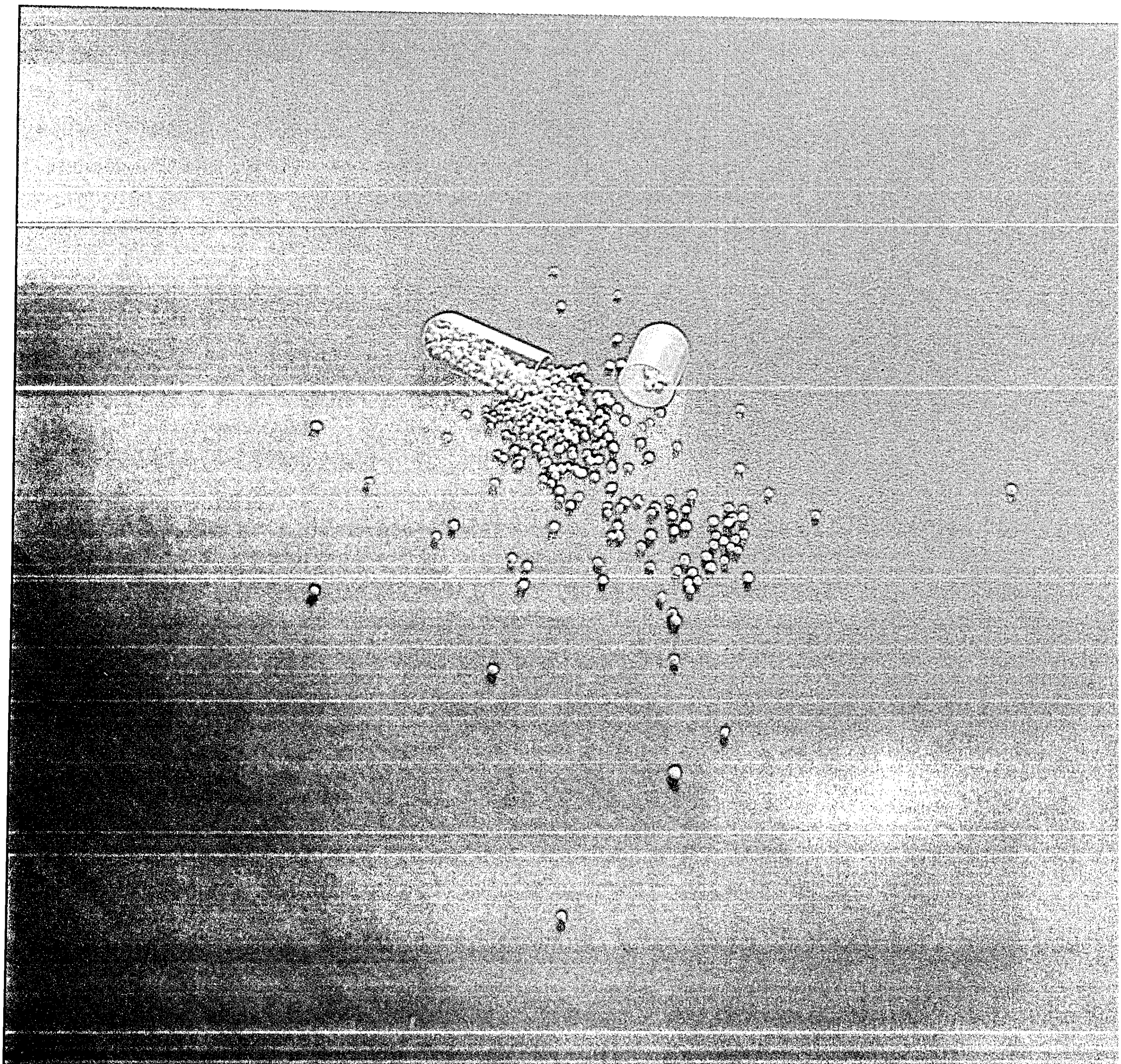
UNIVAC

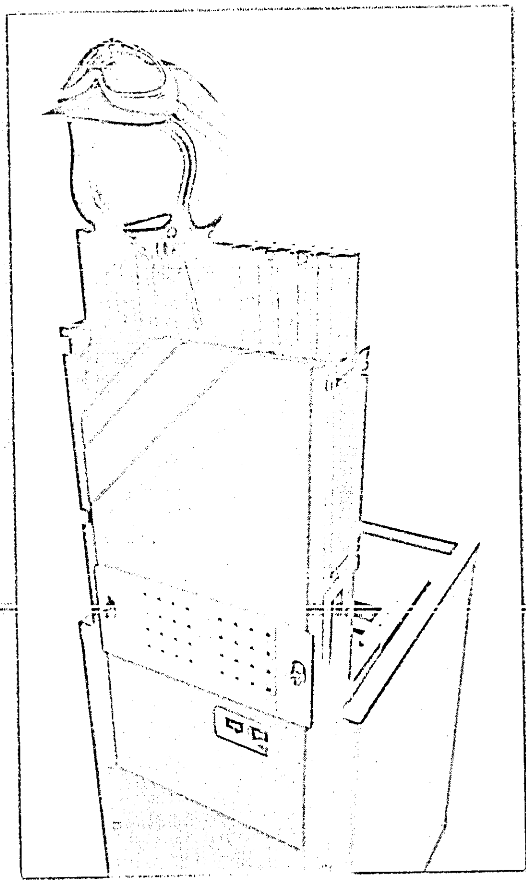
Univac is saving a lot of people a lot of time.

SPERRY RAND

CIRCLE 47 ON READER CARD

# The white ones are the men and the yellow ones are the women.





# The DSU-8100 "Fastrack"™
## A real winner in the mass memory race!

You don't win the Grand Prix or the "500" by driving a truck — or weaving all around the track. The same is true in the mass memory race.

Until now mass disc memories were ponderous brutes. They took up a dozen feet of valuable floor space. Weighed close to a ton. Required thousands of kilo-watts. Most used positioning heads which do have drawbacks. Time lost in positioning. Positioning errors. Positioner wear. Maintenance.

CPC has changed all this with a fast head-per-track disc memory which stores up to 200 million bits in a compact 19" chassis just 40" high. It weighs only 300 pounds. Requires but 1 Kw of power.

The secret to on-site expansion is the modularity. From one through four 25 million and/or 50 million bit disc modules may be used on the same compact drive. 256 "fail-safe" flying heads per surface access data fast. 16.7 milliseconds average. Data transfer rate is 3 MHz.

There's more to tell. Like the single disc security which eliminates the possibility of head avalanche. Or a worst-case-failure recovery time of only minutes. Or the ability to serve up to 3 controllers.

Want the whole exciting story? Request a copy of our DSU-8100 brochure.

cpc computer peripherals corp
5037 Ruffner St., San Diego, Calif. 92111
Telephone (714) 279-7500

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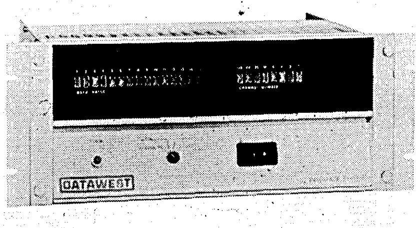
A new concept in rotating memories . . .
Designed for the exploding world of
Program Swapping, Time Sharing,
Message Switching and Real Time Computing.

# new products

110 KHz for following channels. Up to 256 channels can be handled by the standard multiplexer offering, but the number is easily expandable. Off the shelf interfaces are available for sev-

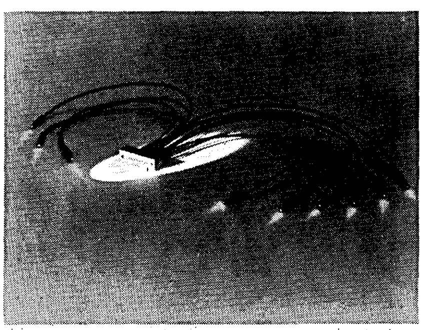



eral computers, including the IBM 1130, and 1800, the Sigma 5, and Data General's Nova. Other interfaces will be constructed if desired, and four extra card slots are built into the multiplexer to accept the interfacing logic. The 380 sells for $11,800 and the 301 can be purchased separately for $3,-800. DATAWEST CORP., Scottsdale, Ariz. For information:

CIRCLE 531 ON READER CARD

### fiber optic read head

Individual glass fibers are bundled into nine strands, ground and polished on both ends, and mounted into an aluminum case to form this nine-channel paper tape read head. The flexible glass strands can then be mated with any photosensor array to complete the



package. One significant advantage of the resulting reader is that the light at any channel can be modulated individually, allowing for accepting coded information on each channel. Price for the fiber optics assembly is under $50. BENDIX CORP., Sturbridge, Mass. For information:

CIRCLE 532 ON READER CARD

### paper tape folder

The Model DFH-3 paper tape folder is a manual unit intended for winding short lengths of perforated tape. It adjusts to make 5-, 6-, or 7-inch folds. A single-flange reel with adjustable guide posts provides accommodation for different tape sizes. List price is $40. ROBINS DATA DEVICES, INC., College Point, N.Y. For information:

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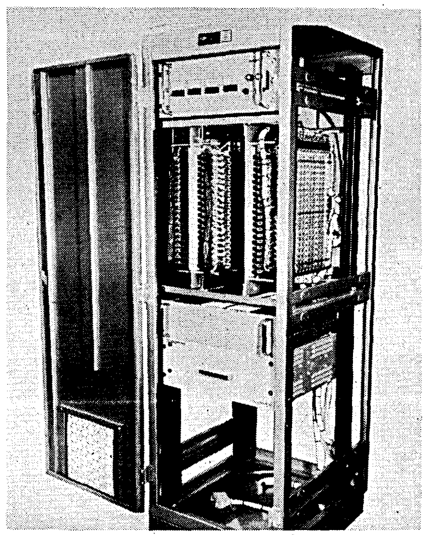
### switching matrix

In some large laboratory, process control, and communications applications it is necessary to control a large number of input and output signals, and to leave open the choice of which input is



linked to which output. The Model 407PPS switching matrix allows the user the control of up to 30 X 120 circuits at six signal levels. Several input lines may connect to one output line or vice versa, and the allocation of these lines may be dynamically controlled by linking to a small cpu. Interfaces for the HP 2115A and the DEC PDP-8/I are available; others can be developed. Prices vary widely depending upon size and options. A minimum configuration for the switching matrix runs about $15K. CUNNINGHAM CORP., Honeoye Falls, N.Y. For information:

CIRCLE 534 ON READER CARD

### electronic card dryer

If you're like most public utilities we know, you've probably found that your meter-readers get their punch cards wet every time it rains, and drying the cards can be quite a tiresome chore. But now, with the RFC Model 3000-ECD electronic card dryer, you can avoid this rainy-day drudgery! The dryer not only dries 500 cards at one-tenth second per card, but presses them flat, in case they've been folded

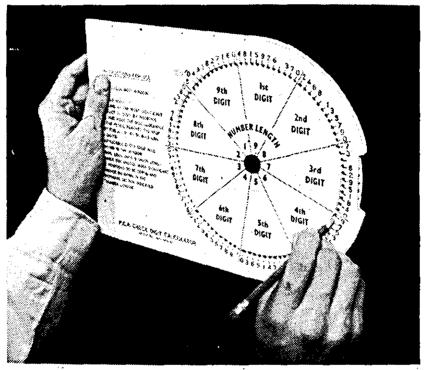
# new products

or spindled as well as drenched. The unit includes air controls, exhaust, and safety switches. Floor space required is about ten square feet. Price is $4,950 plus installation. RADIO FREQUENCY CO., Medfield, Mass. For information:

CIRCLE 535 ON READER CARD

## check digit calculator

Got $31.75 in your pocket? That's all you need for a nifty 12 X 9 inch Check Digit Calculator which determines check digits for numbers up to nine digits in length, such as account numbers or policy numbers. Made like a large circular slide-rule, the Check Digit Calculator is operated by a pencil point: each digit within a number is selected and advanced to the next "stop" position, causing the resulting check digit to appear in a window. Standard moduli are as follows: Modulus 11, weights 3, 6, 8, 5, 7, 10, 2, 4, 9; modulus 11 S/W, weights 10, 9, 8, 7, 6, 5, 4, 3, 2; modulus 10, weights 1, 3, 7, 1, 3, 7, 1, 3, 7. Other moduli or weight arrangements may be obtained



on special order. The devices are made in England by Punched Card Accessories, Ltd., and distributed in the U.S. by JAY SMITH, INC., Westport, Conn. For information:

CIRCLE 536 ON READER CARD

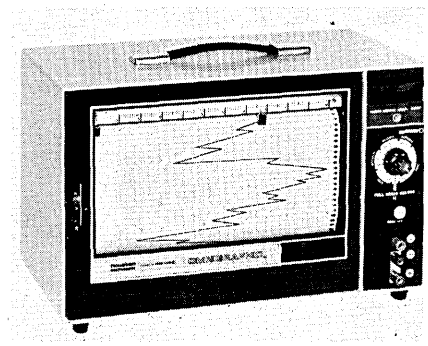
## strip chart viewer

In most cases strip charts and plots are produced in roll form, and hunting for a critical point after a few hours of recording requires either a very large table or some kind of juggling act. The Model 802 chart viewers are designed to help out. Model 802-A comes with a 12-inch viewing table and with hand-cranked rollers on each side, and sells for $165. Model 802-B adds a translucent back plate and lighting apparatus, and another $30 to the price. Custom sizes, for 22 inch plots, for example, can be constructed for about the same price. ROYSON ENGR. CO., Hatboro, Pa. For information:

CIRCLE 537 ON READER CARD

## 10-inch strip recorder

Standard features of the OMNIGRAPHIC Model 10 strip recorder include half-second full scale pen response, remote pen and chart control, and a choice of five chart speeds from .05 to 20



inches/min. Disposable fiber-tipped pens are used on the device to record inputs presented in volts, millivolts, ohms, milliamps, or microamps from

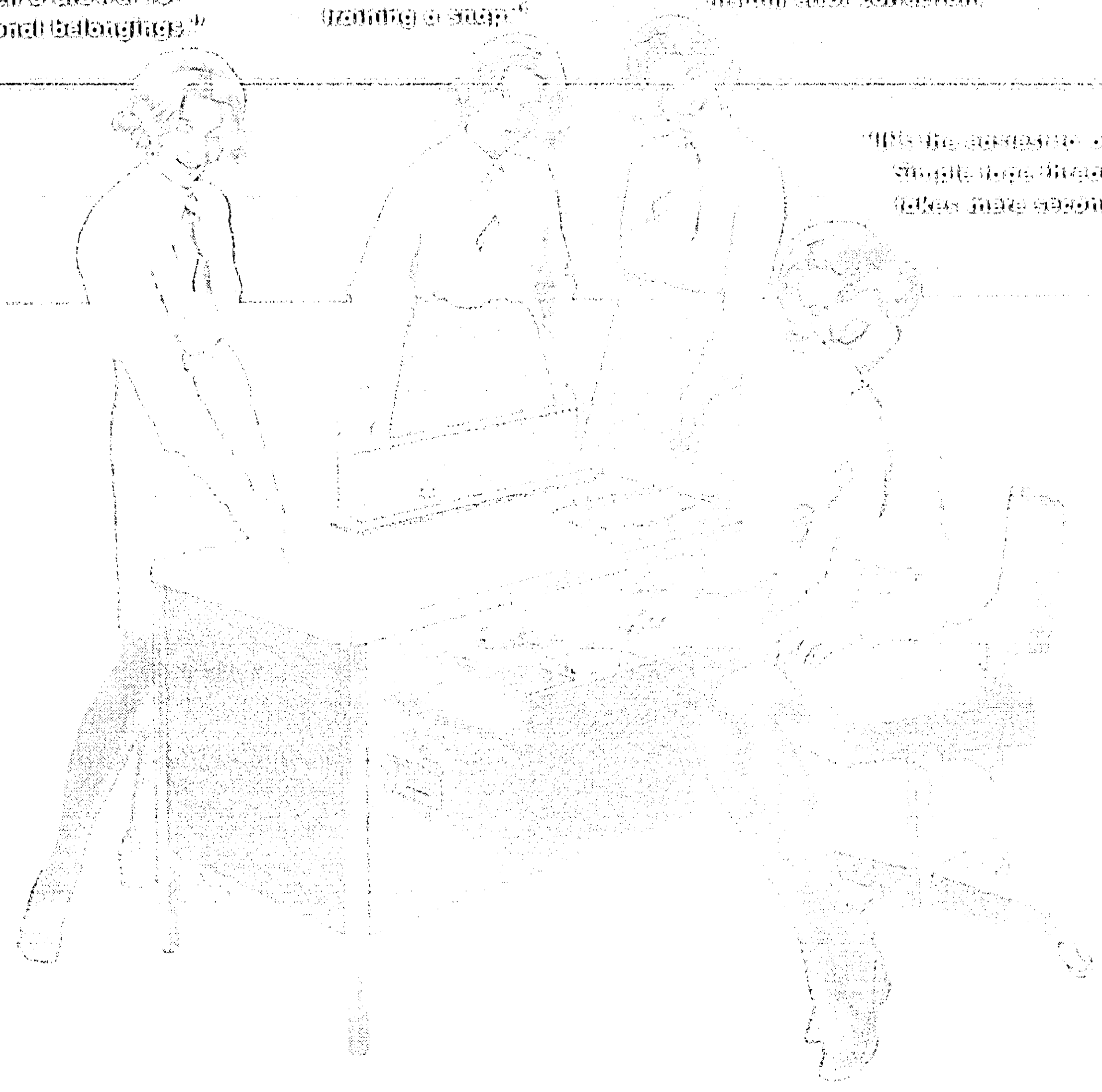
# Why select Sangamo Data Stations for keyboard applications?

## *Ask the operator who uses one.*

"There's more work space. Plenty of leg room. Even a drawer for personal belongings."

"It speaks 'English.' No confusing codes to learn. Makes training a snap."

"It's almost silent and magnetic erasure provides instant error correction."



"It's the [illegible] Simple tape threading takes mere seconds."

*It's human engineered!* [illegible] ning of the new Sangamo Data Station [illegible] vantages. It produces computer compatible tape [illegible] eliminates cards [illegible] as a verifier. Its electronics are 40% faster than the other leading keyboard-to-magnetic [illegible] trained by keyboard training, [illegible] Let's communicate!

SANGAMO ELECTRIC COMPANY Springfield, Illinois 62705

10-691

## new products

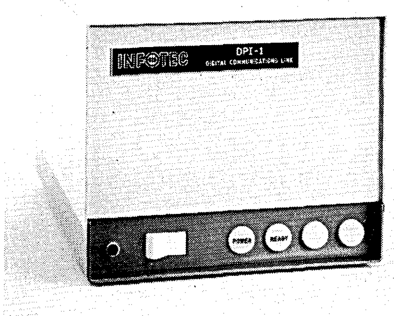
17 possible input ranges. Output is accurate to .25% full scale. The instrument is priced at $995. HOUSTON INSTRUMENT, Bellaire, Texas. For information:

CIRCLE 538 ON READER CARD

### data set interface

The DPI-1 Digital Communications Linkage has been redesigned using more intergrated circuits and fewer circuit boards, and is now a standalone unit, instead of a base for a data set. The DPI-1 provides exchange of data between a computer and remote peripherals, including printers, card reader/punches, plotters, crt's, etc. The unit includes a logic board and two interface boards. Price is $1,255, reduced to $1,060 in quantities of ten. The logic board alone, including all logic and control circuits, is available for $315. INFOTEC, INC., Rye, N.Y. For information:

CIRCLE 539 ON READER CARD



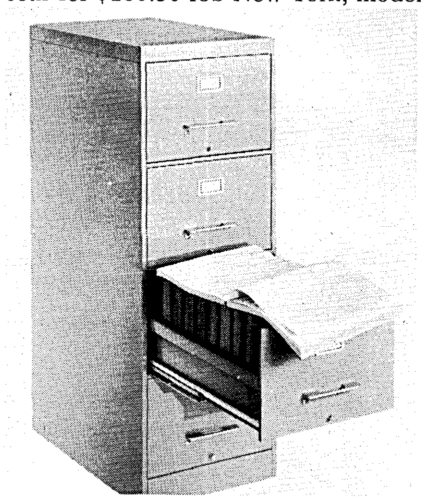

### multi-digit nixie

This Dutch vendor offers a 14-decade Nixie display which is packaged in a single tube. Because of its construction, only 27 connections are needed to display the 14 numerals rather than the 168 which would be required for 14 individual Nixie tubes. The characters are 10 mm high, and commas and the decimal are included but not counted in the total. The tube, which is called Pandicon (or type ZM 1200) is compatible with BCD coding. The unit is oem priced at about $27, which makes it about $2 per digit. Manufactured in the Netherlands by Philips, the display will be distributed in the U.S. by AMPEREX ELECTRONIC CORP., Slatersville, Rhode Island. For information:

CIRCLE 540 ON READER CARD

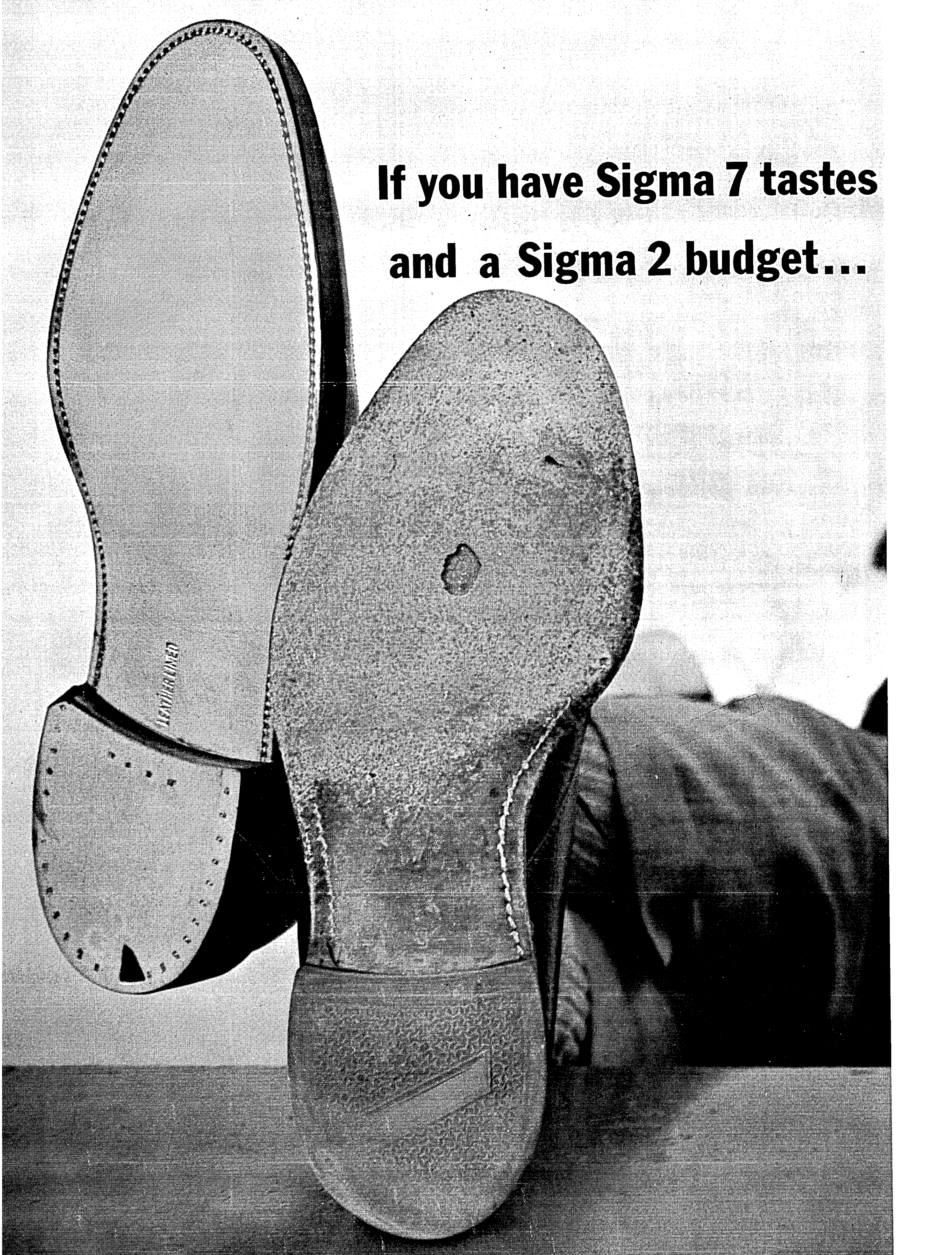
### printout file

Listings are too large for most standup file cabinets, and piles of nylon post binders are difficult to store or use. This EDP file has been designed to the dimensions of a bound listing specifically for computer users. Drawers are approximately 16 X 13 X 26 inches inside. Model 802, a two-drawer version, sells for $139.50 fob New York; model



804, the four-drawer size, sells for $219.95. Locks and special binder hangers are available if desired. COLE STEEL EQUIPMENT CO., New York, N.Y. For information:

CIRCLE 541 ON READER CARD


If you have Sigma 7 tastes
and a Sigma 2 budget...
LEATHER LINED

# new literature

**SERVICE BUREAU DIRECTORY:** 100-page directory lists nearly 450 ADAPSO member firms and their branches, approximately 45% of the total industry, and is arranged by state and city with an additional alphabetical grouping in the index. New software and timesharing members are included. Cost: $2. ASSOCIATION OF DATA PROCESSING SERVICE ORGANIZATIONS, 420 Lexington Ave., New York, N.Y. 10017.

**GRAPHICS IN MANAGEMENT:** Brochure describes the use of graphic presentations in various management functions and shows how CalComp digital plotting systems can be used to generate such presentations automatically, directly from the output of a digital computer. CALIFORNIA COMPUTER PRODUCTS, INC., Anaheim, Calif. For copy:
CIRCLE 542 ON READER CARD

**PERSONNEL SURVEY:** The results from 29,826 completed questionnaires for the "Information Processing Personnel Survey, 1968" are presented in the form of 15 charts, 6 tables and 77 graphs, plus explanatory text. The survey was conducted by six constituent societies of the American Federation of Information Processing Societies, the Data Processing Management Assn., and The Numerical Control Society and covers the membership of these organizations. Questions were asked about age, sex, education, employment professional activities and salaries. Salary breakdowns are extensive and include variations by age, experience, geography, education and type of employment. Cost: $5. AFIPS, 210 Summit Ave., Montvale, N.J. 07645.

**INSTRUMENTATION LITERATURE:** 1969 instrumentation publications catalog lists available annual ISA conference proceedings; proceedings of ISA-sponsored or co-sponsored symposia and conferences; standards and practices; books, monographs and reference works; International Federation of Automatic Control publications; educational and training aids; and periodicals. INSTRUMENT SOCIETY OF AMERICA, Pittsburgh, Pa. For copy:
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**COMPUTER LAB WORKBOOK:** 100-page workbook contains an interrelated set of experiments on logic gates, flip-flops, counters, adding circuits, register operations, logic circuit simplification, A/D conversion, and other types of digital circuits. The book contains over 150 problems ranging in difficulty from very simple to complex and is designed to accompany a course on logic design, digital techniques, or computer design. Solutions to problems are available in an accompanying instructor's manual. Cost: workbook, $3.50; manual, $1. ADTECH, INC., Box 10415, Honolulu, Hawaii 96816.

**LINE MANAGEMENT SUPPORT:** Twelve-page brochure describes the use of computer-based systems for order processing, production management and inventory control. The view is taken that the most profitable use of computers today lies in applications which increase management's ability to plan and control rather than in applications to further automate accounting functions or replace clerical effort. Systems which amplify management's ability to plan future activities are reaching a high state of development and are being effectively used by a number of companies and industries. Systems expanding management ability to control, however, have been slower in development even though they are logical extensions to planning systems. Case studies are given. BONNER & MOORE ASSOCIATES, INC., Houston, Tex. For copy:
CIRCLE 544 ON READER CARD

**ROLE OF COMPUTERS:** Two volumes of bibliographies on the role of computers in information sciences are available for $3 (microfiche, $.65) each. Volume I (304 pages, order AD-679 400) contains 249 references grouped under two major headings: time-shared, on-line, and real-time systems; and computer components. Volume II (297 pages, order AD-679 401) contains 239 references grouped under three major headings: artificial and programming languages, computer processing of analog data, and computer processing of digital data. CLEARINGHOUSE, U.S. DEPT. OF COMMERCE, Springfield, Va. 22151.

**DATA SETS:** Four-page brochure describes the Models PM-24A and B 2400 bps data sets specifically designed for use in multi-point polled systems. RTS-CTS delay is only 8.5 msec. Another application is in switched networks. The data sets operate over lines without adjustable equalization and can be switched between lines and operate effectively. No manual equalization is required. They can also be used in straightforward point-to-point transmission systems. The PM-24B is fully compatible with the Bell 201B. It has a wider transmitted spectrum than the PM-24A and requires a line with C2 conditioning. The PM-24A operates over unconditioned lines. The data sets are available for rack or shelf mounting or in drawer-type configuration. RIXON ELECTRONICS, INC., Silver Spring, Md. For copy:
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**CAREER OPPORTUNITIES:** Fifty-page directory gives corporate profiles and lists employment opportunities available in computer design, software development, and programming at 44 U.S. corporations. Cost: $2. RESOURCE PUBLICATIONS INC., 194 Nassau St., Princeton, N.J. 08540.

**PORTABLE CARD PUNCHES:** Twelve-page booklet contains 16 case histories showing how the company's portable card punches are being used both in and out of the computer room in data collection and processing systems. WRIGHT LINE, Worcester, Mass. For copy:

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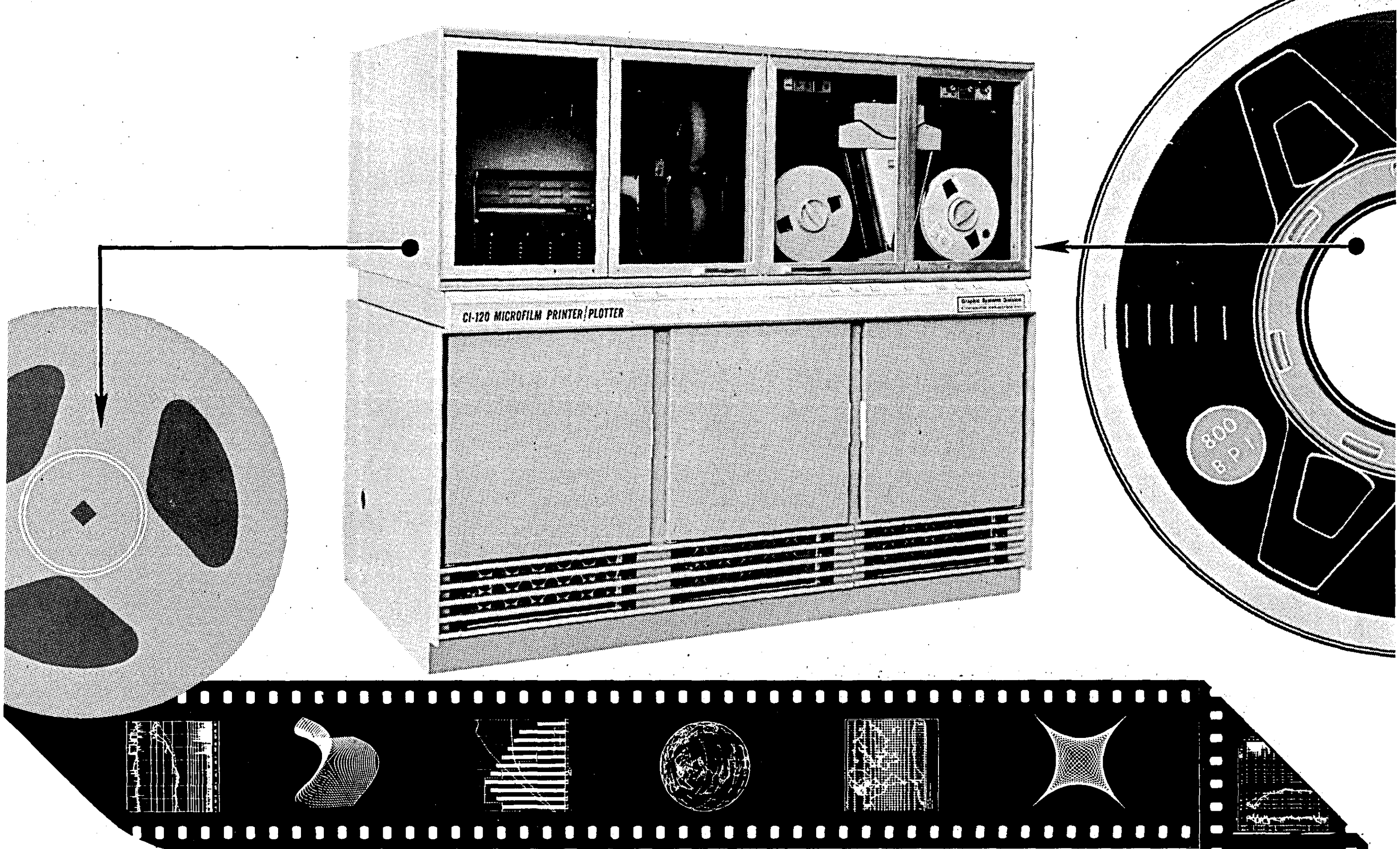
**KEYBOARDS:** Two four-page brochures describe solid state keyboards using integrated circuits that are actuated by magnets to produce a control voltage through the Hall effect. The only moving part in the keyboards is the switch plunger in each key. The basic difference between the two is a variation in key assignments. One model has a full 128-character code assignment. The

# MAG TAPE TO MICROFILM

## AT LOWEST COST




**LOWEST COST — FASTEST THRUPUT — SIMPLEST OPERATION — PROVEN SOFTWARE**

CI-120 MICROFILM PRINTER/PLOTTER provides independent off-line operation; 120 pages per minute; 5 film formats from 16mm to 8½ inches; functions include symbol plotting, axis and vector drawing; generates up to 192 characters; quick-look copies in 4 seconds; 7 or 9 track; print tape compatibility; extensive software available.

Model CI-180 MICROFILM PRINTER is available for applications requiring high speed printing.

**REQUEST PRODUCT-LINE LITERATURE**

**Computer Industries Inc.**

Graphic Systems Division
PIONEERS IN COMPUTER GRAPHICS
14761 Califa St., Van Nuys, California

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other has a dual mode USASCII encoded keyboard with 15 unassigned keys to be specified by the customer. Options for both include two-key rollover, non-delayed strobe, shift lock and enclosure. The product sheets also list power requirements, output levels, output interface, weight, operating and non-operating temperature ranges, button description, key row offset dimensions, and button orientation. MICRO SWITCH DIV. OF HONEYWELL INC., Freeport, Ill. For copy:
CIRCLE 547 ON READER CARD

**IDENTIFICATION CODE:** 242-page report suggests a universal code designed to organize and identify material in such a way that computers as well as humans can reduce the margin for error in identifying specific items of knowledge and information. Report supersedes PB-179 781. Order PB-180 521. Cost: $3; microfiche, $.65. CLEARINGHOUSE, U.S. DEPT. OF COMMERCE, Springfield, Va., 22151.

**COMMUNICATIONS SYSTEMS:** Eighteen-page brochure describes the company's line of data equipment and systems. The DigiNet line includes hardware and acoustically coupled data modems. Also covered are high-speed DigiNet wideband communication applications and DigiNet 150 multiplex for time-sharing. GENERAL ELECTRIC CO., Lynchburg, Va. For copy:
CIRCLE 548 ON READER CARD

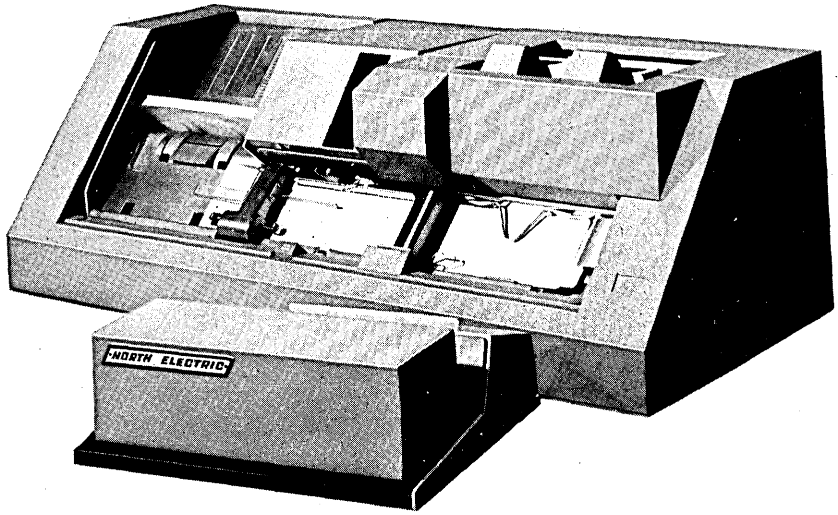
**MATH LANGUAGE:** 92-page report describes SLAMS (Simplified Language for Abstract Mathematical Structures) which combines the simpler syntax of the FORTRAN languages with some of the capabilities of the list processing language. AD-679 603. Cost: $3; microfiche, $.65. CLEARINGHOUSE, U.S. DEPT. OF COMMERCE, Springfield, Va. 22151.

**GOVERNMENTAL ADP:** 105-page booklet contains 35 essays on adp and its application to state and local government. Each essay deals with a particular adp problem or presents a point of view on automation in the public service. Authors of the articles have gone through the process of designing and programming a series of dp applications and installing a computer system. Topics covered are federal and state relations, adp planning, adp training, and adp usage in the executive, legislative and judicial branches. Price of "Governmental ADP: The Practitioners Speak" is $5. PUBLIC ADMINISTRATION SERVICE, 1313 E. 60th St., Chicago, Ill. 60637.

**REARS ITS UGLY HEAD:** "Sex and the Single Computer" is a collection of cartoons on man versus machine. Cost: $1. BETA ASSOC., Box 1196, Warner Robins, Ga. 31093.

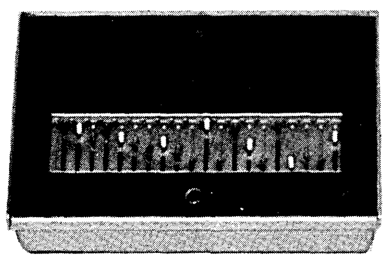
**CAI BIBLIOGRAPHY:** 73-page annotated bibliography cites books, articles, papers, reports and manuals on computer assisted instruction and contains indexes by subject and author. "The Computer in Education" is available for $2.10 from THE LIBRARY ASSOCIATION, 7 Ridgmount St., Store St., London, W.C.1, England.

**CORE MEMORY SYSTEM:** Ten-page technical bulletin describes ECOM-S random access core memory system fully




# this keypunch machine is being operated automatically by a shipping clerk

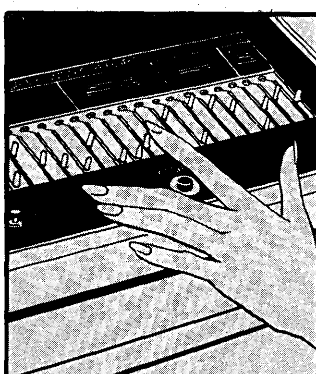
## (...and for less than $95.00 per month.)



Now with the basic North Electric Message-ComposeR™ System (leased for less than $95.00 per month) an unskilled operator can . . .

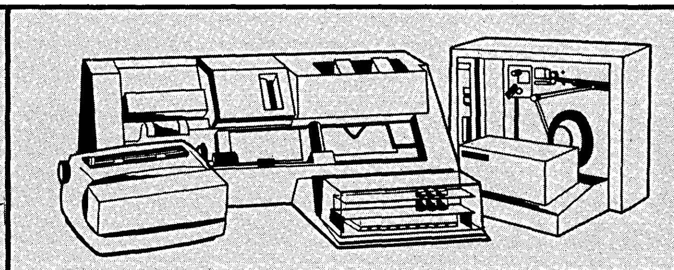
- **Use a simplified keyboard to encode and transmit variable and fixed data.**
- **Visually scan the message for accuracy before transmitting.**
- **Transmit over owned or leased lines . . . or, with North Electric acoustic couplers, transmit over the switched telephone network.**
- **Automatically produce punch cards, key tape or typewritten hard copy at any location.**

The North Electric Message-ComposeR System is a complete system usable by any organization that requires punch cards, key tapes or hard copy (the Message-ComposeR may also be used by real time systems with an adapter unit). In addition to the basic system, Card Readers, Time and Date Generators and Tape Recorders are available to expand the system's capability.



**The keyboard** of the system permits an unskilled operator to encode a message and scan it visually for accuracy, before transmitting.

**Easily changed overlays** serve as a guide to the operator. They are laid out in the language of the job and are coordinated with a program plug that automatically encodes required fixed data into the message.



**The Message-ComposeR System**, can compose and transmit messages to any point of conversion, automatically operating a North solenoid pack to produce punch cards, key tapes or typewritten copy – all three if required.

***Truly the most spectacular breakthrough in data entry and retrieval in years!***

**NORTH ELECTRIC**

Electronetics Division/Galion, Ohio 44833/419-468-8100
A subsidiary of United Utilities, Incorporated

contained on a single 7.50 x 16.70 PC board and designed for volume applications as a refresh memory for displays, a block buffer in key-to-tape, and as a small memory in process control computers. ECOM-S is available as an off-the-shelf memory and in capacities from 128 x 9 to 256 x 18. Complete specifications, memory interface timing, connector pin assignments, and complete dimensions are given. STANDARD MEMORIES, INC., Sherman Oaks, Calif. For copy:
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**DISCRETE DEVICES:** 64-page catalog contains a complete listing of the company's discrete devices, presenting key parameters and package outline dimensions along with a numerical index for quickly locating the device of interest. The listings are grouped by applications and include diodes, small signal transistors, dual transistors, field effect transistors, power transistors, communication devices, silicon controlled rectifiers, specialty diode products and electro-optical devices. All are Planar constructed. FAIRCHILD SEMICONDUCTOR, Mountain View, Calif. For copy:
CIRCLE 550 ON READER CARD

**HEXADECIMAL DEBUGGING:** 32-page manual explains the uses of the HEXADUMP OVERLAY, HEX-DEC ADDER and the HEXAVERTER 360 for analysis of hexadecimal dumps, and the HEXAVERTER 1401 for compatibility address calculations with the IBM 360/30 compatibility feature. Illustrations of operations with the debugging tools are included. SYSTEMS, INC., Elmhurst, Ill. For copy:
CIRCLE 551 ON READER CARD

**CIRCUIT ANALYSIS:** CODED-CAP, a conversational circuit analysis program, is described. The engineer or designer may describe a circuit to CODED-CAP in his own language, specifying the basic elements, component values, and tolerances. He need not be aware of the mathematical equations required or their method of solution for the program to respond immediately with a complete analysis of the circuit. At any time he may alter the model by changing the design or part of the design and do another analysis. Editing features allow immediate correction of errors. CODED-CAP offers AC or DC circuit analysis to calculate nominal, worst case, component sensitivity, statistical analysis, parameter variation, gainphase response. Circuits may contain up to 25 nodes and 75 elements. COM-SHARE, INC., Ann Arbor, Mich. For copy:
CIRCLE 552 ON READER CARD

**DATA ACQUISITION:** Eight-page brochure describes models 1000 and 1500 analog/digital data acquisition and recording systems. Typical system is comprised of the input multiplexing circuitry, the necessary conversion equipment, and an output device (incremental magnetic tape recorder, line printer, tape printer, tape punch, card punch, or Teletype). DATATRON, INC. For copy:
CIRCLE 553 ON READER CARD

**PLOTTER SUBROUTINES:** Four-page bulletin describes a group of relocatable subroutines for driving the company's COMPLOT incremental plotting system. The subroutines are written in FORTRAN II and ASA FORTRAN IV; any FORTRAN language program can call them. HOUSTON INSTRUMENT, Bellaire, Tex. For copy:
CIRCLE 554 ON READER CARD

# THE ONLY TOTALLY COMPATIBLE DISC DRIVE AVAILABLE

Here is the Linnell Model 1100. It is designed specifically for System 360 users who want a disc drive which performs, looks and behaves exactly like the IBM 2311. Not faster. Not trickier. Not differently. But exactly like the 2311 in everything—concept, program, interface, styling, maintenance and reliability. This is more than just plug-to-plug compatibility; it is a completely parallel design from the floor up. This means identical contour, colors and dimensions. It means part-for-part interchangeability in essential mechanical components. And it means identical procedure-for-procedure maintenance. More than that, it means assured performance reliability because only thoroughly proven techniques have been used. And since there has been no expensive experimenting with engineering novelty, it also means that it is the lowest priced disc drive in the industry—slightly more than half the cost of its IBM prototype.

Linnell Electronics, Inc., Cooper Parkway Building West, Pennsauken, New Jersey 08109

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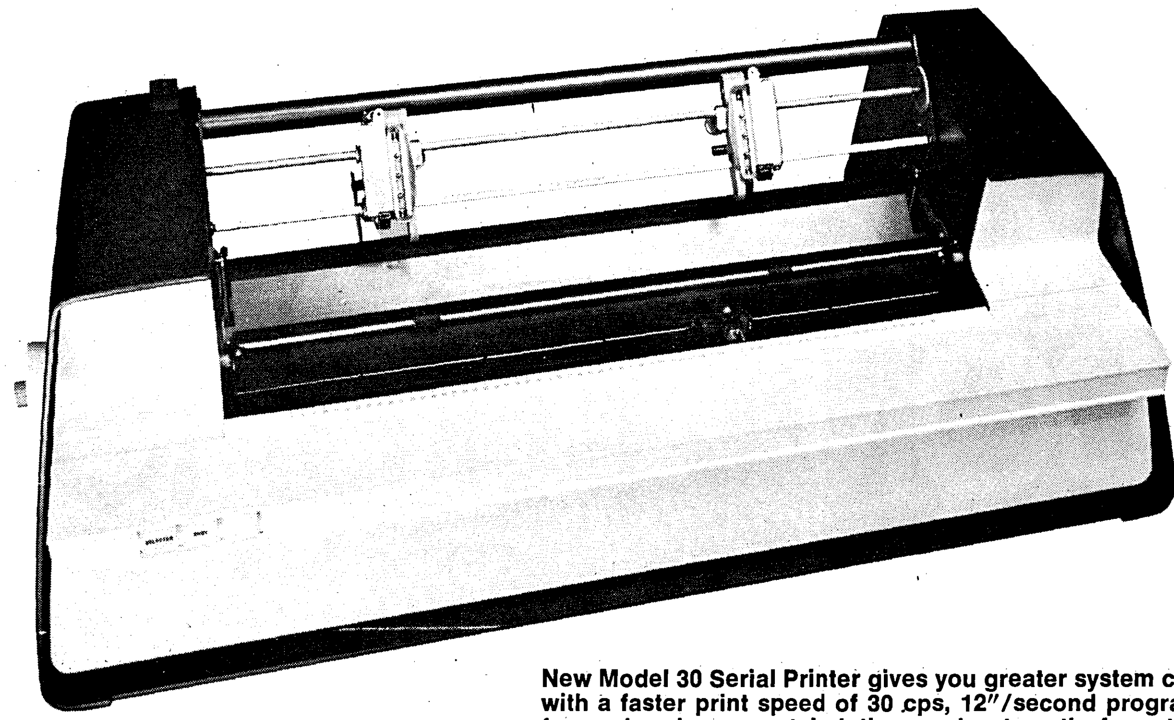
# New printer lets you cut data system design time



**New Model 30 Serial Printer gives you greater system capability with a faster print speed of 30 cps, 12"/second programmable *forward* and *reverse* tabulation, and automatic format control.**

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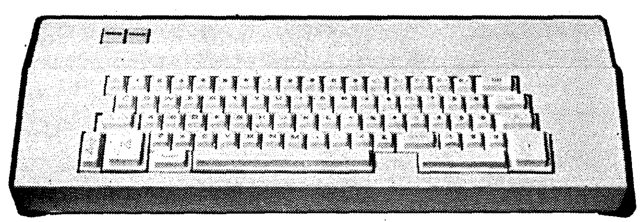
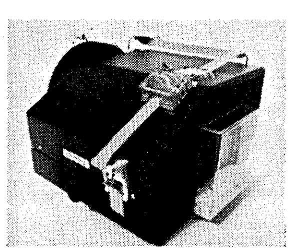
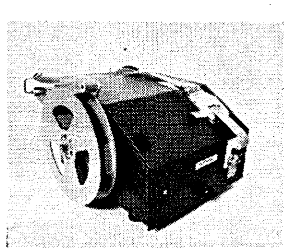
OEM products include reliable 50 cps. edge-punched card and tape punches and readers in a variety of configurations. You get advanced design features such as small, efficient electromagnets in combination with over-center springs for smooth, trouble-free punching over a long life — reluctance type pick up — bi-directional reader — semi-automatic tape feed.



**Companion keyboard**



**Tape Punch**



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# world report

**SOFTWARE HOUSES WEAVE A TANGLED WEB**

Metra International, Europe's biggest computer science and software consulting house, has brought a new twist to the tangled web of the software industry on the other side of the Atlantic. The Paris-based organisation recently completed a 20% stock sale to Leasco and has established two new companies: Metramerica in the U.S. and Metra Canada. This development runs contrary to the trends of the past three years in which European firms have been more inward-looking in attempts to defend themselves against American competition. Right now the European software boom is beginning to emulate the American scene with at least one new firm being registered each day—the bulk of these are two enthusiasts with a package or an idea for a package. But to arrive at this state, software pioneers have been through a number of hoops to consolidate the position of the independents. For example, separate companies with complementary interests and similar names, Computer Analysts and Programmers in Paris and London, joined forces to form CAP Europe over two years ago. An ailing CEIR, Ltd., sold out to British Petroleum, and Computer Sciences finally secured its bridgehead in Europe by taking in the giant Dutch Philips company as a 25% partner. And it took the backing of the huge tea combine, Brooke Bond Liebig, to get the slightly younger Management Dynamics off the ground. In general, the software industry owes much of its precarious state to conservative bankers and financiers who are not prepared to risk capital.

But almost overnight there has been a revolution with the invasion of the cash-happy leasing companies like Leasco, Greyhound, Granite, and Boothe that are rooting for established service firms to join them. Granite's bid for Management Dynamics has been out-maneuvered in a late play by Greyhound, which offered \$6 million cash. One problem is that European bankers have doubts about investments where the profit-earning ratio is greater than 25; stocks of over 100 times earnings cause apoplexy. Against this background, the leasing companies seem to be putting some real verve back into the software scene and at the same time are unifying work in Europe by breaking down national barriers.

**PHILIPS DELIVERS IN RECORD TIME**

For a company that broke into the bigtime market with an industry-compatible series less than a year ago, the Dutch Philips group has wasted no time in dealing with the myriad of users at the billing and accounting machine end of the market. With its new P350 series, the firm is chasing a potential \$50 million a year market with a magnetic ledger card system that has up to 1K words of 16 bits additional store, card and paper tape readers and punches, and four independent form feeds. The units are priced between \$7.2K and \$14.5K. Philips has moved faster than any other European manufacturer in attempting to straddle the field from the accounting and unit record applications to the edp sophisticate spending a comparable sum on monthly rentals. What's more, the group allowed only a month between the unveiling ceremony and the delivery of the first P350 models this month.

*(Continued on page 273)*

# Is cutting your IBM 360 sort time in half worth $200 a month?


The name is PISORT and Programmatics could do it because Programmatics is in the software business. Strictly. PISORT is an amazingly simple piece of plug-in software that's fully compatible with IBM's DOS sort program. Programmatics guarantees that PISORT will not only cut your sort time in half; it will cut your disk space in half at the same time. PISORT includes all the features of DSORT and utilizes the same JCL and sort control cards. What you have to have, of course, is an IBM 360 with 65K or more operating on DOS. Which doesn't mean that all you OS people should defenestrate yourselves. We're working on our OS PISORT now. Lease, license and lots more good information is available on request. By now, you've probably rationalized that your IBM Sort is free. Which is true. But you've got to admit that it's only half fast.

**PI PROGRAMMATICS**
11661 San Vicente Blvd., Los Angeles, Calif. 90049
11401 North Shore Drive, Reston, Virginia 22070

**GE DOESN'T WANT TO SHARE TIME-SHARING**

GE has reaffirmed its intention to dominate the growing European time-sharing business through its subsidiaries. In simultaneous announcements in Paris, Milan, and London, the group outlined plans to more than double its investment, by an extra $20 million, through extending the operations of Bull-GE, France; and GE Information Systems, Italy and the UK. Part of the new drive will be a blanket attack to increase both hardware installations and the number of customers using the 12 main installations that GE has established throughout Europe. GE reckons that it totaled 6,000 users last year.

**BUT ICL WANTS ITS SHARE OF THE CAKE**

International Computers, Ltd., looks ready to get its overdue slice of the time-sharing cake. On System 4, multitest is ready for a small scale system on models 40 and 50 to give an interactive version of Fortran with around 15 terminals. And, still on the small scale systems, Minimop has been delivering a service to other university users with a 1900 series, and up to 10 terminals on multiaccess. But the big break for ICL has come on George 3, the software that, like Univac's Exec 8 and IBM's TSS, has been having a bit of a thin time. The key to time-sharing on the big 1900's, George 3 has come clean just as a number of big orders are in the balance and as the pundits were writing it off as another project to founder on over-ambition. With a lot at stake, ICL has been keeping remarkably quiet about its success with the Swedish concern, L. M. Ericsson, which has been the guinea pig in the effort to get production turnaround using George. The manufacturer's caution is understandable since it is warily eyeing the Customs and Excise job planned for London airport. Clean running of George 3 is the technical point that puts ICL back in the running for the order on legitimate technical grounds. So far, Univac has been a strong contender for the multimegabuck installation that includes a battery of terminal displays and direct links to airlines' edp systems for speeding the handling of freight. A decision on the installation will come from the National Data Processing Service, which, as a quasi-government body, has bias in favour of a local manufacturer. In an attempt at impartiality, the NDPS has had technical evaluations made by outside international software groups. But the decision date has slipped noticeably at a stage when ICL could be the main beneficiary of breathing space.

**BITS AND PIECES**

IBM may withdraw from an arrangement to bulk supply 12 360's to the Algerian government. The middle-east situation poses political difficulties and an alternative supplier in Europe has been sought...And writing in the Soviet press, a Russian academician suggests that IBM is interested in taking up design ideas from the MIR, a recent successor in the medium scientific machine series that started with Promin. Academician V. Glushkov of the Ukranian Academy of Sciences suggests that the giant is interested in the method of interpreters developed for MIR...In defensive mood against the microelectronic invaders, the UK Government has put $12 million development money into the three major component and semiconductor houses, Ferranti, Marconi-Elliott, and Plessey to stave off growing inroads by Texas Instruments, Motorola, Fairchild, and Signetics.

# washington report

## STUDY URGES NEW APPROACH TO MAINTENANCE CONTRACTS

By contracting for dpe maintenance on a time-and-materials basis, instead of using standard service contracts, the Federal government could conservatively cut edp costs $2.5 million per year and pcam costs $2 million per year, says a recent in-depth, voluminous study done by the Boston Computer Group for GSA.

Maintenance of all H200's and IBM 1400's in the Federal inventory should be transferred to a t/m basis first, said BCG; then the arrangement should be extended to all installations now receiving vendor-supplied on-call service. Other recommendations: GSA should train dp installation managers to negotiate maintenance with vendors, and should establish a review board to monitor and improve this process. In-house maintenance of pcam equipment should be started to find out whether it can compete with outside service.

In-house maintenance should also be implemented selectively at single-site installations where: management is "strong," at least two maintenance men per shift are required, and there is a reasonable chance of reducing costs at least $25K below the best offer made by an outside maintenance supplier. Third party organizations should be encouraged to bid on all maintenance contracts, BCG added.

## PACKAGED PACKAGES MAY VIOLATE ANTITRUST

If computer programs ultimately become patentable, software houses could run afoul of the antitrust laws, Justice Department attorney Don Baker told a recent conference on software protection.

The violation would occur, he explained, if a software firm forced a buyer to purchase programs he didn't need in order to get one he did need. Over the years, the courts have considered similar "tie-in" arrangements many times and have decided they are illegal. A pending example is the government suit against IBM; that case rests partly on a charge that the great gray giant has illegally tied its hardware and software together.

Baker said the court decisions already rendered indicate clearly that if software "becomes subject to some type of patent or copyright protection" programs will have to be offered "separately, on reasonable terms," and not "solely on a packaged basis."

## FED COBOL STANDARD BEGINS THE JOURNEY

Preliminary work on a Federal Cobol standard may begin this month with a meeting between NBS, GSA, and BOB to decide: who will write a first draft, what it will cover, and who must approve the version released for industry comment. (This is to be done through publication in the Federal Register.) Dr. Herb Grosch, the bureau's chief standards architect, tells us that: he would like to see a three-level compiler specified, but will go along with four, or two levels, in that order. He thinks the standard should include object code audit capability and a source-code preprocessor. Grosch wants a "floor" specified for each level, plus a "floating ceiling." The flotation would allow users to obtain features not yet standardized by USASI, as well as "some" features of a higher level or levels,

*(Continued on page 279)*

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but not so many of the latter that the user would have to pay a lot more for capability he didn't need.

If USASI-blessed preprocessor and audit modules were added to all Cobol compilers purchased by Uncle Sam, it might reduce development costs considerably by eliminating the need for each supplier to work up his own routines, said Grosch. He thought the result would be lower compiler costs to the user.

There is a "big opportunity for software companies to develop and market their own Cobol compilers to the government, independent of the hardware companies," he added, implying that NBS wants to stimulate competition so that users don't have to accept, and pay for, the Cobol compilers presently available; they frequently contain features superfluous to individual needs.

Related developments: The hassle over publication of the USASI Cobol standard seems to be on the way to a settlement. The standards group, reportedly, will permit reproduction of parts of the manual (which will be copyrighted), and will provide the government with bulk quantities at a reduced price. The amount of the discount, and the publication format, were being negotiated at press time.

## ASCII TO BE IMPLEMENTED AS FEDERAL STANDARD

Instructions for implementing ASCII as a Federal standard were finally approved last month by Commerce Secretary Maurice Stans, almost a year to the day after LBJ ordered the move. Strong opposition by CDC and Honeywell was apparently overcome largely by NBS director Allen V. Astin, who was serving temporarily as an assistant secretary of commerce when the final draft of the ASCII instructions reached Stans' office. The adopted version differs only slightly from the one we described last month (p. 102). Industry opponents say they've lost a battle but not a war. The real meaning of several instructions will be revealed only gradually, as Federal users who want to operate nonconforming systems ask for waivers.

## CAPITOL BRIEFS

Brig. Gen. William C. Pratt, director of data automation for the Air Force, retires August 1. No successor has been named yet...Tom Bianco, who became national sales manager for Software Products Corp. last October, has joined SPC's arch rival, Comress, Inc., as manager of Federal marketing. "He came to them, not vice versa," says a knowledgeable source. SPC explains the company and Bianco were "incompatible." ...VIP Systems, DC-based t-s service bureau, plans to open in Boston next month after doing likewise in New York City recently. One voice-grade line connects VIP's 360/40 with either city; each is multiplexible into 10-14 circuits. The company is reportedly eying other east coast outlets, and ultimately hopes to expand into the midwest and/or far west...Microwave Transmission Corp., a UCC subsidiary, has acquired Columbia Basin Microwave Corp., a Washington state video common carrier. Meanwhile, FCC has agreed to the transfer of Transamerican Microwave's license to MTC...Hearings on HR404, Congressman Jack Brooks' bill to computerize Congress, are likely this month. Brooks wants GAO to run the system, but the agency has been unwilling—at least until recently. "Brooks is persistent," says one source. "He has persuaded GAO brass that they are uniquely well qualified to take on the job."

position on FCC matters, are apparently devoting appreciable time to hammering each other. Representatives of IBM and Honeywell are reportedly fighting the others. We are told that the argument got so heated at one point recently that a majority was on the verge of asking chairman Wally Dowd of IBM to resign. IBM and Honeywell don't want to fight AT&T on foreign attachments "because their ability to market communications hardware isn't as well developed as the other manufacturers," says a member of the opposition camp.

**UCC's FASBAC: MODIFIED T-S**

Although it's currently tied to the 1108—considered by industry savants as a poor time-sharing machine—ever-resourceful University Computing has figured out a way to offer T-S thru its computer "utility" network.

The Dallas cowpokes have hooked up a modified PDP-8 (multiplexer) to a modified PDP-9 and a Fastrand drum to allow on-line use of new software; text editing, calculator languages and output reports. Coming: file manipulation. The T-S system will be linked thru the drum to the 1108, allowing remote batch entry of large jobs to the big beast, after the multiplexer converts the T-S ASC11 code. Each multiplexer will handle 28 simultaneous terminals; they're planning up to four multiplexers per T-S system.

Named FASBAC, the system is now in field test in Dallas and El Segundo, should be available soon.

**NEW T-S TERMINAL DOFFS WRAPS AT SJCC**

A new San Antonio firm, Computer Terminal Corp., will show its initial product at the SJCC. It's a self-contained, solid-state/keyboard crt terminal aimed at the time-sharing market, and compatible with all T-S services using Teletype terminals. The keyboard has a 64-character set, and the crt can accommodate up to 1800 characters at one time in its 25-line/72 character-per-line format, with a data transmission rate of up to 600 bps standard. Optional: 4800 bps, mag tape memory, ten-key adder keyboard and hard copy printer. Gerald Mazur is chairman of the board of the new firm. Phil Ray, president, and Austin Roche, vp, formerly were with General Dynamics Dynatronics division.

**FEDS PAVE WAY FOR INDEPENDENTS' PERIPHERALS**

GSA plans to release an RFP this month that will give independent peripheral makers their first opportunity to bid directly on Federal ADP systems. The details have been worked out in extensive discussions between GSA and peripheral makers the past several weeks. Bryant Computer Products' Dick Caveney was among the participants; his incessant nagging is largely responsible for convincing GSA to give the independents a chance.

The procurement covers a system to be operated by the Commerce Department in parallel with an existing installation—either a 360/30 or /40—acquired entirely from IBM. Hopefully, the parallel buy will show whether acquiring independently made peripherals is more cost effective than buying them from the mainframe maker.

Four tape units, a disc, card reader/punch, and printer, are among the peripherals needed. Peripheral bids will be accepted from mainframers as

(Continued on page 283)

well as from independents. Each vendor who bids a cpu will describe its I/O requirements, and each independent peripheral maker will be benchmarked on his ability to satisfy these requirements without degrading system operations. A team composed of GSA, DOD, and Commerce officials will act as installation manager. Maintenance responsibility probably will go either to government personnel or to a third party.

GSA plans, later, to test the cost effectiveness of procuring software and hardware from different sources, but this project reportedly is still in a "preliminary" stage.

Related development: DOD has directed its installation managers to solicit bids from independent peripheral makers whenever systems are to be augmented or peripherals are to be replaced. But the new policy isn't likely to be implemented for awhile because the Pentagon wants GSA to prequalify potential suppliers, and the agency lacks facilities to do this.

RUMORS AND RAW RANDOM DATA

RCA's maintenance firm, hot for computer maintenance contracts, including IBM equipment, has snagged an impressive customer: American Airlines' 1500-1800 terminals and some related equipment, developed by IBM Federal Systems Division. RCA is also trying for IBM mainframe maintenance at AA...And while we're mentioning Federal Systems, it's rumored that its "civil programs" group has achieved about $25 million worth in commercial contracts, primarily in facility management, for this year. The group, which is part of the Federal Systems Center of FSD, is said to have 250 people...Share is reviewing its membership requirements because some are using "the club" as a place to do business...Yale University won't comment, but rumor says its computer center is in bad financial shape and that several of its staff have or will quit. A 360/50 may be returned to IBM...A large time-sharing service uses a specially designed timer which may be the hottest in the business. It slightly exaggerates the amount of time used; we don't know if users are aware of this surcharge...Another exodus at CSC? Walt McHale, originator of the Compticket idea, and Warren White, a key man at Computer Sciences Institute, have left...ITT Data Services has lost three top marketing people over policy disagreements. Don Freel, marketing vp, has formed a marketing services firm, Don Freel & Associates, New York. Services include marketing plan development, direct selling for software, hardware, service bureau and time-sharing firms, consulting and advertising. Bill Mulligan has gone to Computer Corp. of America, a Freel customer; Arnold Silverman is with Interactive Computing Corp...IBM, bowing to the screams of users of the Conversational Programming System (IBM version of RUSH), reinstated support for the package a few days after withdrawing it...Burroughs is said to be planning internal use of any B-8501's in construction. Customers like the University of Wisconsin will get the 8502, now under wraps but said to have "unique" and "significant" architectural design...The IBM announcement that version 5 of PL/I includes teleprocessing rubbed salt into the wounds of Cobol fans who had been fighting for years for the same capability in Cobol F. It will come someday in IBM's Usascobol, as soon as USASI develops the teleprocessing standard.

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Third, we've got our production line rolling. Delivering ahead of schedule. It isn't surprising. Because we deliberately designed NOVA to be the easiest small computer in the world to make. No complicated back-wiring. It's MSI. This year we're making several hundred. Next year, over a thousand.

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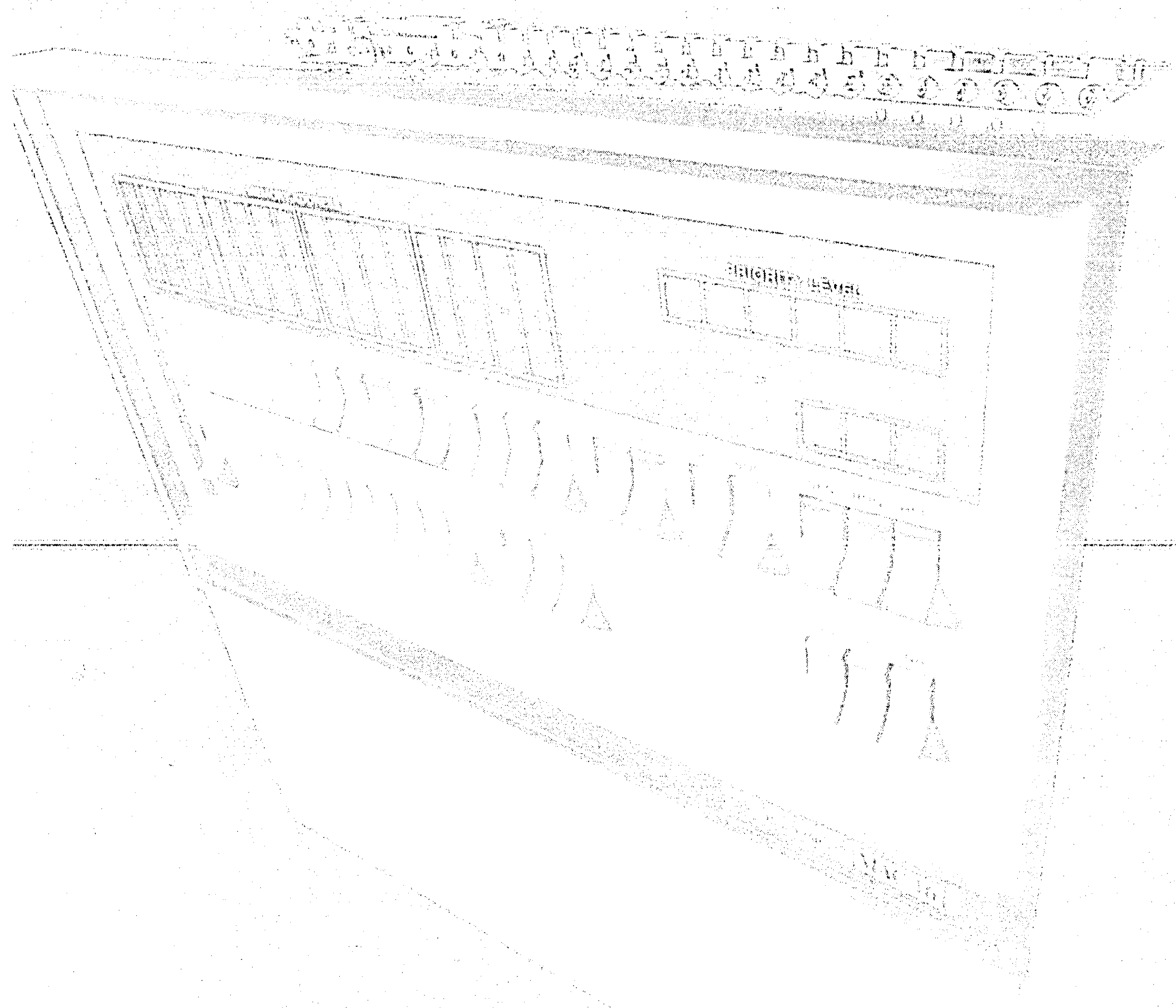
DATA GENERAL CORPORATION
Southboro, Massachusetts 01772
[illegible]

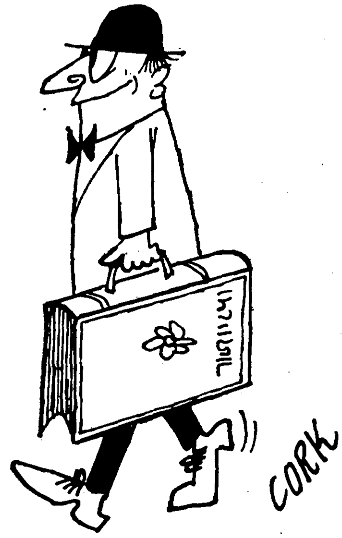
Harvey P. Newquist, Director of Manufacturing



# books

**_Computer Peripherals & Typesetting_, by Arthur H. Phillips. Her Majesty's Stationery Office (London, 1968); 665 pages, $28.80. Available from Sales Section, British Information Services, 845 Third Ave., New York, N.Y. 10022.**

Just as with sex, computerized typesetting has come on like gang busters in recent years. There seems to be no limit to the techniques that can be devised, and the activity is no longer limited to the formal institutions previously associated with it. If the Puritan ethic is a thing of the past, so also, it



seems, is the hot-metal typesetting technology that has been the industry mainstay.

The latter has served the printing and publishing industries well since the first mechanization of this function in the 1880's or so. But at that time, and until recent years, printing was dominated by the letterpress printing process. And that required type set in relief form. To computerize this activity, one wrote a program to read raw copy and output coded paper tape that could be used to drive a linecaster.

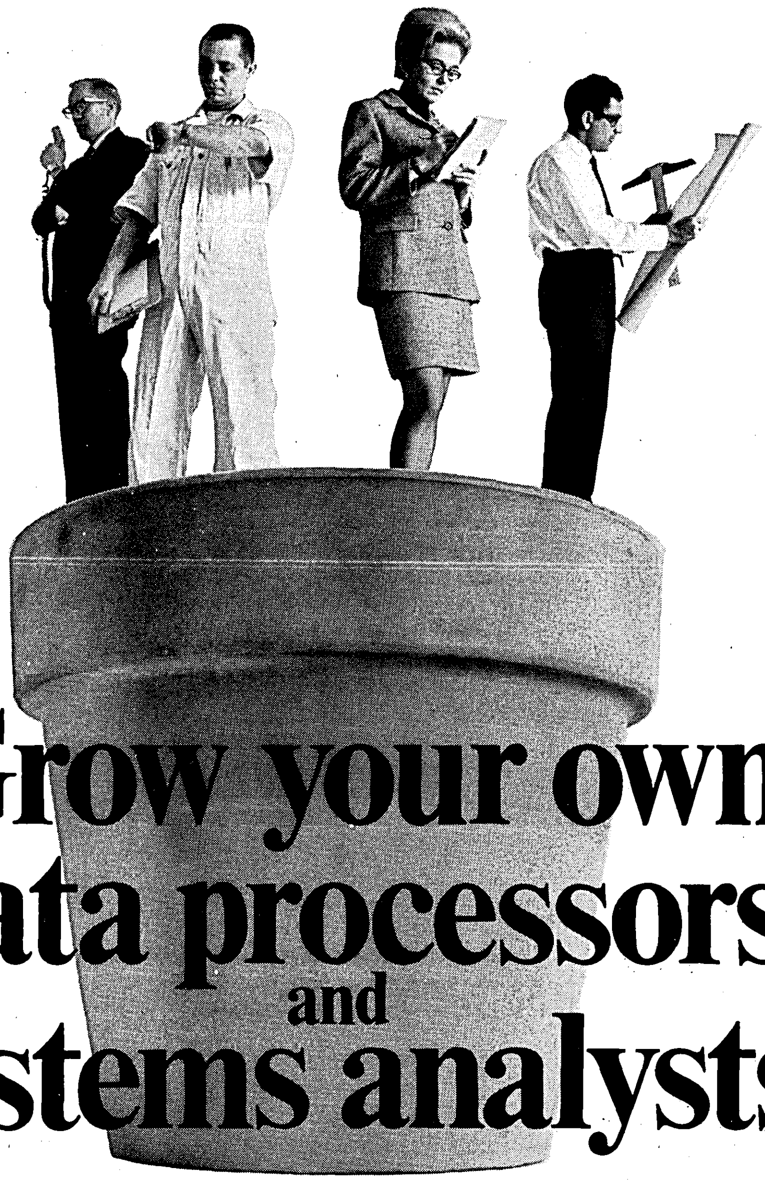
This is what the Los Angeles Times did back in 1962, using an RCA 301. While it opened the eyes of those in the graphic arts industry to other possibilities of harnessing the computer's capabilities, it also became evident that the typesetting device was the limiting factor. The tape-driven Linotype, for example, could produce only about 12 to 15 lines per minute, and this in the form of a bloody slug that still required physical handling.

By contrast, today's printing scene is dominated by the offset lithography process, which accounts for slightly more than 50% of the dollar volume of printing in the U.S. DATAMATION is printed by offset from plates exposed through photographic film. Although it would be presumptuous to say that computerized typesetting is behind this recent surge to lithography, it can be said that lithography has opened the way to the broader use of phototypesetting. No longer is it adequate to produce hyphenated and justified lines of type; now, photographically, they want to generate full pages of text and illustrations, complete with headlines and footnotes, page numbers and indexes.

Not all endeavors in the industry are this ambitious, but the manpower being assigned to the design of hardware and software for varying chunks of it is being held back by the shortage of qualified personnel. And ideas. (And money.) Manufacturers, for example, have yet to come up with a cheap and fast way of preparing input, forcing the majority of users to go from keyboard to paper tape. Nor is there a solution to the proofing problem.

In the software area, one user says he finds it preferable to train typesetters to write application programs, rather than to teach programmers typesetting. The latter find typesetting too dull, while typesetters find the computer field attractive and therefore are motivated to excel in some phase of it.

In this otherwise excellent guide to the application of computers to the generation of alphanumeric text, the subject is not enhanced in glamor. But the volume, written for the printing practitioner, serves as both a valuable introduction to the subject, the problems encountered and the efforts made so far to overcome them, and as a reference to the hardware and software. It started out as a study of the applicability of computers to typesetting, performed for Her Majesty's Stationery Office—Britain's equivalent to the U.S. Government Printing Office. Following a limited distribution of several reports, it was urged that Phillips ex-



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pand them into a reference work.

As a result of this history, the book is a straightforward, descriptive tome. It is divided into three parts. The first section, some 80 pages in length, is devoted to an introductory survey of the topic: the problems, goals, and alternative routes. Enumerated are typesetting jobs most suitable for the computer, and a questionnaire for the systems analyst. In a chapter on programming and languages, the author repeats a cardinal principle: there must be only one keyboarding of text, other than for corrections.

In the following chapter, the author focuses on six examples of typesetting jobs, setting forth the problems encountered in each and showing simplified flowcharts. The jobs: numeric data phototypesetting, alphanumeric phototypesetting, alphanumeric typesetting with crt control of page makeup, information retrieval and composition, phototypesetting from a data bank, and composition with crt-edited input.

Closing this section, which is an education in itself, is a survey of typesetting R&D and information retrieval projects. In lesser and greater detail, Phillips reviews systems placed on the air by newspaper and magazine printers and book compositors worldwide. It is noted here, for example, that Time magazine's stories are keyboarded four times before reaching ink.

The second section provides a fairly detailed look at peripheral equipment, all discussed with text composition in mind. A chapter on OCR is followed by one on crt's, discussing their display function as well as character generation. In a separate chapter, crt's are examined in relation to microfilm. Keyboards, which are of paramount importance and viewed with more concern by typesetters than are keypunches by the edp man, are given heavy emphasis and treatment. Befitting a volume of this magnitude (and price), the complement of hardware is not restricted to that of British origin or use.

In the third section, Phillips looks at units of measurement used in printing, bookwork format specification and character sets, teletypesetting systems, teletypesetter coding analysis, and phototypesetters. In the latter chapter, the evolution of phototypesetters is traced and accompanied by a sample of composition from the Orotype, a machine whose lineage dates back to 1925. From this heritage came the familiar Intertype Fotosetter, which operated much like the hot-metal lincaster except that it produced images photographically. A Japanese and a Chinese filmsetter are also described.

In individual chapters, more detailed treatment is given the Monotype and Monophoto systems, which are driven by 31-channel paper tapes referred to by some as toilet paper, the Linofilm and Linofilm Quick, and the Photon 200 and 713. Shorter but adequate examinations are also supplied on the Photon 900, Linotron 505 and 1010, the Alphanumeric/IBM 2680, and the RCA/Hell Videocomp 820.

The Fotosetter mentioned above dates back some 20 years, and since that time the developments in photocomposition have come fast. While the Fotosetter ran at 8 cps, both the IBM/Alphanumeric and recent RCA Videocomp systems have speeds in the 4,000-6,000 cps range. Additional features of the newer hardware include the ability to mix type sizes and faces, produce a full page for formatted text, and output on paper, film, or short-run offset plates.

And this, in many circles, is the hoped-for short-range goal—to go directly from the photocomposer to press-ready plates. For the long run, they talk about going directly from the computer to the press, bypassing the plate, and probably transferring the image without any physical contact with the paper—or whatever they'll be printing on. Meanwhile, of course, they're also tinkering in the copy preparation stages where, it is hoped, computer scientists will make it possible for editors to work with lightpen and crt to perform both the editing and page layout functions.

Early studies of such systems that have been undertaken are indicated by Phillips. But today the concern is still centered on the task of getting throughput at an economical cost. And it is to the growing population of typesetters who are turning to the computer that this volume is directed. While the book's price is high, there is no other single volume that compares with this in providing an overview of the field. —EDWARD K. YASAKI

# book briefs

*(For further information on the books listed here, please write directly to the publisher mentioned.)*

***How Computers Do It*, by David B. Moursund. Wadsworth Publishing Co., Inc., Belmont, Calif. 1969. 124 pages.**

A paperback introduction intended for college freshmen and assuming no knowledge of mathematics beyond

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second-year high school algebra. Includes student exercises and a brief glossary.

***A First Course in ALGOL 60*, by Eric Foxley and Henry R. Neave. Addison-Wesley Publishing Co., Inc., Reading, Mass. 1968. 246 pages (paperback), $4.95.**
A text developed at Nottingham University to be suitable for anyone interested in using a computer, regardless of technical background. It's very carefully arranged, with many examples and exercises in a step-by-step explanation.

***Circuit Design of Digital Computers*, by Joseph K. Hawkins. John Wiley & Sons, Inc. New York, N.Y. 1968. 515 pages, $17.50.**
The author says in a preface that his intention in this book is to bring some "order and unity to the subject of digital circuit performance." He covers "detailed circuit performance analyses" of the bipolar transistor and the magnetic component. The book is based on material developed for a one-semester graduate course in engineering.

***Planning by Network*, by H. S. Woodgate. Brandon Systems Press, Inc., Princeton, N.J. 1968. 385 pages, $15.**
This is the second edition of a book first published in 1964 that has received considerable praise. It has been revised to include recent developments in PERT and CPM and is written from the viewpoint of operational management rather than that of the theoretician.

***The Computer Programmer's Dictionary and Handbook*, by Donald D. Spencer. Blaisdell Publishing Co., Waltham, Mass. 1968. 244 pages, paperback.**
A miscellany, intended for use as a supplementary handbook for students in programming courses. It includes a dictionary with about 1200 entries and sections on number systems, number conversion methods, various code tables, computer service organizations, and so on.

***Simulation: The Dynamic Modeling of Ideas and Systems with Computers*, edited by John McLeod. McGraw-Hill, New York, N.Y. 1968. 344 (oversize) pages, $15.**
This is a collection of 30 articles that have appeared in *Simulation*, the journal of Simulation Councils, Inc. They are grouped in three sections: evolution, present state of the art, and future extrapolation. ■

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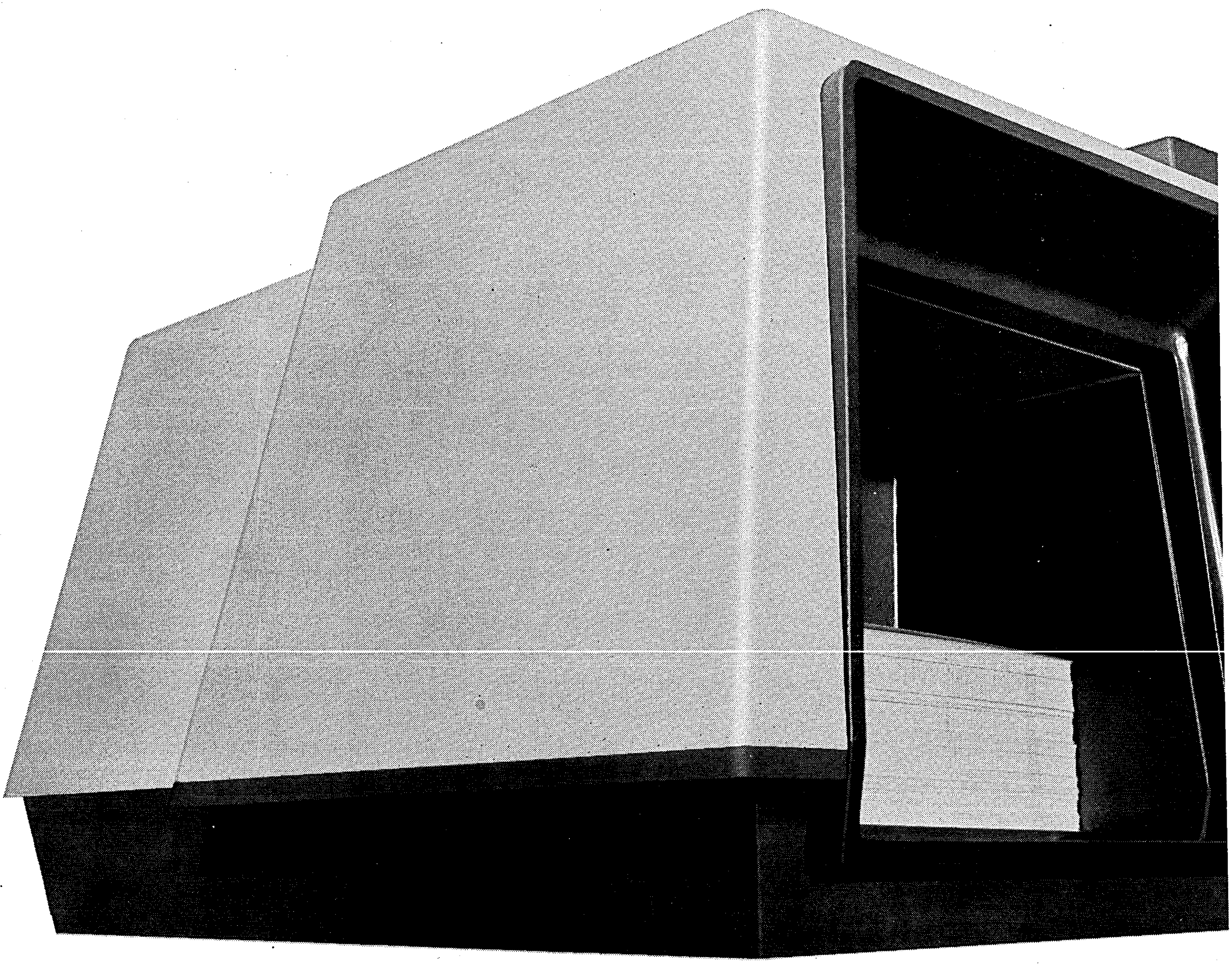

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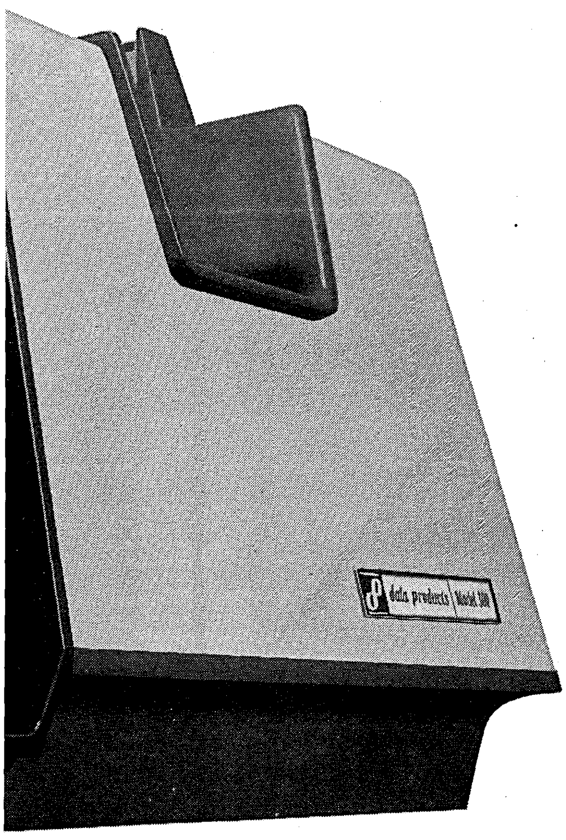

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# people

**Joseph J. Sacco,** formerly general manager of the Memory Products Div. of Burroughs Corp., has been elected president of Ferroxcube Corp., manufacturer of memory systems and ferrite cores and a wholly owned subsidiary of North American Philips Corp. **Ned W. Buoymaster,** former Ferroxcube president, is now staff assistant to the parent company's senior group vp. New president of North American Philips is **Pieter C. Vink** who had been president of the former North American Philips Co., now Corp., as a result of the recent merger with Consolidated Electronics Industries Corp. . . . **R. Paul Toeppen** has been elected chairman and chief executive officer of Digitek Corp., Los Angeles software house, to succeed James Dunlap, who resigned. Toeppen has been a Digitek director since 1967. . . . **George F. Gorgol,** former director of data processing for the City of Chicago, has

joined International Computing Service, Miami, as president. . . . Data Dynamics, Inc., Los Angeles, has elected **M. O. Kappler** president. He had been vp and chief executive of DDI's system development group and will retain that responsibility. . . . **Frederick A. Gross,** formerly director of educational and governmental systems for Computer Usage Co., has been elected president of Systems & Computer Technology Corp., West Chester, Pa. . . . **John R. Munro,** one of the founders of Ty-core, Inc., has been elected president, treasurer and general manager of the Chelmsford, Mass., peripheral maker. . . . **B. C. Hogan,** former Wells Fargo Bank senior vp, has joined Corporation S, Dallas-based software services firm, as president. . . . **C. Mathews Dick, Jr.,** former vp-marketing and a director of A.B. Dick Co., has been elected president of the Business Equipment Manufacturers Assn. to succeed **Harry C. Anderson** who will remain with BEMA in a staff capacity. . . . **Russell C. Dubois,** former Tally president, is now president of Data Pathing, Inc., Sunnyvale, Calif., manufacturer and lessor of data collection systems. . . . **Ronald A. Furman** has joined Infodata Systems, Webster, N.Y., as president. He is the former manager of programming development for Xerox Corp. in Rochester. Joining him from Xerox are **Donald H. Stromber,** vp of marketing; **Bansi Bharwani,** director of management science applications; **Harry Kaplowitz,** director of computer services; and **Robert Schreier,** director of information services. . . . **Joan Van Horn,** president of VIP Systems, Washington, D.C., is the first chairman of ADAPSO's Time Sharing Section. . . . **George L. Athanas,** former MacPanel and Athana Corp. president, has joined Consolidated Computer Services of Toronto, Canada, and will be responsible for establishing the U.S. marketing organization for CCS timesharing systems. The company also plans to sell proprietary input preparation equipment in the U.S. and Canada in the near future. . . . **Dr. Michael W. Lodato** has resigned as manager of the information technology department at McDonnell Douglas Astronautics to form MACRO Systems Associates in Newport Beach, Calif. **John W. Taul,** his assistant at MDAC, is vp-technical operations. Major General **J. B. Bestic,** USAF, Ret., most recently the Commander, USAF Electronics Systems Div., joins the company as vp-corporate operations. . . . **Joseph D. Minutilli,** president of Commercial Credit Computer Corp., Baltimore, has been named director of information systems for Commercial Credit Co., the parent organization. **George F. Troy,** exec vp, will succeed him as president of the computer service center. . . . **Dr. G. Neil Harper** has been named president of CLM Systems, Inc., of Cambridge, Mass., a new firm specializing in advanced systems services in the planning, design, construction, and management fields. Harper was formerly an associate partner at Skidmore, Owings and Merrill. Founder of the company, **Prof. C. L. Miller,** is head of the Dept. of Civil Engineering at MIT. . . . University Computing Co. has named **Frank R. Nicholson, Jr.,** former vp and gm, president of its subsidiary D. R. McCord and Assoc., Dallas-based firm specializing in professional consulting and computer services for the petroleum and petrochemical industries. . . . **John L. McLucas,** president of The Mitre Corp., has been named

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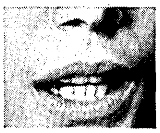

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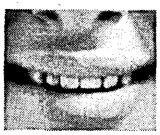

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Undersecretary of the Air Force. . . . **Milt Stone** will tack on to his present duties as manager, business research and systems planning for Hunt-Wesson the job of vp, western operations at MISCO. . . . **James E. Webb**, former NASA Administrator, has been elected a director of Sperry Rand. . . . **Donald J. Andrews**, former vp and regional manager for Greyhound Computer Corp., has been elected exec vp and a director of Rowan Computer and Equipment Leasing Corp., Baldwin, N.Y. . . . **Roger A. Hirschkind** has been appointed vp of Fimaco's new Software Development Marketing Div. which has developed BOCOL (Basic Operating Consumer-Oriented Language). . . . **Dr. Frank A. Rose**, former presi-ent of the Univ. of Alabama, has been named chairman of the board of General Computing Corp. and president of its affiliated division, the Education, Health and Research Foundation. . . . **Robert E. Courtney**, formerly director of ADP development for the State of New Jersey, has joined Computer Conversions, Inc., as director of public systems. . . . **C. W. Vaughan** has joined Honeywell in the new post of vp of the business development department and will have corporate responsibilities for the selection and initiation of new business ventures. He had been director of planning at Scott Paper Co. since 1963. . . . **Chuck Cole**, former SDS marketing vp and now head of his own personnel recruitment house, Resource/Computer Corp. in L.A., has added two more top brass to his organization. **Don Zimmerlin**, who recently resigned as director of market planning for CDC, will supervise east coast operations; and **Irving Cohen**, ex-Informatics vp, will be involved in technical development. . . . **Dr. Howard I. Oshry**, former director of research of Honeywell's Industrial Div., has been named a principal scientist for TRACOR, Inc., Austin, Texas. **Robert C. Chinn** has been appointed staff vp, manufacturing, for Control Data Corp. Most recently he was manager of Ford Motor Co.'s Twin Cities Assembly Plant. . . . **Ted Y. Johnston**, formerly manager of data processing systems for California-Western States Life Insurance Co., has been appointed a senior member of the advisory staff of the Software Systems Div., of CTC Computer Time-Sharing Corp. of Palo Alto, Calif. . . . **Robert S. Berkelo** and **William Kendall Overturf** have joined PRC Technical Applications, wholly owned subsidiary of Planning Re-

search Corp., as senior associates. . . . **William D. Conel** has been named to the new post of senior vp of Telecredit, Inc., Los Angeles-based check-verification firm. He is the former gm of the Retail Merchants Credit Assn. of Los Angeles, recently bought out by Computing and Software. . . . **Dr. Helmut M. Sassenfeld,** most recently manager of control systems and program planning for RCA, has been appointed vp and director of engineering for Applied Logic Corp., Princeton, N.J., time-sharing firm. **Dr. Robert L. Rosenfeld,** formerly with RCA Laboratories in Princeton, has joined Applied Logic as manager of the applications department. . . . **Bruce C. Dale** is the new manager of engineering information processing systems development at Raytheon Co. He had been a senior systems consultant for Honeywell EDP. . . . **Digby Pridmore,** former assistant Commonwealth statistician, has become head of the School of Administrative Studies of the Canberra College of Advanced Education, Australia. . . . **Harvey D. Kushner** has been appointed corporate technical director of Leasco Data Processing Equipment Corp. He was formerly vp of Operations Research, Inc., Silver Spring Md., which was acquired by Leasco last year. . . . **William H. Seaver,** most recently manager of Camco Computer Systems Div., has joined Applied Peripheral Systems, Houston, as general manager. . . . **John E. Koretz,** former manager of systems and programming at Armour and Co., has joined Input, Inc., Highland Park, Ill., as exec vp and gm. . . . **James C. Neely** has been appointed vp and gm of Soroban, Inc., subsidiary of Mohawk Data Sciences Corp. located in Melbourne, Fla. He had been vp/gm of Anelex Corp., Boston-based manufacturer of line printers which merged into MDS in 1967. . . . **C. Kenneth Clift** has been named manger of U.S. Systems & Software's new Data Products Div., Los Angeles. . . . **Jerome J. Dover,** former gm of the Special Products Div. of Ampex Corp., has joined Data Memory, Inc., as exec vp. Also joining the company are **Robert J. Given,** former manufacturing manager for Microwave Electronics, as vp of manufacturing; and **Jeffrey L. Thwaite,** most recently manufacturing product manager for magnetic discs for IBM, San Jose, as vp of the component div. of the magnetic disc recording systems firm. . . . **Marvin L. Goldstein** has joined Astradyne Computer Industries, Inc., as senior vp. He is the former manager of application programming and senior computer consultant at S. D. Leidesdorf & Co. ■

usual charges are incest and self-perpetuation. Third, the individuals are hardly "casually" selected. It is at least arguable that the skill mix is often wrong, but as one who has been involved in standards recruiting, let me assure you that "casual" is an erroneous charge. Finally, rather than it being the case that the boss doesn't watch, it is the usual situation that he watches altogether too closely without full understanding. In a structure that is voluntary (at the organization level) management control is quite different from the "one mistake and out" philosophy espoused, if not actually effected, by business firms.

The implication that proposed standards are often not published at all is also in error. Further, if the readership of the publications that are willing to publish proposed standards is small or inappropriate, what can be done? Would DATAMATION publish standards, in full, together with an expository discussion of the economic and technical consequences of equal or greater length?

User lethargy is, of course, a material factor, but I dispute your contention that it results from anything other than your deprecated concept—human nature. Typically people try to solve today's problems, curse the past for not having made the road easier and deny that they have the time to worry about tomorrow's problems. They forget that tomorrow comes.

Standards solve a second order problem and are treated that way. I am not black, so what are the blacks' problems to me; I am not poor, so why should I pay to fix their needs; I am not a Jew (or an Arab), so why should I care whether Egypt (or Israel) has the Bomb; I am not a politician, but I could fix things if I were in office; etc., etc., etc. The translation is simple. I haven't got time for standards, but if I did I could do it right.

Life is complicated, data processing is complicated and standards are complicated. The standardization community is trying to improve its operations. Several groups have been studying the process for the past eighteen months and have, in a coordinated and cooperative manner, generated a set of proposals that cut to the heart of the problem. Whether these proposals will be adopted fully and how much improvement they will generate remains to be seen, but it is certain that there is a recognition of the problems and a serious effort to fix them.

The fact that DATAMATION takes the trouble and space to discuss these questions is encouraging and I hope it continues. At the same time I hope that DATAMATION will not adopt some absolute editorial posture that could result in less than candid commentary on progress. As you know this sort of thing is not unknown in journalism—even technical journalism.

As a final thought, I must protest your implied canard toward *Bradypus tridactylus*. The sloth is a happy, friendly little fellow with soft fur and no pretentions toward imitating a four year old human demolishing a fudgsicle while awaiting Medea's multiple infanticide. Pick on standards all you wish but leave our furry friends alone or I'll have the Sierra Club after you.

T. B. STEEL, JR.
*Santa Monica, California*

The Editor replies: Some of my best friends are sloths . . . and standards workers.

### by the numbers

*Sir:*

Dr. Donald E. Knuth states in his article "The Evolution of Number Systems" in the February issue that the Maya Indians "used a mixed radix system, alternating between radix 20 and radix 18, and so it was not very suitable for operations like multiplication of large numbers, nor is there any known evidence that Mayans were skilled at arithmetic."

The radix 18 was used only in calendar representations in order to be able to carve annual records relatively conveniently onto stone pillars. In all other records and in any calculations, a pure radix 20 notation was used. As for the latter portion of the statement, it would seem to me that a calendar more accurate than our present one, in continuous use without any need of revision for the entire period of Maya civilization, is evidence of a certain amount of skill both in arithmetic and in interpreting their own number system.

PATRICIA NELSON
*Syracuse, New York*

Dr. Knuth replies: Dr. Nelson has caught me doing some bad scholarship: Four hours of searching in the library today turned up over a dozen sources which confirm her statement about the Maya use of base 18, while I could find none which agreed with what I said. Now I can't remember where I got my information, since I am sure I saw it in two different places.

My remark about arithmetical skill was somewhat overstated; I meant that evidence of multiplication and division has never been found among the Maya. This statement still seems to be substantially correct; but it is hard to make a definite inference about their arithmetical capabilities, since the Spanish missionaries burned all of the "heathen" Maya writings they could find. The Maya did prepare tables of multiples of 91 to aid them in doing certain multiplication problems that arose in connection with

← FOR LOCKHEED CIRCLE 338 ON READER CARD

# letters

calendar conversion (see J. E. S. Thompson, *Contr. to Amer. Anthrop.*, Carnegie Inst., Washington, 1942).

*Sir:*
Dr. Knuth's article "The Evolution of Number Systems" in the February issue was most interesting. I wish, however, to point out either a misprint or an error in the given value for $\pi$. The correct value, to thirty decimal places, is

$$3.141592653589793\ 238462643383279$$

The readers might be interested in the following rhyme, which gives the above digits if one counts the letters in the words. I don't know where the rhyme originated. It was told to me by a friend who had learned it from one of his college professors.

3 1 4 1 5 9 2 6 5
Now I, even I, would celebrate in rhymes inept,
3 5 8 9 7 9
the great immortal Syracusan, rivaled nevermore,
3 2 3 8 4 6 2 6
who, in his wondrous lore passed on before,
4 3 3 8 3 2 7 9
left men his guidance how to circles mensurate.

DEENA KONIVER
*Bethesda, Maryland*

Dr. Knuth replies: But I, I know the octonal facts about pi. [This gives the octal representation, $\pi = (3.11037552\ldots)_8$, if "know" is taken to mean "no" letters!]

*Sir:*
As an amateur, in the literal as well as pejorative sense, of numbering systems, may I express my interest in knowing, and my wonder at needing to ask, why Dr. Knuth omits entirely from his historical survey the curiosity of Roman numbers?

Surely that system is worth comment, exemplifying as it does both a widely used nonpositional system lacking a zero symbol, and also an operating bi-quinary system.

This lacuna, combined with his lack of mention of the zero as a "step-jump" in numerical manipulations, creates some doubt in one's mind over the remaining six-plus volumes of his projected publication.

P. M. BEATTS
*Los Altos, California*

## negative to photo

*Sir:*
In your issue of Feb. '69, I read with great interest the MAI 100 Data Transcriber writeup which appeared on Page 149. The story about the transcriber is very good and we are grateful for your consideration in this respect. Unfortunately, however, the picture that appeared in the writeup appears to be one of our competitors, namely Vanguard Data Systems. In addition, I would like to point out that the MAI 100 Data Transcriber is *designed and built* by Digital Information Devices rather than designed by MAI and built by DID as stated in your article.

We at DID are proud of our Data Transcriber and feel that it is considerably more advanced than the competitive equipment for the following reasons: It has a cartridge load using computer compatible ½" tape and reel in the cartridge, automatic threaded loading and unloading, and dual vacuum capstan controls on the tape drive.

We would appreciate very much that, consistent with your accurate and excellent reporting tradition, you would make the necessary correction in a subsequent issue relating to our product.

LEON J. STACIOKAS
*President, DID*
*Norristown, Pennsylvania*

Ed. note: See New Products, p. 248.

## obfuscation

*Sir:*
I am putting pen to paper to write you about something that has been annoying me for some time, to wit:

Almost every issue of DATAMATION contains acronyms, abbreviations or just plain nouns of a technical nature which are brand new to me. It is distracting, not to say confusing, to run across such items in the course of reading an article and to have to stop and ponder on their meaning.

I realize that my 17 odd years in business data processing working with only one manufacturer's hardware excludes me from the ranks of the cognoscenti who, without batting an eyelid, recognized the meanings of such items as "unit record equipment," or CRT, or CAI, or a myriad others the first time they saw or heard them.

My main responsibility of writing computer programs for my employer precludes my spending all my time reading technical magazines and attending conferences where so much of this nomenclature first sees the light of day.

So in the interests of making DATAMATION more informative and more pleasant to read, how about either having more footnotes[1] or adding a glossary section devoted to terms that have not before appeared in your magazine.

VLADIMIR V. PRAVIKOFF
*Glendale, California*

1. As a charter member of CRAMP (Committee for Reasonable Acronyms Mellifluently Phrased), DATAMATION tries to oblige.

# datamart

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Classified Advertising

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FOR SALE OR LEASE—IBM COMPUTER SYSTEMS 7090—7094—7080—7074—7070—1401 (several) 1410. Also Magnetic Tape Drives IBM 729 Model IV, V, VI and 7330. The Halsey Corp., 2305 Central Avenue, Middletown, Ohio 45042 (513) 424-1697

"For Sale: SDS Fault Tree Simulator. New Sept. 1966. Purpose to evaluate systems-safety and reliability by parallel processing in terms of probability. Performs rapid simultaneous solutions of Boolean algebraic expressions and calculus. Was used with SDS9300 computer thru interface. Offered at 25% of cost. West Coast Machinery Company, 10831 E. Marginal Way South, Seattle, Washington 98168. Phone: 206/762-7410"

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Box 4-1 DATAMATION

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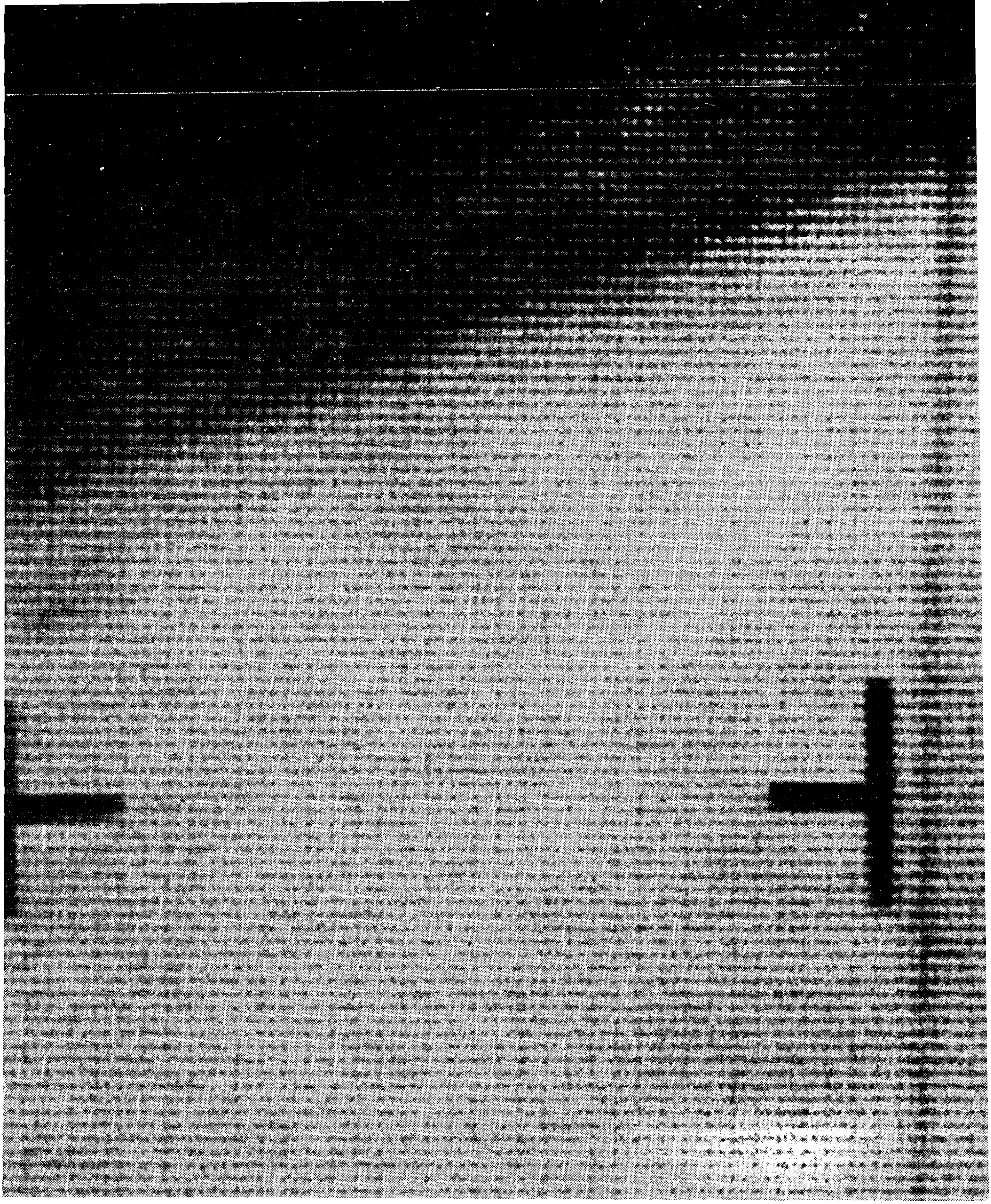

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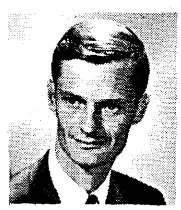

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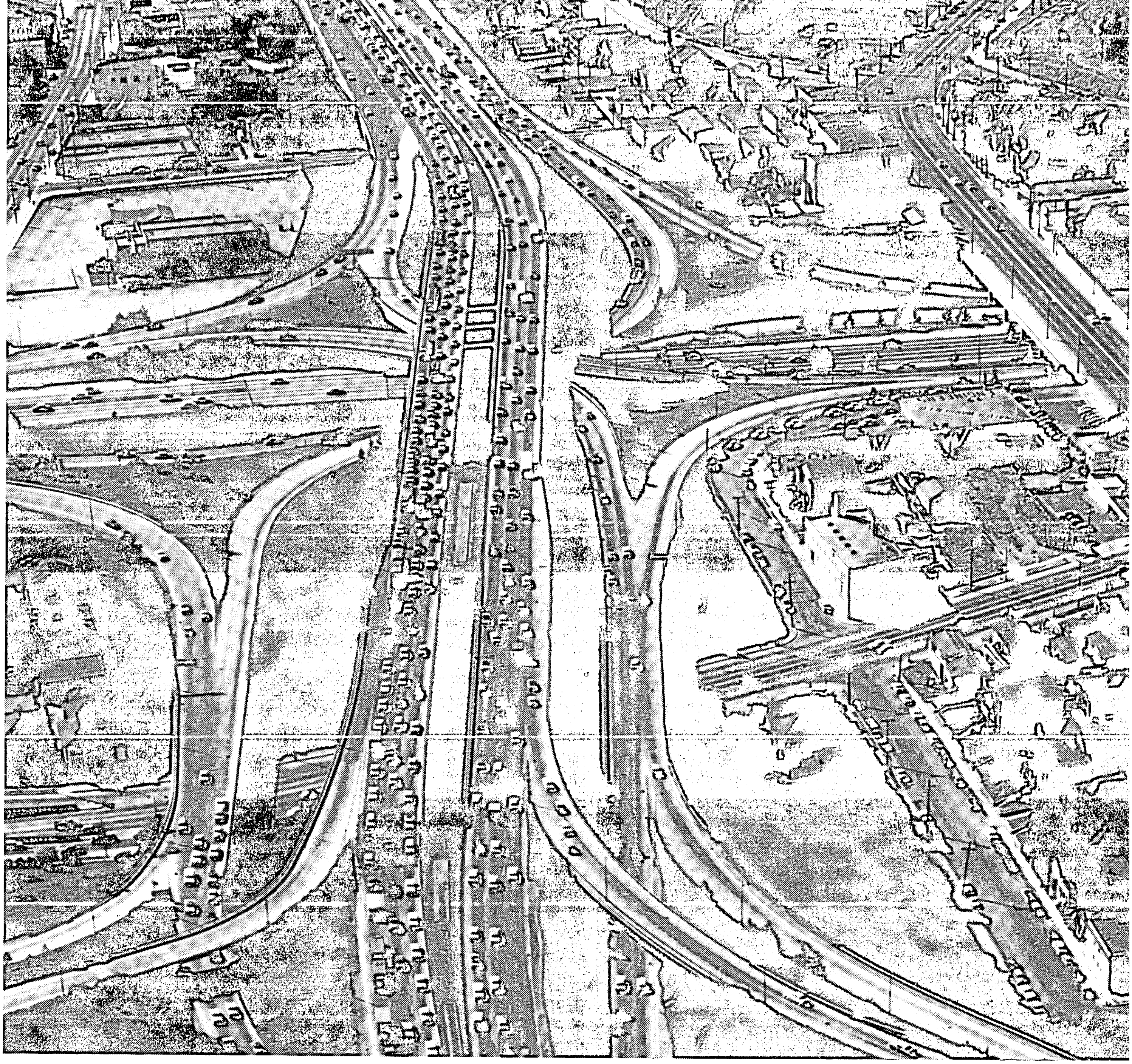

## If you don't make the right turn today, you may not get another chance.

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Is this your kind of environment? If so, and your background includes the design of circuits, logic, memory, power supplies, systems, communications, or design automation, we'd like to hear from you.

Mail your resume to Mr. J. H. Nostrand, Dept. HW—12, RCA Information Systems Division, Bldg. 13—2, Camden, New Jersey 08102. We are an equal opportunity employer.

RCA

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*About six years ago we started with $2,500 in assets, today it's $40,000,000; and in the not too distant future, we expect to be the largest software house in the data processing field. When we are, the people who'll join us this year will probably be managing their own departments and hiring many more to staff and perhaps manage their own groups.*

*Comress intends to be the established leader in the country's fastest growing business—computer services.*

*If this strikes you as ambitious, you're right. If it strikes you as impossible, well, maybe you're not for us and you might as well stop reading right now.*

**Where we're going**

*I think few would argue about the growth potential of the computer services field. So let me dwell exclusively on Comress.*

*First of all, we start with a pretty uncommon record. Our average growth in sales and profits has exceeded 90 per cent per year since we formed six years ago. Our staff numbered 200 last year and will be up to 325 by year end. Our entire growth has been financed from retained earnings, and we've been successful enough to have invested in several affiliated corporations — including Comcet, a new communications computer systems manufacturer; Comnet, one of the few profitable time-sharing firms; Computer Microtechnology, an advanced memory manufacturer; and Commed, a company using computers to serve the medical field.*

*Our services, too, are uncommon. Initially, we formed the company to develop and market a dynamic simulation program called SCERT—a simulator that would allow our clients to compare the cost, performance and operational aspects of any real or conceptual computer system.*

*SCERT has become so widely accepted that it has been used by more than 200 top EDP users and by most major hardware manufacturers in the United States and Europe.*

*SCERT also saved its users enough time to accelerate their need for software development. And they sought out our help. Because of the technical advantages SCERT and our other proprietary systems had given us, Comress was best qualified to help them plan and implement their complete data collection, processing, and communications systems most quickly and most economically.*

**The future for us**

*This year marks the introduction of MINI-SCERT. A package designed for the medium and small EDP user. As a result, our client list will grow astronomically. We alone can offer this simulation program assistance. We're so sure of this—that we only quote fixed price contracts—how's that for confidence!*

*To continue to soar, a company needs only three things — superior products and services, a dynamic and expert management group, and the best people it can possibly find.*

*We have a clear lead in our products and services, a lead that was highlighted when the founders of Comress, received the 1968 Small Businessman of the Year award. We have developed a management team that few firms can match—some of the best regarded, most successful men in the industry are part of that team. And as for our technical staff—we have a superb group and we're intent on adding only the best.*

*An indication of the way our people view the future of Comress and the challenge of the work they do, is to look at our employee turnover records. In this past year, we had only three professional people who chose to quit. One formed his own company, another returned to school, the third joined a competitive firm. Few companies in this or any industry have employee satisfaction this great.*

**The people we need**

*We're looking for pros—programmers and analysts with an absolute minimum of two to three years experience on third generation systems. The more systems variety and experience, the better.*

*Everyone we hire must be able to communicate persuasively—in both personal presentations and in writing.*

*We have immediate openings in Washington, New York, Philadelphia, Chicago, Los Angeles, Pittsburgh and London. We'll soon have more in San Francisco, Houston, Detroit and Atlanta.*

**The offer we make**

*You'll start at a top salary; the specific figure depends on your experience and background. And you'll be able to participate in our comprehensive stock option plan.*

*Full training is provided, and you'll be assigned to the group where your background and experience will show immediate results. We'll work with you for your choice of follow-on assignments to develop your professional skills and meet your personal goals.*

*Past experience indicates that if you've got it, in an average of two years you will be in line for a management position. Our sustained growth dictates rapid promotion of our good people to positions of increased responsibility. Your speed of growth will be fully up to you.*

*If Comress sounds right for you and your goals, just send a copy of your resume to me. I'll see that your resume is put into appropriate hands and an interview will be scheduled either in Washington or one of our branch offices. Write: Fred C. Ihrer, President, Comress, 2120 Bladensburg Road, N.E., Washington, D.C. 20018.*

COMRESS

# How to handle a head hunter

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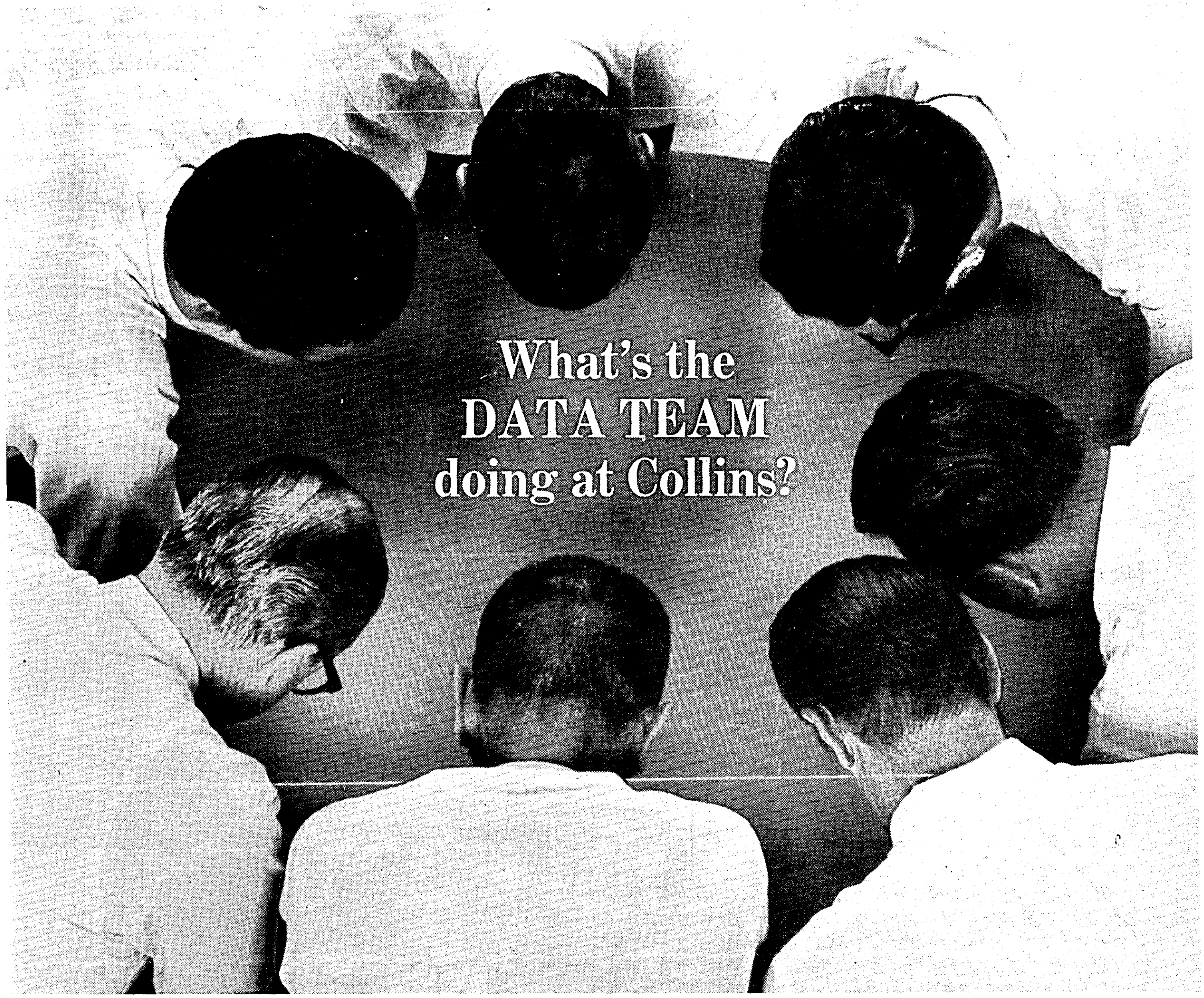
## advertisers' index

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# the forum

*The Forum is offered for readers who want to express their opinion on any aspect of information processing. Your contributions are invited.*

## A MODEST PROPOSAL

Computer center management may be recognized on the organization chart as the point where hardware and software responsibilities cross. Because of the remarkably high rate of expansion of the computer industry, new computer center managers are constantly created. These may be grouped into computer professionals who have had a management course and professional managers who have had a programming (Fortran) course. Few people would claim that management or computers are simple enough to be quickly mastered. Consequently, it is no surprise that computer center management is a sorry mess. Indeed, the only people I have found who argue the point are, as one might expect, managers of computer centers.

The arrival of third-generation computers was a stellar example of incompetence. The cost of converting existing operational software to a new computer is considerable. This was visible during the conversion from the first to second generations. Indeed, there was a certain grim, if semiconscious, humor in the christening of one prevalent operating system "SOS."

That the difficulties of conversion were not a one-time fluke was well demonstrated by the second great conversion, now largely complete. When the new operating system was a year or two late and riddled with inefficiencies and errors, when the hardware was known to be erratic and untrustworthy, and when the vendor's support personnel obviously had a distinct green (but sincere) coloration, one might suppose that the true costs and benefits of the conversion process would have been ascertained, at least to preclude still a third occurrence of this fiasco.

In fact, of course, accurate measurements of the cost and value of the transition between generations have never been made, and the industry is now enthusiastically speculating about the arrival of the fourth generation. The reason is not hard to find: The professional managers know better than to ask such questions, and the thought has never occurred to the novices.

Rumor to the contrary, the management of software development is well understood. However, dealings with hardware management and with computer users must take place through computer center management. Similarly, the operation of computers is beautifully done nowadays, except for problems with software (systems) and users (priority). These are processed through the same management. The inadequate synthesis of hardware and software management, which occurs at just one place in most organizations, is the common root of computerdom's most serious shortcomings. This should be recognized and dealt with as a widespread and unmitigated disaster.

If the computer industry were only growing, and not changing rapidly as well, the situation at any given computer center would improve as the manager mastered the areas in which he was deficient. The professional manager, though, does a poor job of management as he vainly seeks to catch up with an area which is changing so quickly, while the ex-technician invariably loses his technical grip as he seeks to master management skills. The general tendency, then, is for computer center management to start out poor and get worse.

The difficulty of measuring the value of a computer center, the generally exotic nature of computer technology, and the existence of a very talented and aggressive sales force in the computer industry, all militate against the clear recognition of this situation and, hence, against any vigorous steps to correct it.

No one is to blame for this. The people of the computer industry are of a remarkably high caliber, and are undeniably well intentioned. Either to dispute the existence of the problem, or to believe that it is maliciously caused, is to deny daily experience.

I offer as the pathway out of this morass, a theorem:

"The useful tenure of a computer is no greater than half the life of a computer generation."

Computer generations are currently lasting about six years. Accordingly, computer center managers should be changed after no more than three years. As we have seen, the peak of a new manager's value occurs at the beginning of his tenure. By ensuring that such beginnings occur fairly frequently, we will improve the level of management or, at the very least, prevent it from steadily becoming worse. Since each manager will naturally seek to lengthen his stay, we incur a corollary blessing, that the lifetime of computer generations will tend to increase. This may bring some much-needed stability to the computer industry.

The managers who have departed will have learned much during their stay, and they will be freed from the necessity of defending their past blunders. Hence, they will be valuable men for another organization to hire and will not want for employment. Their replacements will be able to correct the more blatant problems, and having only a limited time in office, will be able to do only a restricted amount of novel damage.

Naturally these problems do not exist in any installation with which I am associated but, for all others, I have described the much-needed remedy.

— T. F. Woods

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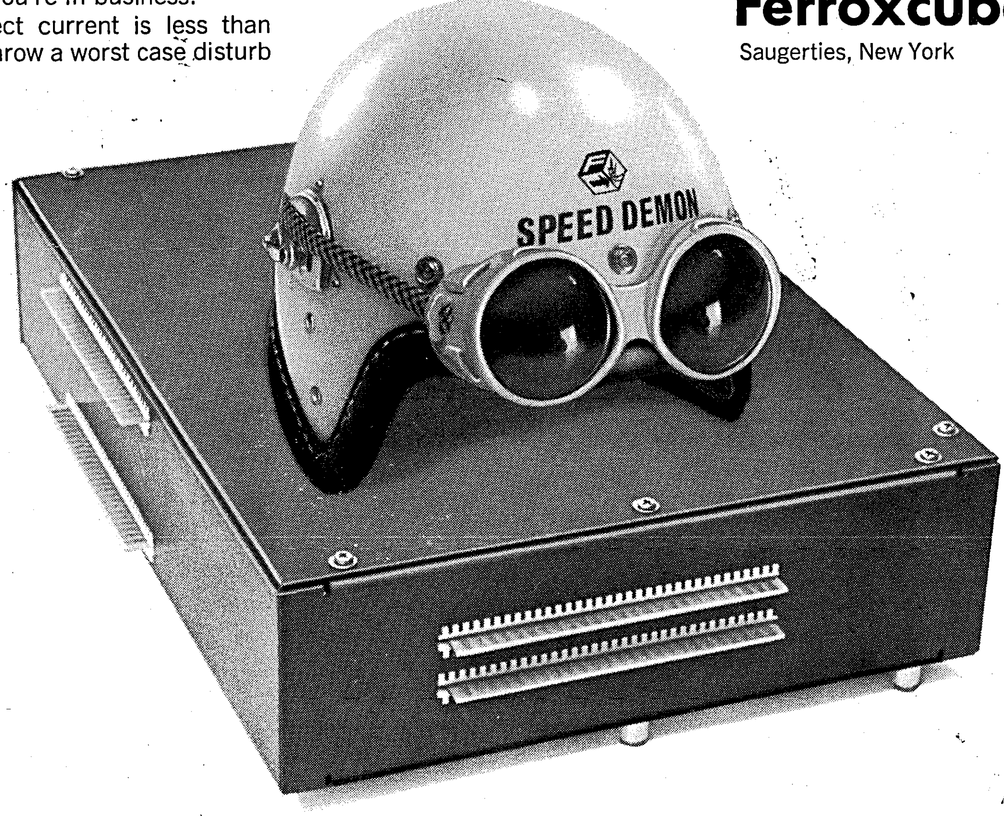


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