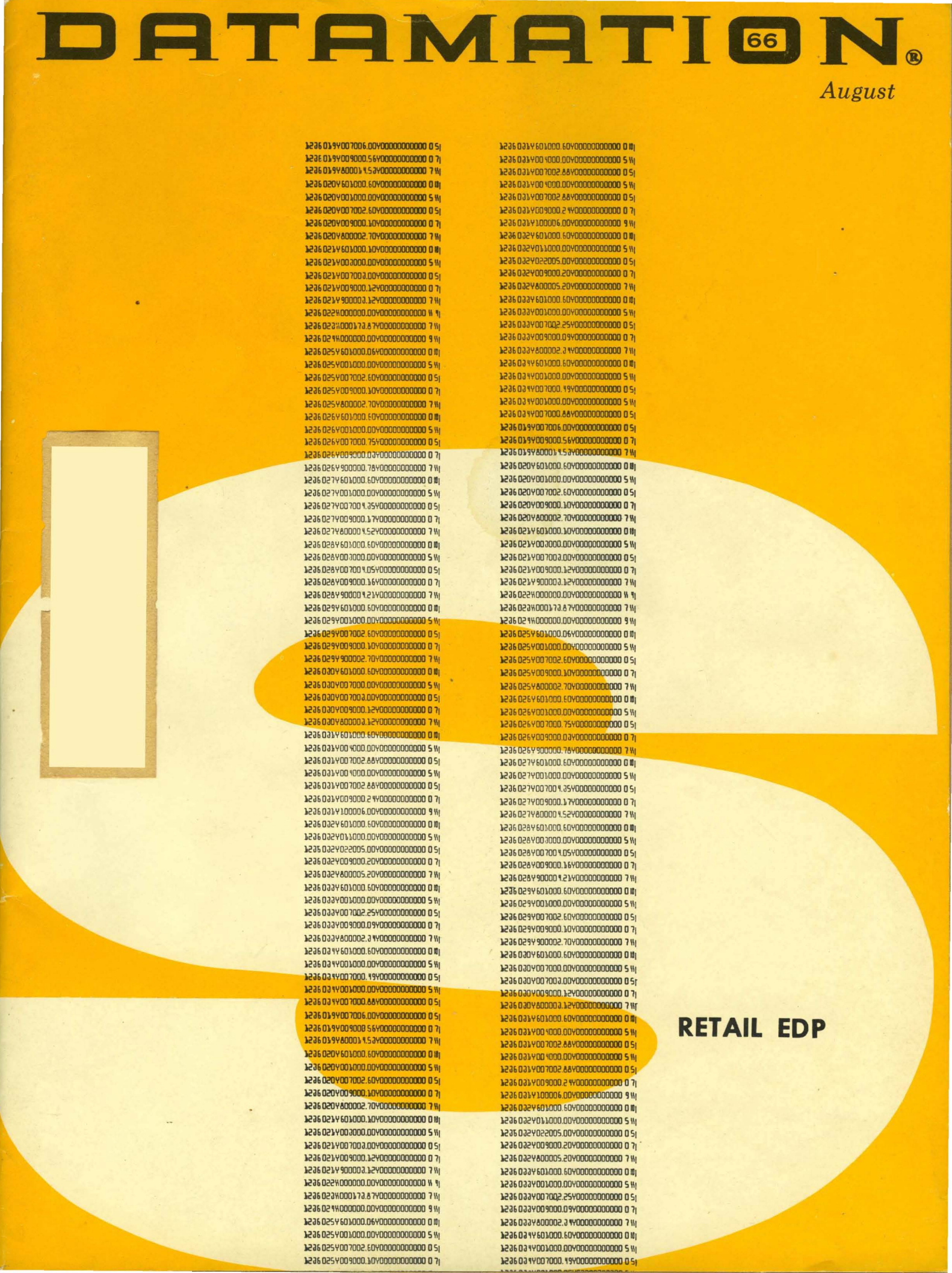
DATAMATION 66®

August



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When your computer marries one of our single capstan tape transports,

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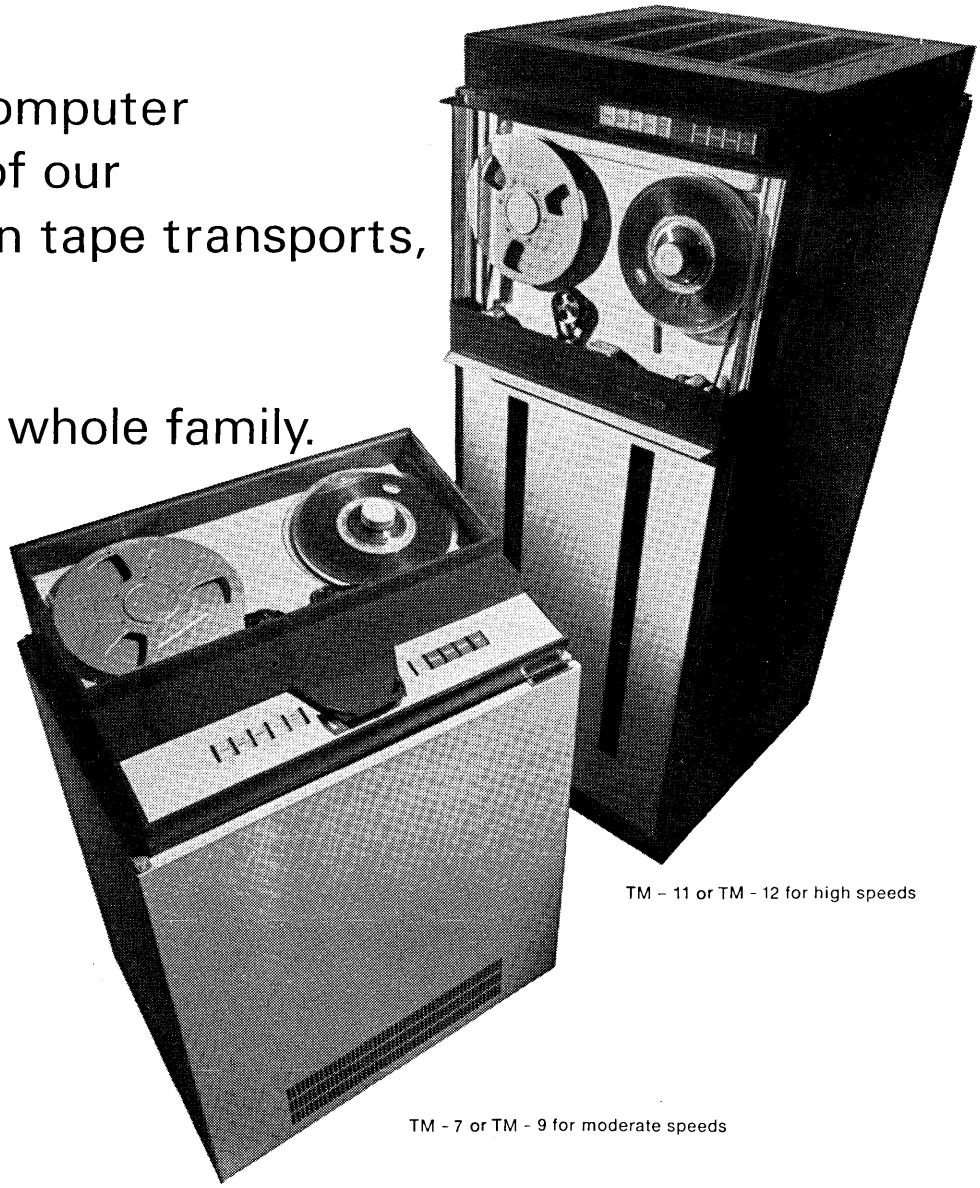

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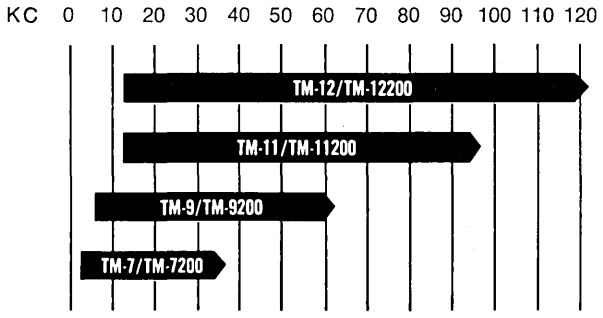

*Pat. Nos. 3,185,364 and 3,251,563

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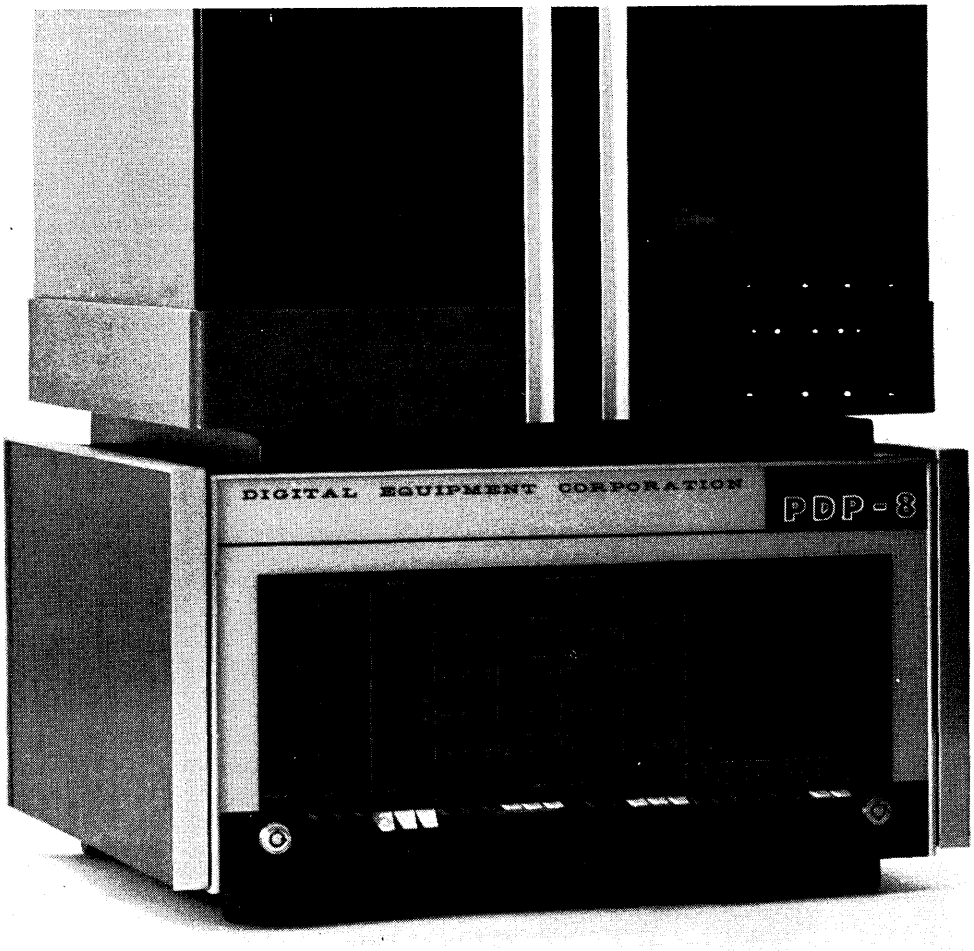
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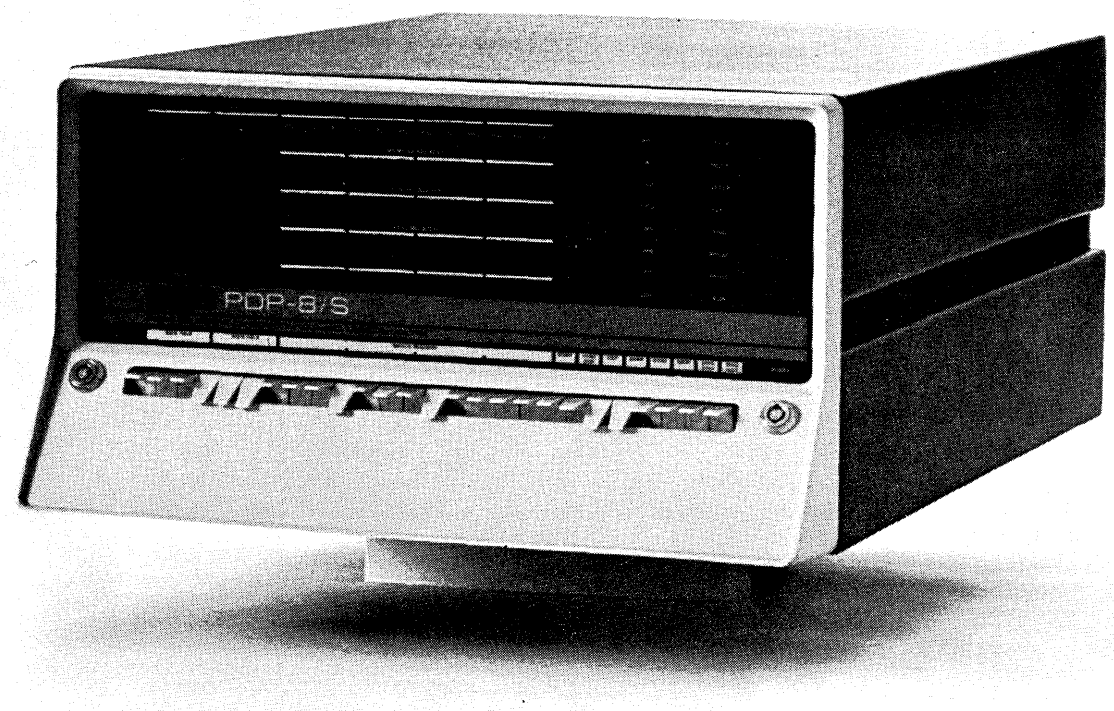
PDP-8



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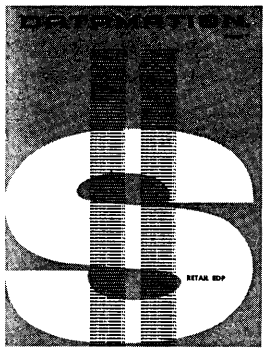
CIRCLE 5 ON READER CARD

august
1966

volume 12 number 8



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This issue 64,902 copies

this is a commercial:

about commercial memory stacks. Like the one on the right, for instance.

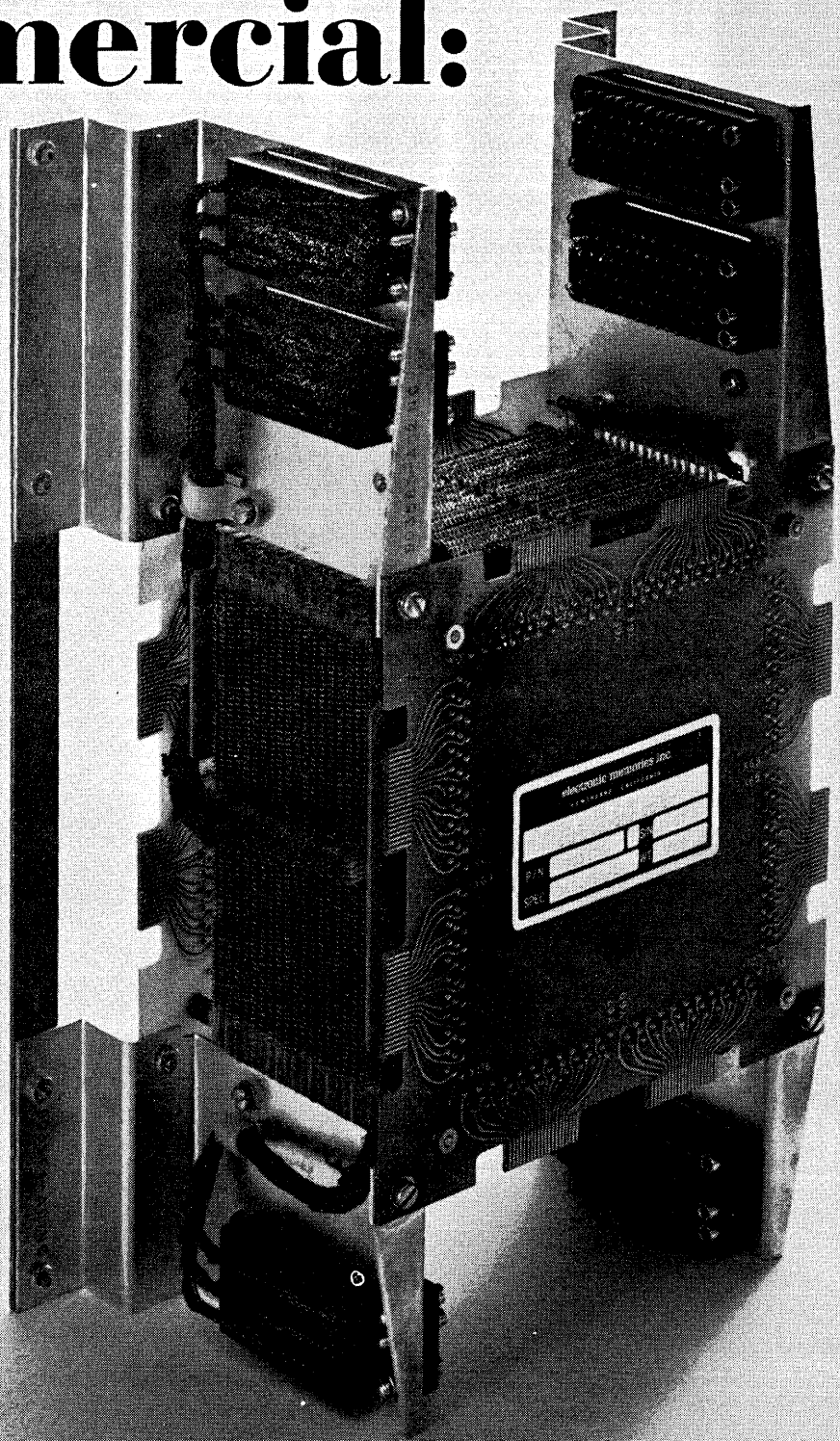
It's one of 30 we designed and built this year for new computers. This one, as well as the 29 others, was developed by our responsive, technically talented engineering group. They're concerned solely with the design of economical, fast commercial stacks.

For most of the stacks, we used or adapted standard cores from stock. In the case of the well-arrayed model at the right, we quickly made a brand new one. That's why we have our own core-development plant, staffed by research ceramists, chemists and pilot line people. All specialists in ferrite cores.

Since 1961 we've been producing high reliability cores, stacks and memory systems for commercial, military and aerospace use, in one's and two's and production lots. For small computers, big computers, everyday computers and wayout computers.

If you're designing something new, all you have to do is tell us what you have in mind. We'll send you some cores to test and evaluate. Or, you might want an array to check out your electronics. If you're well into your design we'll build you a prototype stack. How's that for a commercial?

If you'd like a further word from our sponsor write or phone.



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Well, like the song says, "it ain't necessarily so."

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Has to be. Not a reel of tape leaves the plant that hasn't been checked and re-checked dozens of times for perfect quality and uniformity. And of course, each reel has been meticulously produced to meet the individual specifications of the equipment on which it will be used.

Nothing is completely sure in this life, but when you can come this close with Computape, why tempt fate with some other brand?

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DATAMATION 66®

august
1966

volume 12 number 8

automatic
information
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datamation departments

how simple can data communications be?

Even if you have a highly sophisticated data processing system, data communications can be as simple as this standard Teletype Model 33 KSR (keyboard send-receive) set. Why? Because Teletype terminal equipment is still the most reliable, versatile, and least costly for collecting and distributing data.

One reason is that Teletype Models 33 and 35 equipment utilize an 8-level code that is compatible with the official language of many computers and other business machines—the American Standard Code for Information Interchange (ASCII).

Input/output Features In many data processing systems, Teletype equipment serves as the input/output medium for computers as well as for on-line communications. And, the punched paper tape capabilities of the Models 33 and 35 ASR (automatic send-receive) sets add the versatility of automatic, unattended operations.

For instance, messages and data can be punched into tape for later transmission on-line at full speed to distant points or directly to computers. Efficiency and accuracy are further increased because fixed information can be stored on punched paper tape and combined with variable data to save retyping.

These sets have 4-row keyboards that are familiar to any typist, and also help to reduce the chance of errors.

Data Communications At Work An electronics manufacturer uses Teletype equipment to transmit payroll information from a California plant to the firm's payroll processing center in Baltimore. The information is fed into a computer, which sends back payroll and detailed employees' earnings data. This is received at the California plant by Teletype sets and printed directly on payroll checks and earnings statements.

There are many more versatile applications of Teletype equipment in data communications systems. For example: a nationwide trucking firm uses standard Teletype sets to transmit daily progress reports from terminals to the home office computer, which processes the data and sends back recommended routing and scheduling. A major electrical manufacturer uses standard Teletype machines to link 300 sales offices, plants, and warehouses to two real-time computers to streamline order handling, production scheduling, and reduce large inventories.

For Reliable Communications These examples show why the Teletype Models 33 and 35 equipment are used by the Bell System and others who require reliable communications at the lowest possible cost. For more examples of applications, write for our new brochure, "WHAT DATA COMMUNICATIONS CAN DO FOR YOU." Teletype Corporation, Dept. 81H, 5555 Touhy Avenue, Skokie, Illinois 60076.

machines that make data move

TELETYPE

CIRCLE 9 ON READER CARD

calendar

DATE	TITLE	LOCATION	SPONSORS
Aug. 23-25	Course: Time-Sharing. $195.	Jack Tar Hotel San Francisco	Computer Usage Education, Inc.
Aug. 29-Sept. 2	Course: Control Engineering. $185.	Berkeley, Calif.	Univ. of California Engineering Extension
Aug. 29-Sept. 2	Course: Basic APT	Chicago, Ill.	IIT Research Institute
Aug. 30-Sept. 1	National Conference	Ambassador Hotel Los Angeles, Calif.	Assn. for Computing Machinery
Sept. 12-16	Course: Militran Language. $200.	Willard Hotel Washington, D.C.	Gulton Systems Research Group, Inc.
Sept. 12-Dec. 19	Course: Operations Research. $85.	Los Angeles San Francisco Fullerton, Calif. San Diego	Univ. of Calif. Extension Offices
Sept. 19-22	On-line Computing Methodology. $225.	Marriott Key Bridge Motor Hotel Washington, D.C.	Informatics, Inc.
Sept. 20-22	IBM 360/Software $195.	Hotel Royal Monceau Paris, France	Computer Usage Education, Inc.
Sept. 21	Symposium: Process Control	Viking Theatre Haddon Hall Hotel Atlantic City, N.J.	American Institute of Chemical Engineers
Sept. 25-28	International Systems Meeting	Queen Elizabeth & Sheraton-Mount Royal Hotels, Montreal, Canada	Systems & Procedures Assn.
Sept. 26-27	Symposium: Prospects for Simulation	Westinghouse Defense & Space Center Baltimore, Md.	USAF Office of Scientific Research & Westinghouse
Sept. 26-Oct. 14	8800 Maintenance	Princeton Computation Center New Jersey	Electronic Associates, Inc.
Sept. 27-29	Time-Sharing $195.	Hotel Royal Monceau Paris, France	Computer Usage Education, Inc.
Sept. 29-30	Users' Conference	Netherland Hilton Hotel Cincinnati, Ohio	Honeywell 200 Users' Group
Sept. 30	Deadline for papers: Joint Automatic Control Conference	Mail to: Program Chairman Mr. Gary K. L. Chein IBM Corp. 1000 Westchester Ave. White Plains, N.Y.	Host society: Instrument Society of America

letters

graphics software

Sir:

In the article, "Computer Graphics" (May, p. 22), Ivan Sutherland mentions the hidden line problem as being unsolved for surfaces other than planes. I would like to refer him to my article, "BE VISION, A Package of FORTRAN Programs to Draw Orthographic Views of Combinations of Plane and Quadric Surfaces," in the April issue of the Journal of the ACM.

RUTH A. WEISS
Bell Telephone Laboratories
Murray Hill, New York

computers & anthropomorphism

Sir:

Newspaper and magazine articles, and even DATAMATION, contain items that reinforce the layman's idea of a computer as a magical box to be held in awe. I am referring in particular to the NCR advertisement on p. 58 of the May issue . . . which implies that an NCR computer is so intelligent that it can tell the army when to promote Alvin Smith. We all know that any computer could be equally intelligent if it were provided with the same data and an equivalent program. This is obvious to us, but the implication that a computer has the ability *on its own* to perform such tasks is put before the public so often that I regulary meet people who are actually afraid of computers.

Souldn't we, the people who use computers every day and plan our futures around them, do what we can to keep such misconceptions and groundless fears from forming?

LYLE B. SMITH
Stanford, California

manufacturer's software

Sir:

Mr. Goetz's (The Forum, May, p. 117) exposure to software produced by computer manufacturers leaves something to be desired. With regard to the building of generalized business packages, he states "computer manufacturers have ignored this area."

I suggest Mr. Goetz familiarize himself with the commercial software offered by SDS. Specifically, he should become acquainted with SDS MANAGE, a general-purpose file management system that is currently operational on SDS 910, 920, 925, and 9300 computers. Additionally, a powerful Payroll Generator is available to SDS users. Like the other MANAGE Program Generators (File Maintenance, Data Retrieval and Report Generator), the Payroll Generator is independent of the format of the data base being processed and employs a parameter notation that is readily used by *non-programmer personnel.*

MANAGE was implemented for all five computers concurrently by writing only one set of source code. Such source code was written in the SDS BUSINESS LANGUAGE, a PROCedural extension of the SDS Meta-Assembler, META-SYMBOL. By merely changing one variable and reassembling, a MANAGE Processor was implemented for a different computer, The "logical generative macros" to which Mr. Goetz refers, are merely subsets of the BUSINESS LANGUAGE *Super Proc's* employed in implementing SDS MANAGE . . .

DON SUNDEEN
Scientific Data Systems
Santa Monica, California

The author replies: While MANAGE has many features which make it suitable for solving specific data processing problems, I question its overall effectiveness as a general-purpose business language for efficiently solving complex commercial applications such as railroad payrolls, insurance premium accounting and utility billing. For Mr. Sundeen's education, SDS describes MANAGE as a generalized file management system designed to aid corporate decision making. Apparently, Mr. Sundeen believes it will do more than that.

In any event, my article was addressed to the *major* computer manufacturers, representing 99% of all small- and medium-scale computer installations that are delivering COBOL, RPG's and assemblers to support the programming of all commercial applications. These software systems are the systems I referred to as being defined and implemented back in the middle 1950's, and this is an historical fact.

Until software is priced separately from hardware, there will be a continuing tendency on the part of computer manufacturers to produce only the minimum amount of new software required for meeting competition or for gaining a competitive edge in the sale of hardware.

system conversion

Sir:

Because the conversion from one computer to another can be an expensive and traumatic experience for data processing users, I was quite pleased to read the three articles in the June issue. These well-written articles covered the various factors involved with greater insight and clarity than any which I have read before.

It must be noted, however, that in each situation discussed by the authors the conversion was from one computer to another of a higher level manufactured by the same company. It is unfortunate that at least one article did not consider the greatly magnified problems involved in converting from the equipment of one manufacturer to that of another . . .

Data processing employees of small or medium-size installations are often intensely loyal to the equipment they are presently using. This stems from a familiarity with the equipment . . .

Management must be alert to undue loyalty when planning the conversion to equipment of another manufacturer. Plans to minimize the effect of this attitude must begin very early, well before there is any definite commitment to acquire new equipment. Management should attempt to develop, on the part of employees, an independence of mind toward hardware. This may be done by providing means whereby employees are instructed in the features (advantages and disadvantages) of other manufacturer's equipment and by promoting an arms-length relationship between employees and personnel of the present manufacturer.

BRUCE JOPLIN
City of Los Angeles
Los Angeles, California

memory terminology

Sir:

According to R. L. Patrick ("Not So Random Discs," June, p. 77), information access from discs is "neither random nor direct, but cyclic in nature." I notice ads in the June issue calling them "direct access devices." It is a classic example of terminology in a field that is relatively new . . . I would suggest further differentiation—e.g., disc access as distinguished from drum, etc.

UDHAM SINGH
Stratford, Conn.

text editing

Sir:

Robert Magnuson's article, "Computer Assisted Writing" (June, p. 49), describes objectives which have been implemented, with a somewhat different approach, as part of a research prototype and production code at the Univ. of California at San Diego. The UCSD program differs in two respects. First, instead of relying on manual corrections to a card deck, it uses a context editing technique which enables the operator to perform all editing by means of English-like instructions to the computer. Insertions, deletions, reordering parts of the text, adding new material, changing the paragraph structure, etc., are performed directly. Page format commands similar to those described by Mr. Magnuson are also available.

The second point: the UCSD code

letters

is oriented toward eventual use with a time-sharing system having a mass storage device and remote consoles which give access to the main computer.

JAMIE SWANSON
University of California
San Diego, California

Sir:

Mr. Magnuson's system utilizes two elements of the transliterating program from Simon M. Newman, Rowena W. Swanson and Kenneth Knowlton, "A Notation System for Transliterating Technical and Scientific Texts for Use in Data Processing Systems," Office of Research and Development Reports No. 15, Washington, D.C., U.S. Patent Office, U.S. Dept. of Commerce, May 22, 1959. Sec. 2.2 (p. 5) discloses the ignoring of ends of lines and pages. Sec. 2.16 shows the insertion (and removal) of matter in the body of the text.

The *codes* of the report, equivalent to the *editing instructions* of the Magnuson articles, were mnemonic, where possible, but the computer output transliterations were *user oriented* and easily comprehended.

SIMON M. NEWMAN
Washington, D.C.

Mr. Magnuson replies: While there are some similarities, there are a great many differences between my Automated Documentation System and Mr. Newman's system . . . designed to store patents in machine readable form for retrieval purposes. It was never intended that these patents would ever be printed in other than a coded system . . . Furthermore, the processing programs (for retrieval purposes) were written for a large computer, the IBM 704. Mr. Newman's system was documented by means of an ordinary typewriter, and not by means of itself. Indeed, it could not document itself for, among other things, there are forbidden strings of characters which cannot be typed within his system (e.g., his *codes*). Mr. Newman's procedure for insertion of matter into the body of the text requires that the correct portion of the entire card beyond the area of insertion be manually retyped. Ignoring ends of lines and pages, a feature of both systems, is of rather ancient origin; it is practiced at times by every typist.

My Automated Documentation System was designed to produce documents of any type. The processing program was designed to fit into a small computer—initially a 4K IBM 1401. The system was used to document itself. Indeed this very letter was produced by means of an improved form of it. There are no forbidden strings; any combination of characters may be printed. The correction procedure (e.g., for insertion of material) requires the typing of the matter to be inserted and not of the other correct material on the IBM card .

The present version of my Automated Documentation has been implemented on an IBM 360/30 computer. It is at least as good as IBM's Administrative Terminal System, but costs 1/10th as much to use.

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to do the following jobs:

- Shipboard Telemetry Data Acquisition and Processing
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- Business Data Conversion
- Character Recognition
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- Biomedical Research
- High-Energy Physics Research
- Wind Tunnel Data Acquisition
- Isochronous Cyclotron Data Processing
- Time-shared Engineering Calculations
- Portable Aerial Survey Data Processing
- Aircraft Test Data Acquisition and Processing
- Sonar Data Reduction
- Nuclear Effects Study
- Optical Scanning
- Communication Concentration and Switching

The new Data/620 is a remarkably versatile computer adaptable to a wide variety of system, real time, and data handling applications, with such features as 16 or 18 bit words—over 100 machine commands—1.8 usec GP core memories—up to 64 I/O devices—software including FORTRAN, Assembler, Aid and Maintain.

If you have a computer requirement, ask about the computer that really does the job, and costs $28,800—the DATA/620. We have an interesting fact filled 36-page brochure, yours for the asking. Write to:

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CIRCLE 36 ON READER CARD

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Here's who: leading companies in many technical fields. These knowledgeable computer buyers have recognized the advantages of the *ADVANCE* Series such as the exceptional processing power. Similarly the true modularity of *ADVANCE* Series Computers permits several levels of expansion at low cost. *ADVANCE* Series Computers offer greater productivity than anyone else can offer at the price and, as a result, we have been chosen by those who really know computers well enough to be selective. ASI Computer Division, Electro-Mechanical Research, Inc., 8001 Bloomington Freeway, Minneapolis, Minn. 55420. Phone: 612-888-9581.

ASI COMPUTER DIVISION EMR

CIRCLE 15 ON READER CARD

look ahead

ONWARD
TOWARDS ASCII

The proposed ASA standard for mag tape, which IBM opposed, has been pulled from the balloting in favor of a revision which could be a small step toward making equipment now in use compatible with ASCII. The ASA-preferred zero value for the 8th bit (high order) will remain — still a controversial point, but the track assignment will allow an interchange of binary or packed numeric tapes between IBM and ASCII-oriented equipment. EBCDIC, in major use now and throughout at least the life of the 360 line, still requires a black box for translation into ASA or ISO codes. The revision, IF approved by ASA, has a good chance of adoption by the International Standards Organization.

Another IBM-opposed proposal — Decimal ASCII punch card standard — has been killed by a split vote, and ASA X3.2 must decide before Sept. 13 whether to revive it or propose a new standard — a tough decision since ISO is also voting on Decimal ASCII and needs only a majority, not a consensus as ASA does.

ANOTHER FIRM
JOINS THE FRAY

Chalk up another entry in the burgeoning mainframe field. Interstate Electronics Corp., Anaheim, Calif. (wholly owned subsidiary of Interstate Engineering Corp.), after 10 years in the instrumentation and systems arena, is announcing a 16-bit (plus parity and protect bits) gp computer, the IEC 1010. The 16-bit length facilitates 8-bit-byte (ASCII) manipulation. A single-address machine, it operates in 1- and 2-word modes. A 4K CPU with four levels of interrupt will sell for $30.5K, less than the CDC 1700 and IBM 1800. Add an ASR 33 Teletype and basic I/O and it's $38K. Memory is expandable to 64K, all directly addressable.

Using CTL integrated circuits, cycle time is 1 usec, add time is 2 usec, and multiply time is 7 usec. It has 81 instructions, nine registers, up to 28 devices on a standard low-speed I/O bus (200KC — 16-bit words) and four data channels, each handling up to eight devices; word rate is 900KC. Standard peripherals are available with an extended peripheral set available in the near future. Software will include Fortran IV, test and utility programs, symbolic assembly and math subroutines.

360 SOFTWARE:
CHANGES, DELETIONS, ADDITIONS

According to a recent IBM OS 360 announcement to users, binary numeric fields have been dropped. Oh, and so has the PL/I H compiler. Users are wondering if IBM is de-emphasizing PL/I, but IBM says no. It's intended, but not announced, that a beefed-up 44K F level compiler will incorporate the features of the H, such as list processing and code optimization (requiring additional passes) and do it within memory constraints. Larger compilers haven't been ruled out either. For now, without the H level system, future PL/I compilers can't be written in PL/I.

Many of the other manufacturers don't seem too

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look ahead

(Continued from page 17)

concerned; their plans for PL/I did not reach to the complex 256K H level. In the meantime, the first F compiler should come out around Aug. 5, ahead of its slipped Aug. 31 date.

On the COBOL front, a new, improved E level compiler for the 360 should be available by late fall.

PROGRAMMING THE "EMOTIONAL FACTOR"

An investment management firm that seems to be on the right track in today's stock market is Los Angeles-based William O'Neil & Co. They're applying computers to stock analysis but, unlike others in the same game, they have added an "emotional factor" that affects weightings and timing.

O'Neil is not an advisory service but a portfolio manager; you give them a fixed amount of money and delegate the management to them. Two or three years later you might be much richer — at least many of their clients have been so far. During calendar '65, when the Dow-Jones industrials finished the year just about where they started on Jan. 1, O'Neil's growth accounts were up some 40%. They now use an IBM 1440, are getting a 64K 360/30 early next year, scheduled to be upgraded in stages to a 262K mod 50.

RUMORS AND RAW RANDOM DATA

To get a running start on its multiple projects, the NBS Center for Computer Sciences and Technology directed by Norman Ream has parceled out contracts to Advanced Computer Techniques for performance of FORTRAN criteria; to Computer Technology for documentation standards; and to Informatics for time-sharing. Two jobs go to Auerbach — state of the art on source data information, interface and communications standards — and three to Computer Sciences: systems definition requirements, criteria for selection of edp, compatibility and data interchange...Mohawk Data Sciences, with 1300 of its source-data-to-mag-tape recorders sold, will announce the 6400 series — a similar unit but compatible with 800 bpi 9-channel tape used by the 360...The Los Angeles Univac office already has 30 orders for the just-announced 9200 and 9300...Data Automation Co., Dallas-based leasing firm dealing in IBM equipment, plans expansion into the Pacific northwest, west coast, Rocky Mountains, and midwest during the next six months — hopes to become a $10 million operation by next year...The 360 65 at Northrop, after being in for about six weeks, still hadn't passed its acceptance tests...Los Angeles City has withdrawn certification of its 360 — software problems...Computer Sciences is said to have had some success in wooing GE personnel to change employers but stay at their same jobs at Huntsville. CSC has set up a department for the big project there, headed by Donald A. Jackson...Financial speculation of the month: what will the booming leasing firms do with all those machines they own when it's time for customers to trade up? So far, they've been placing money but in a few years they'll be in the business of selling computers...Contrary to last month's story in Look Ahead, Dr. Walter Simonson is not leaving CEIR, has been promoted to Director of Management Sciences...Good news for paper and core salesmen, optometrists, and forklift manufacturers: military programmed budgeting routines turn out reports up to 10,000 pages, require 62K of core... A truly ground-floor training scheme: DPMA is helping work out details for granting a Boy Scout merit badge in data processing...Affluence-in-the-computer-world note — one of Fletcher Jones' horses won the 100 grand handicap at Hollywood Park.

You'd have to be crazy to publish a firm software delivery schedule. Here's one for Sigma 7:

Fourth quarter 1966. Stand-alone package, operating without a monitor in minimum storage. Includes SDS standard FORTRAN IV, a standard Assembler, a Library of Mathematical and Utility Routines, and a program debug package. This package permits you to operate one job at a time—either a real-time or a general-purpose job.

First quarter 1967. The first level of SDS monitors, called Basic Control Monitor. All the stand-alone software is available under the monitor, and you can now do two things simultaneously—a real-time job in the foreground, and a general-purpose job in the background.

Second quarter 1967. You step up to Batch Processing Monitor, a much more comprehensive monitor, plus this additional software:

- SDS Extended FORTRAN IV, debug version, oriented toward program checkout.
- High-Efficiency Extended FORTRAN IV, oriented toward efficient object programs.
- Extended assembler (Meta-Symbol).
- ADAPT, an application-oriented package for numerical control of machine tools.

Third quarter 1967. Debug version of PL/I.

Fourth quarter 1967. Conversational versions of FORTRAN IV and PL/I; standard version of the Universal Time-Sharing Monitor; High-Efficiency version of PL/I.

Soon thereafter we will deliver the Extended version of the Universal Time-Sharing Monitor; MANAGE, a management information system which includes a Report Generator; a generalized Sort/Merge program, and other applications packages.

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CIRCLE 17 ON READER CARD

editor's read*ut

THE THOUGHTLESS INFORMATION TECHNOLOGIST

a guest editorial

Several years ago a senior vice president of one of this country's largest industrial firms—among the first 50 of Fortune's 500—indicted his information technologists with this bill of particulars:

> They don't exercise enough initiative in identifying problems and designing solutions for them. As salesmen, the information technologists consistently fail to impress me with the importance or the benefits of the work proposed to be undertaken. They are impatient with my lack of knowledge of their tools, techniques and methodology—their mystique; and sometimes their impatience settles into arrogance. The information technologists are too often insufficiently concerned with the cost and contribution to profitability of a proposed—or even accepted—project (i.e., its economic feasibility); technical feasibility seemed to be the technologists sole desideratum. In sum, "The technologists just don't seem to understand what I need to make decisions."[1]

What is worse, according to this man, his pre-computer information technologists were at least sympathetic to his occasional demands for unanticipated information; they would try—and frequently enough succeed—to get him what he needed with reasonable dispatch. Four years ago, with more than five million dollars worth of fancy equipment and an even larger number of dollars worth of fancy people—people like you and me—the response of the new breed of information technologists was, "It'll take 90 days to write and debug a program to provide that information." In the V.P.'s view, that was not progress. It's not progress in my view either.

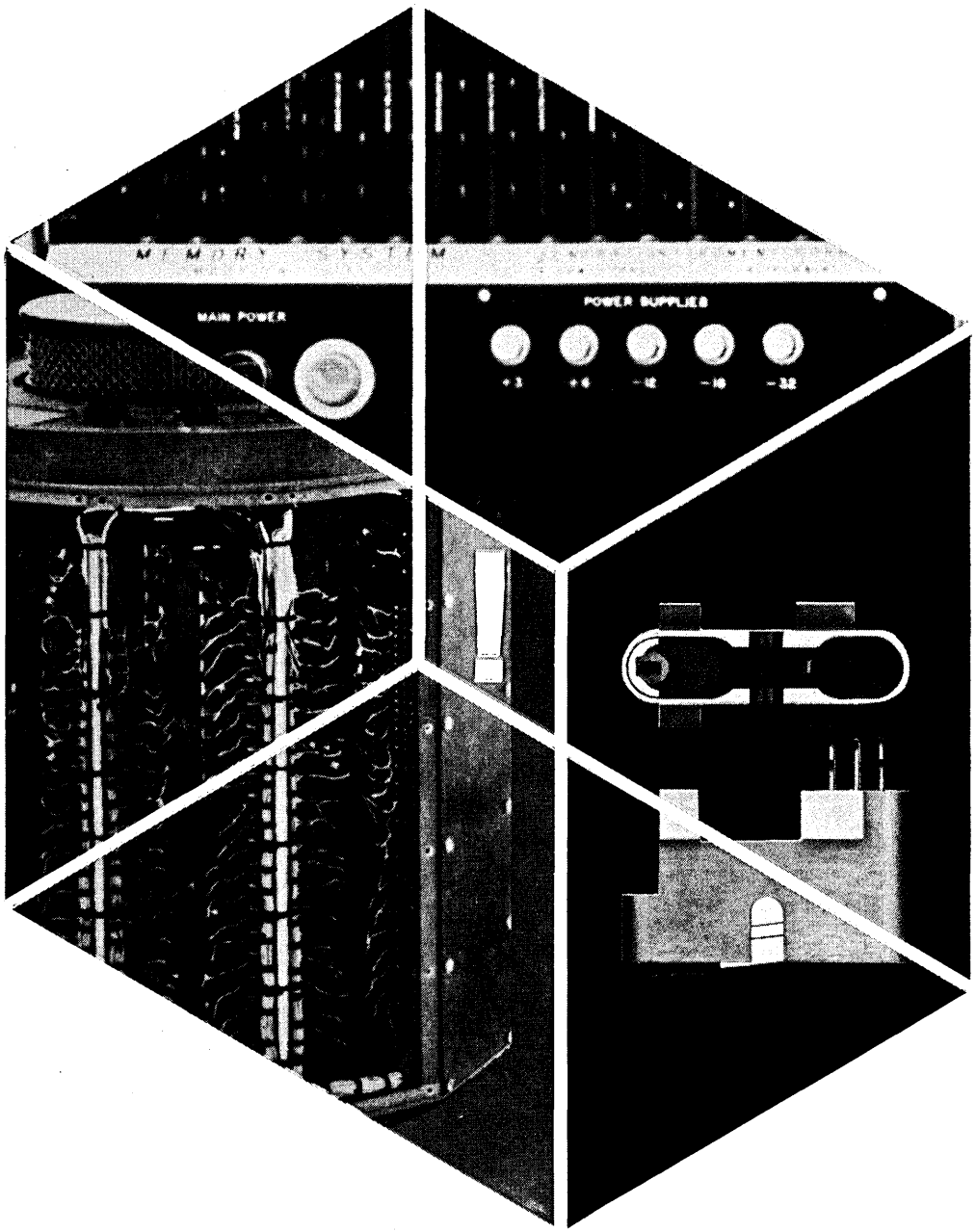
In many other ways we information technologists seem to insist upon alienating those whom we serve.

I can give you an indication of the magnitude of our problem by quoting to you excerpts from the Proceedings of the first SIGPROM meeting. The Proceedings identify questions we haven't answered—but must:

1. "Management of programming" must be defined.
2. The environment in which programming is done must be defined. How does one establish and protect such an environment?
3. How can programmers be taught to "appreciate" resources?
4. "Efficiency" is the name for how well one does whatever he does. "Effectiveness" is the name for doing the right thing. (It is more important —usually—to be inefficiently effective than to be efficiently ineffective.) We must develop measures of effectiveness and efficiency—and a combined measure of both.
5. How does one estimate the cost of a programming task? Does cost vary with attributes of the task? How does one know when a task is 80% complete? 90%?
6. How can programmer performance be evaluated?
7. What forms of organization enhance the performance of programming tasks?
8. How does one exercise effective control over the development of a program: "How do you keep programmers building the thing that was to be built?"
9. What are the "real costs" of data processing? What are the "real revenues"?
10. What are the "operational costs" of programming?
11. What can managers do to improve the chances of obtaining maintainable programs?
12. How little of programming technology must a programming manager know?

It is little wonder—if we can ask these questions and NOT obtain answers to

[1] Running through the conversation that is summarized here was the executive's conviction that the functions of management he exhibited were intrinsically and essentially different from the functions of management he required of the information technologist—whom he did not regard as a manager—for one moment!—in identifying problems and specifying domains of acceptable solutions.



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CIRCLE 18 ON READER CARD

them—that we make little use of our own technology to help us manage that technology. But it is a cause for great concern that we are not doing more about it. In our failure I sense the same responses I have seen in those operating managers who have declined to accept the technology's embrace. Whereas we have learned, in the last 20 years, that the activities that can be programmed are seemingly numberless and of endless diversity—and we have urged acceptance of this view by operating management—we seem unwilling to consider our own province a subject fit for planning or programming.

I think I understand some of the reason why we haven't programmed important segments of our jobs: it is because we know that only the easier parts can be programmed. If we give the easy parts to the computer, it must be that we will *have to* contend with the difficult ones. And the difficult tasks are just the ones we have always been able to defer because we can never get our desks cleared of that messy, routine paper work. Or we excuse poor performance of the difficult task because of the need to attend to the programmable tasks. The principle demand of the new technology, as described by Patrick J. Robinson,[2] is for a rational, systematic and disciplined approach to a manager's jurisdiction; such an approach requires a soundly-based knowledge of the environment in which an activity is conducted. Only with such knowledge will a manager be able to face the *future* with reasonable conviction that he can function effectively. The future—that is the key to the problem of our reluctance. If we are to accept the "intelligent technician"—the trained technologist *cum* computer—as a partner, we must do an about face. Where previously, like historians, we were concerned mostly with the past, aided by the new technology we can be, we must be, soothsayers, concerned mostly with the future.

There is another aspect of programming our jobs that is illuminated by Robinson's remarks: it is an implicit assumption of the ability to program our jobs that we shall have a comprehensive and accurate description of our environment. In the absence of such a description—and which of you is in possession of it?—some part of our resources *must* be devoted to obtaining it, and to assuring that, once obtained, the description remains valid. Thus, the use of the new technology demands of its practitioners that they be possessed of at least a modicum of the spirit of research.[3] Such a spirit is alien to the "practical" man of business whom most of us become when we become involved in or with the technology whether as Indians or Chiefs.

It is also too true that we don't always know the difference between a problem and a solution to a problem. How many times have you heard it said, "We've got a problem; we've got to reduce inventory?" Probably, not one person in ten making the statement is aware that "we've got to reduce inventory" is *not* a problem statement; it's a statement of a solution to a problem! The chances are pretty good that a lot of work must be done before we even know what the problem is, let alone which of many alternative solutions might be acceptable.

It is a commonplace that the majority of business executives are not equipped to deal with the technicians who use the tools and methodologies of science to do the firm's bidding. It is almost equally a commonplace that these same technicians are ill-equipped to deal with the executives for whom they work.[4] Moreover, there does not seem to be reason for optimism that this situation will be rectified in the near future except, perhaps, in isolated instances, where understanding can be nurtured and there is a willingness, on the part of both parties, to work toward closing the gap.

As I have already noted, some information technologists are given to public introspection. But the technologists more closely identified with the digital computer have been the most arrogant in their willful disregard of the nature of a manager's job. These technologists have clothed themselves in the garb of the arcane wherever they could do so, thus alienating those whom they would serve.

One of our most important tasks is to get our own house in order. We should go forth and get on with the necessary work.

—Robert M. Gordon

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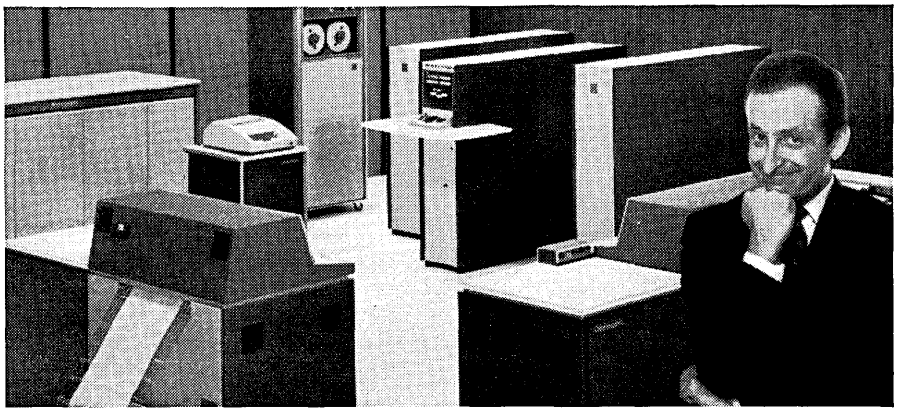
[2] Operations Research, "The Canadian Chartered Accountant," May 1960, pp. 445-453.

[3] Two articles in the "Harvard Business Review" touch on this subject: "The Age of Synthesis" by James W. Culliton (HBR Sept-Oct 1962, pp. 36ff); "The Manager's Job. A Systems Approach" by Seymour Tilles, (HBR Jan-Feb 1963, pp. 73-81).

[4] In 1965, for example, The Institute of Management Sciences was sufficiently concerned to devote a significant number of words to these problems. In February, 1965, in "Management Science," the journal of TIMS, there appeared "The Researcher and the Manager: A Dialectic of Implementation." A substantial part of the October issue of "Management Science" was given over to the responses of twelve individuals to the February paper. And, finally, in December, 1965, D. F. Heany of General Electric was allowed to ask, "Is TIMS Talking to Itself?"

"If that computer of ours has all the answers, let's have a few...now!"



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CIRCLE 19 ON READER CARD

COMPUTERS IN RETAILING

the technical problems

by SAMUEL B. HARVEY

This year the electronic computer is just 20 years old. Already, there is the "third generation" of equipment. Both of the first two generations were really made obsolete before the equipment achieved its full potential. With each change the market expanded.

In 1955, market projections for the sale of computers looked pretty thin after the top 500 companies. Ten years later, there were thousands of installations, manufacturers scrambling for new markets, and no end in sight. In this explosion the retailer has been slower to move to computers. Why? Ask this question of most data processing people and you will receive the following analysis:

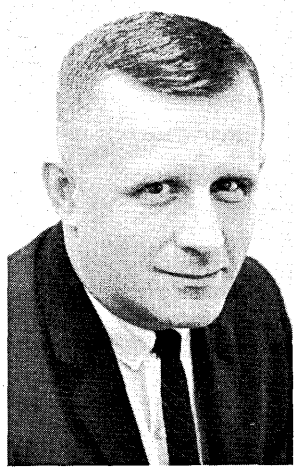
1. The retailer won't spend the money. He wants something for nothing.
2. The retailer is not as progressive. He doesn't have the imagination or the intelligence in his organization.
3. The potential for profit is not as great.

Are these valid conclusions? In the systems business, judgments are supposed to be supported by facts. The fundamental rule of the analyst is to make objective observations and to understand the situation before reaching a conclusion. What has happened and what are the facts?

The following hypothetical situation describes the type of thing that has occurred many times over the past 10 years. Allowing some license for a generalization I believe the main points are valid.

From his suburban headquarters, the computer salesman, accompanied by his analyst support man, sets out for a local downtown department store. On their way they stop for coffee at a multi-million dollar shopping mall where the store has a 250,000 square foot branch (air conditioned, magnificently decorated, a fabulous arrangement of merchandise, fountains, trees, etc.). After coffee they drive downtown to the highest rental-per-square-foot area in town and park the car in the new multi-level garage owned by and adjacent to the store. They walk through a ramp directly into the store. Remembering they have to go to the bank before the call, they go out the front of the store to cross the street. Even though it's January and 11 degrees outside, the front of the store is wide open, protected by a curtain of continuously flowing warm air. Coming back they pass windows beautifully decorated at high cost, several million dollars worth of cash register equipment, and go up to the appointment.

The analyst has just assisted in a large installation at International Oil. In this installation a punched card check was installed at every gas station. Imprinters to record and print on the salescard from a plastic plate were used. The



Mr. Harvey is corporate systems manager for The Singer Company. Formerly with RCA, ISA, and Strowbridge and Clothier, he worked on the Associated Merchandising Corp. (AMC) electronics project. He is a graduate of Pennsylvania State Univ.

saleschecks were batched and mailed to a central point where amounts were key punched and customer account numbers optically read. Once a month the file was updated and bills were mailed. Naturally, the analyst is very interested in relating this experience to the store controller (since it's a direct parallel). He takes off enthusiastically, but unfortunately the controller doesn't seem to comprehend. His mind is confused by complications on the retail sales floor. The salesman jumps in to save the situation by explaining how the store could use a factory production source recorder which can read a customer card and a garment tag, and set up variable data on a series of keys or dials. The entire recorder rents for only $130 per month.

At this point, the controller remembers he has to go to a meeting. He leaves the manufacturer's representatives with some parting advice.

1. He doesn't have a staff, and expects a lot of help. (Which the manufacturer should be glad to give to get this prestige account.)
2. The production control recorder won't work. He needs a special device. (More capable and under $500 per unit.)
3. The International Oil Co. machine cost twice as much as the store's entire accounting staff.
4. The computer manufacturer should work out a special deal with his store to crack the retail business.

Riding down the escalators, the salesman observes, "These people are really cheap. They don't want to spend any money. They don't understand modern techniques. Let's get out to Inter-City Telephone where they know the score."

The events in this illustration have often been repeated. Similar conclusions have been drawn many times by salesmen, analysts and computer management. Retail management has probably contributed to the misunderstanding by responses similar to those given in this example. The balance of this article will be directed at analyzing some of the factors involved.

will the retailer spend money?

The conclusion that the retailer will not spend money is not supported by fact. Retailers spend millions of dollars on buildings, advertising, public image, inventory and accounting. In fact, one of the largest initial computer efforts was undertaken by the Associated Merchandising Corp. (AMC) in the early 1950's. The project involved hundreds of systems people, operating executives, millions of dollars and was, to our knowledge, the first "On the Line Real Time" computer system installed. The management of the AMC stores, when they made this expenditure, had every intention of extending the results of the project into their stores in the late 1950's. However, like any other business investment, dollars must show a payout. The early efforts pointed out that problems remained to be solved to achieve this payout.

There were hardware developments needed. There were systems developments required. Some of these will be discussed later.

At the same time retail systems problems were being recognized, exploration was taking place in utilities, transportation, manufacturing, financial institutions, insurance, etc. The requirements of each of these businesses varied and in many cases the initial fit of computers more completely solved the problems. These industries started to mechanize rapidly. The computer manufacturer was suddenly in a rapid growth industry, but his resources, particularly in people, were limited. They followed the course of going after the easiest business first. Since the computer divisions of all but IBM were in the red, this policy was probably a logical one.

The situation is a great deal like the children in an Easter egg hunt. Eggs are all over the lawn, but the prize eggs are hidden. There is always an initial scramble to pick up everything that shows. After the visible eggs are gone, the tough part of the search begins. Although prize eggs are harder to locate, they are very rewarding when found.

A large share of the systems know-how and approach of computer manufacturers had its roots in punched card accounting.

In most industries, the use of punched cards has been a major step in the transition to computers. Tabulating systems were more economical and more effective than manual operations. The use of tabulating systems introduced a "machine discipline." Input was standardized. Management became accustomed to machine reports. In the retail industry punched cards had at best been of marginal value and at the worst had been involved in some disastrous fiascoes. The bridge to computers from punched cards was not present. As a result the relationship with data processing manufacturers and a mutual understanding did not exist. This lack of a common background and the subsequent breakdown of communications between manufacturers and retailers has retarded edp growth.

The salesman in our illustration made a quick generalization that the problem lay in the retailer as a person and his lack of appreciation of edp. The fact is, there were some very real problems which have complicated the retail environment. These problems had to be solved before much progress could be made.

point of sale

The first problem to be solved and the most basic is at the point of sale. A retail sale is a very complicated transaction. Many people, including the methods man in our illustration, underestimate the complexity. In the case of the oil company, an extremely high percentage of customers have a credit plate with a pre-printed number. The number of products sold is very small. The principal products are gas and oil. Taxes are recorded on the pump. There are no sends or part paids, c.o.d.'s or will calls, etc. In the retail store there are a whole series of services, products, terms and commissions to be paid. For example, below are some typical point-of-sale conditions:

- Different terms—cash, revolving charge, budget, c.o.d.'s, layaway, (combinations of each).
- Salespeoples' numbers for commission must be accurately recorded.
- Customer numbers for billing must be accurately recorded. Many customers will not have identification plates. Credit look-up requirements are very important.
- There is a tremendous number of products. A large department store carries more than 100,000 styles and over a million items. Within these products there are many combination prices (i.e., $1.50 or 2 for $2.88). Some products may be sold from samples and delivered from remote warehouse stocks. Some products must be controlled by class while others are controlled by unit.
- On top of these factors, there are a large number of services and conditions such as taxes, discounts, service charges, mail charges, exemptions, etc.
- Merchandise delivery conditions may vary with every sale. Some customers take the merchandise. Others want the merchandise sent. Some transactions are part take, part send. There are different send options such as United Parcel, parcel post, special delivery, etc. Special delivery instructions may be required—deliver on Tuesday—leave on back porch, etc.

• Customer service is very important to a retailer. The lost sale caused by a customer walk-out usually goes across the street to the competitor. The extra sale can only be made if the salesperson is free to sell. The time required to record data cuts down on sales time. At one minute per transaction, it would take the equivalent of 120 salespeople recording full time to handle 50,000 sales. The situation is further complicated by the fact that sales volume peaks sharply in key hours—lunch time, evenings. The peak recording requirements occur simultaneously with the most selling opportunities. Obviously, recording speed is critical.

• Because of seasonal volume changes, large numbers of part time employees are used (housewives, students, etc.), people who are not familiar with procedures and must be rapidly trained.

When these factors are considered together, the problem is quite different from a gas station or shop production control station. A great deal of effort was expended in the mid-1950's to develop shop data capture devices. Recorders were built by NCR, RCA, Univac, Clary, Burroughs, Friden and, later, Sweda. Unfortunately, these efforts were premature. Stores were not yet mechanized in the backroom accounting functions. Developing a data capture device to record data automatically for a manual system was putting the cart before the horse. The false starts supplied additional impediments which led manufacturers to shy away. The high investment in current cash registers also caused stores to move carefully.

Cost is an important consideration since the number of point-of-sale locations can run into the thousands.

The retailer has continued to look for point-of-sale solutions, and currently there are a number of specification requirements and requests for bids issued by major retailers to manufacturers.

low transaction value — high volume

A normal part of life in a retail accounting operation is the handling of huge volumes. A medium to large department store will average 50,000 sales per day. Each sale will average only around five or six dollars, which must include all services, overhead and the cost of merchandise. The initial sale of merchandise may cause other transactions—payments, returns, transfers, markdowns, returns to vendors, orders. The wide variety of input complicates the recording. When all of these are totalled, the number of transactions per month can run into the millions for a relatively small retailer. The retailer, to survive, must know how to move this volume at low cost. There is little chance to catch up if you fall behind. The paper flows in like a never ending river. Generally speaking, most stores, out of necessity, have learned to run fairly tight, high volume manual paper handling operations. Computer approaches, particularly with high cost input entry, were not always easy to justify. Lower clerical salary levels made justification even harder. Within recent years creeping costs are tending to change this situation. The volume of low-cost transactions and the large variety of them retarded initial edp development.

In the back room, total accounting cost for a store (from the controller's salary down) might average about 2% of sales. The cost of managing inventory, in the broad sense, is many times this. The national average for markdowns is around 6%. If you add the dollar investment in inventory, shortage percentages and the unknown cost of losing customers because of being "out of stock," accounting costs are dwarfed. Everyone admits the big profit potential is in the better control of inventory. It has been slow coming. A 10% markdown reduction would be worth $50,000 per month to a $100-million store. These kinds of dollars will justify an awful lot of computer power. This potential has not yet really been tapped.

lack of communication

Standing in front of a larger computer in 1955, an executive of a large store remarked, "It's another world." Too often, unfortunately, this has been very true. As illustrated above, the controller and the computer salesman both spoke English, but they didn't speak the same language. Although both had good vision neither saw the same thing. This lack of communication is not unique, but because of the complexities of retailing it was probably wider in the retail business. The chains and stores who are now leaders in the edp field have managed to successfully bridge this gap.

What does the future hold? The chains are now large multiple computer users. Most department stores of any size have installed or ordered computers. Hardware costs have come down. The processing capabilities and capacities have increased. Restrictions of 1955 equipment no longer apply.

It's true, retail data processing progress has been slow and sometimes painful. Gradually, however, the gap between manual processing and practical edp operations is being bridged. A recent survey was made by the Retail Research Institute in over 600 stores with volumes of $50 million per year or greater. There were less than 10 stores in the group that did not have computers either installed or on order. One large chain has over 75 systems on order. Many retailers have or are installing large systems.

What are the significant changes?

1. Retail accounting operations on edp equipment have finally become standard procedure. Disciplines have been established. Mechanized retail operations are no longer news.

2. Computer equipment has gone way up in capacity, while coming down in price. Hardware now available makes sense to stores unable to think seriously about a computer 10 years ago.

3. Technical developments offer new possibilities for more complete point-of-sale solutions.

- A breakthrough in the cost of electro-mechanical devices is being achieved through the use of electronic components.
- Data transmission developments to bring point-of-sale data directly into the computer are more in evidence every day.
- New methods and new materials look promising for sales recording.
- Time-sharing central computers and associated software will complement point-of-sale development.
- The point-of-sale area is not an unknown. Voluminous data has been recorded on every phase of sales recording. With the accounting functions on computers and the technical pieces in existence, it is only a matter of time until pieces fall economically into place.

4. Stores are finally turning their attention to the biggest profit potential—control of inventory.

A handle on this problem will really open the door for profit.

There have been some very impressive computer systems installed in the past 10 years in airlines, manufacturers, and financial institutions. Some of the largest have up to 1,000 remote terminals. I believe we'll start to see some very large retail systems. Many department stores have over 1,000 terminal points; a number of big retailers have well over 10,000 terminal points. As the retailer can see a profitable answer, he will move. Progress has been slow but the page is turning. Maybe it's time for our salesman to take another look; 590 out of 600 is a pretty good percentage to start. ■

RETAIL FORECASTING

aids in inventory management

by M. D. SEVERSKY

In 1960, IBM's Distribution Industries Group began an intensive study in the area of merchandise management. As part of this effort, a new computer-based inventory management system specifically formulated to regulate the in-stock position of staple and fashion merchandise has been designed and tested in selected retail stores throughout the country.

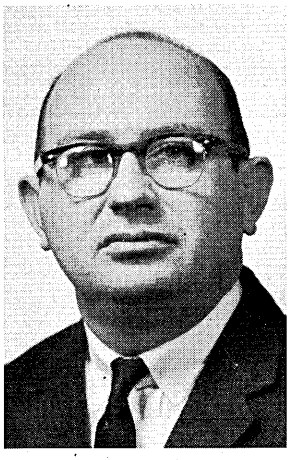
Portions of this system include new advanced sales forecasting techniques, such as probability and adaptive forecasting, which detect and outline the course of an ever-changing consumer market environment. This system, though limited at this time solely to retail applications, eventually may be incorporated in other merchandise management systems.

what is the problem?

Retailing's need for such a system is based, first of all, on the merchandising structure of the industry, and secondly, on the selling characteristics of the merchandise itself.

Department store management has traditionally divided merchandise into three major categories: "staple," "fashion," and "big ticket". Staple and fashion merchandise—the primary objectives of the retail system—account for nearly 90% of a store's total dollar volume and about 95% of the total inventory. Big ticket merchandise (furniture, major appliances, etc.) comprises the other 10 and 5%, respectively, of dollar volume and inventory.

Staple merchandise is characterized by repetitive, but fluctuating, sales patterns. Although these patterns vary among the different types of merchandise, they can be forecast with appropriate techniques, as will be discussed later in this article. Historically, retailing has not been able to quantify these patterns, since (1) they are dealing with literally hundreds of thousands of items, considering differences in size, color, style, etc.; and (2) they were required



An advisory systems planner with IBM's DP Division, Mr. Seversky has worked with the Retail IMPACT system since 1962, and was previously with the Advanced Systems Development Div. He has a masters degree in industrial engineering from South Dakota State Univ., and specialized in OR at the Universities of Minnesota and South Dakota.

to analyze manually the historical sales information for all of these items.

This inability to forecast sales properly has led to a marked and constant reduction in gross earnings in recent years. Results of a five-year study on retailing practices recently completed by IBM show that for every $100 spent by consumers in the average department store, another $90 would have been spent if customer requirements had been satisfied. Further analysis of this situation shows that most stores lose 22% of their dollar demand on planned purchases because of an out-of-stock position and/or because merchandise is unavailable in the desired sizes. And, when the store is unable to satisfy customer preferences as to color and style, the lost dollar demand rises to 40%. In other words, only 60% of the demand, represented by people who walk into the store intending to buy, is satisfied.

Similar reasons for lost dollar demand are associated with impulse-type buying. Here, too, the result is a low level of service (or in-stock position), generally in the area of 55 to 65%.

Ideally, the service level (or percent of demand satisfied directly from available inventory) for staple merchandise should be consistently higher than 90%, preferably as high as 93 to 99%, depending on the type of merchandise. However, increasing the level of service to such a point, without the availability of adequate forecasting techniques, usually results in a staggering increase in inventory investment.

Traditional forecasting methods used for item inventory control have not been able to deal successfully with the two most prevalent types of staple items: seasonal items and low-volume, "lumpy-demand" items. Seasonal items have sales patterns that show distinct peaks and valleys during a year, and although this pattern is repeated, it can be expected to change somewhat from one year to the next. Low-volume, lumpy-demand items are characterized by many periods throughout the year without any sales. When sales do occur, they occur randomly and in varying amounts, producing erratic patterns.

The line ratio method of seasonal forecasting (a method using a ratio of each month's sales to the yearly total) is the exact repetition of past seasonal behavior in the future. If the seasonal behavior remains the same, regardless of average sales, this technique will produce good results. Since seasonal patterns frequently change in the dynamic retail environment, however, the line ratio method produces inaccurate forecasts. Moreover, this method tends to be very unstable when demand patterns change.

The base series method of seasonal forecasting (a method using the average period sales in previous years as a basis for establishing the seasonal pattern) is used in some inventory forecasting schemes. This method also fails to produce accurate forecasts when retail sales data are used. The method lacks stability in periods of low sales and amplifies random fluctuations during low-demand periods, thus seriously affecting future forecasts.

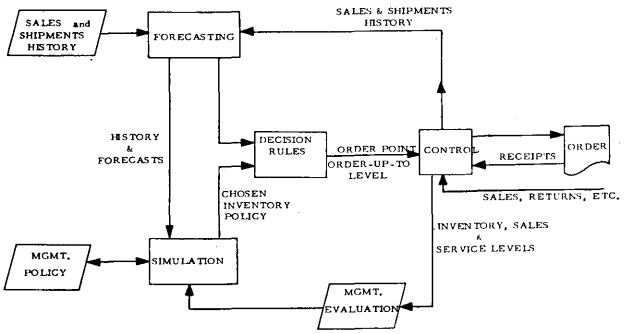
Moving averages, simple exponential smoothing, double or triple exponential smoothing, with a combination of a base series, also tend to be unstable. These combinations cannot accurately define the marked, but changing, seasonal patterns that exist in the demand for staple merchandise.

staple system

The ideal forecasting method required for managing staple merchandise is one that can detect the inherent seasonal patterns and trends and is also able to adapt easily to changes in these patterns. This is provided in IBM's Retail Inventory Management Program and Control Techniques System (IMPACT). Here, the method of adaptive forecasting has been extended and applied to predict anticipated movement of seasonal merchandise, and a new method of probability forecasting has been developed to predict buying habits of low-volume, lumpy-demand items.

The forecast results are evaluated by simulation and monitored by the control element with appropriate decision rules to form a total management system as characterized in Fig. 1. The four major elements of the system are forecasting, simulation, decision rules and control.

Fig. 1. Staple System Elements



Forecasting. When an item is to be reordered, it is imperative to have a forecast (estimate) of future sales. The more accurate the forecasting method, the smaller the errors, or deviations, between forecast and actual sales. The forecasting element carries out the highly complex mathematical computations and provides an accurate forecast for each stock keeping unit (SKU) of regular inventory.

Simulation. Before deciding on a specific inventory policy such as varying levels of customer service, inventory investment, or ordering workload, management would like to know the effects of possible alternatives. The major function of the simulation element is to provide basic information about these alternatives. Simulation can then show the effects that a change in level of service or inventory investment will produce, or what service can be expected with no change in inventory level when the system is installed.

Decision rules. When the forecasting element has generated a forecast for each SKU, the forecast is passed on to the decision rules element, which calculates reorder rules, or control numbers, according to the inventory policy selected by management. Two control numbers are calculated: one the order point; the second, the order-up-to-level, which establishes a maximum level of inventory. Both numbers are consistent with management policy. The size and number of orders placed is a function of the control numbers.

Control. The control element utilizes the control numbers received from the decision rules element for controlling the inventory. The day-to-day inventory transactions (sales, receipts, stock counts, returned merchandise, etc.) are processed, and the on-hand and on-order are established. This total available stock is compared with the order point and order-up-to-level in deciding whether an order should be generated and, if so, how much should be ordered.

Under normal operation, the forecasting and decision rules elements would be run every month. The decision rules element combines sales forecasts from the forecasting element with the chosen inventory policy established through simulation to produce rules governing when and how much to reorder for each item. These reorder rules are passed to the control element, which is generally run each week.

The control element maintains a record of the status of

every item of the inventory by accepting sales, receipts, and other transactions, and then determines whether orders should be placed. Every month the control element passes sales data back to the forecasting element so that new forecasts can be generated.

forecasting

Adaptive forecasting involves consideration of five steps: *data, models, smoothing, forecasting,* and *error measurement.*

The basic data from which the forecast is generated consists of sales records referring to everyday sales transactions (as opposed to promotions, special buys, etc.). In analyzing this data, the system screens out inconsistent information usually caused by incorrect item recording, and in certain cases, fills in missing data with approximations based on the pattern of demand.

From this information, which is broken down to individual SKU's (a white Manhattan shirt, button-down collar, oxford cloth, size 15½-34, for example), a model is developed which identifies the essential and underlying pattern of demand. The data ideally should cover a two-to-three-year period. If such data is not available, however, because of new styles, lost or discarded records, etc., an estimate of the probable pattern for a year can be supplied by the user after an examination of similar styles and/or through buyer judgment. This will be used as an initial approximation. When operation begins, the system will rapidly adapt to the "true" pattern as "live" data is introduced.

In developing the demand model, the adaptive forecasting method automatically considers which of five basic demand patterns is representative of the item under consideration; constant, trend, seasonal, trend-seasonal or end-of-season. Low-volume, lumpy-demand items are analyzed through probability forecasting, as will be explained later.

The constant model represents demand as centering around an average value. Variations may be attributed to random causes and exhibit no discernible pattern in time.

The trend model represents demand as consistently increasing or decreasing with the passage of time.

A seasonal model (Fig. 2A) represents demand as having high and low periods that recur as a function of time. These seasonal or cyclic patterns occur at about the same time during each year.

An end-of-season model (Fig. 2B) represents activity for a specific part of each year. End-of-season merchandise is taken off the shelves for a major part of each year so that there are no sales during that time.

A trend-seasonal model (Fig. 2C) represents demand as having high and low periods in a steadily increasing or decreasing fashion with the passage of time.

Studies of staple merchandise indicate that, for high-volume items, the most accurate forecast is achieved by dealing with each individual item as a separate entity. For items that move at a slower rate (medium-volume items), group forecasting can produce better forecasts than if the SKU's had been individually forecast. The demand pattern of individual medium-volume SKU's is usually such that no well-defined seasonal pattern can be established. However, if taken as a group (style within a store, or end sizes within a style, etc.), a seasonal demand pattern may be detected. These patterns show the seasonality, average sales and trend of the sales.

Once the demand pattern for a forecast group has been established, the forecast for the SKU's making up this group can be derived by calculating the percentage that each SKU contributes to the group and then applying that percentage to the group forecast. The forecast error for each SKU is calculated separately, on the basis of its own actual sales and its forecast as a percentage of the group. Fig. 3 is an illustration showing the group pattern of a style and the patterns of individual sizes within that style. The relative contribution of the two SKU's to the total sales of the style vary even though the overall style sales do not.

Following model selection, the system applies adaptive smoothing to revise the terms of the mathematical models to reflect the passage of time and to make the necessary corrections in the estimates of the terms. These corrections are proportional to the forecast error. In this way the forecast "learns" adaptively from past experience.

Fig. 2. Models of Basic Demand Patterns

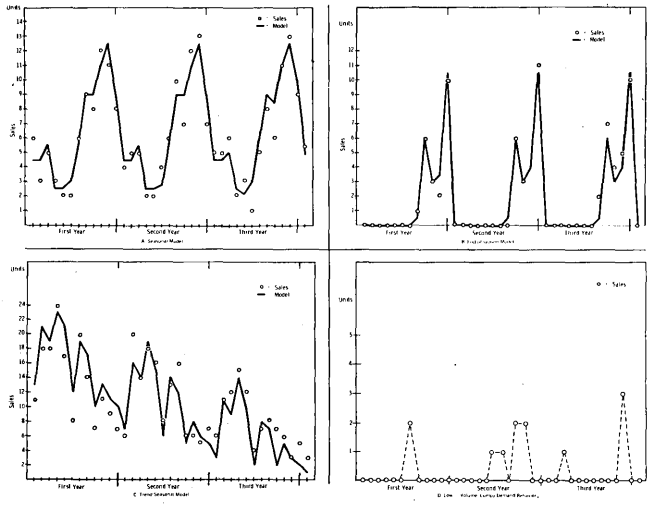
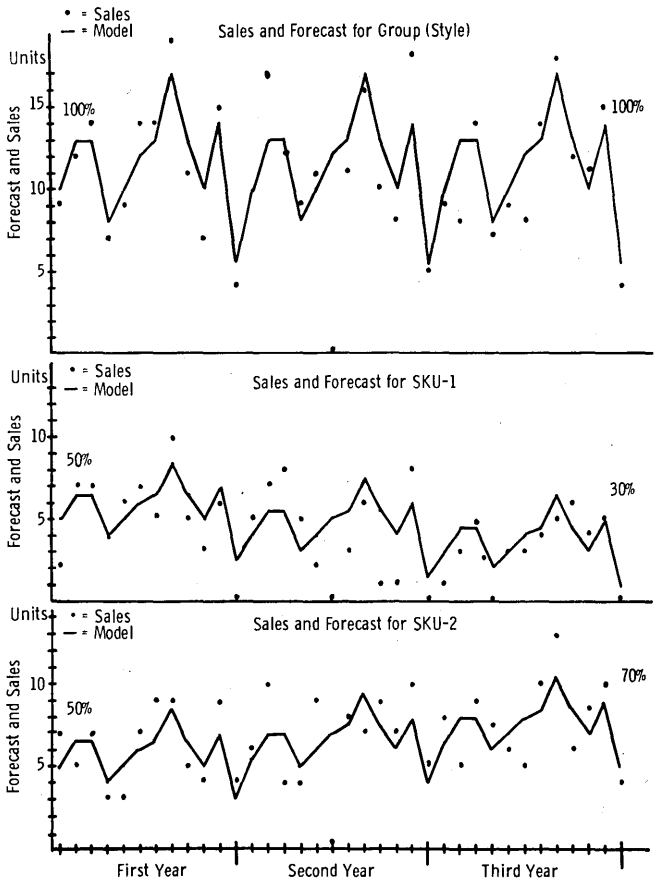


Fig. 3. Group Model



These are some of the functions of smoothing in Retail IMPACT system. Computer-oriented methods have been developed to provide flexibility: they allow changes to the system's rate of response as it tracks changing patterns of demand. When an original estimate of the rate of demand is made with little confidence (as, for example, when a new SKU is added to the system), more weight than normal is given to sales data during the early life of the item. This weight is in the form of a faster smoothing rate and enables the model to adapt more rapidly to the item's behavior. When more data becomes available and a pattern is established, a slower smoothing rate is used. The smoothing rates depend on the type of model, frequency of forecast updating and the desired rate of response.

As was mentioned previously, for low-volume, lumpy-demand merchandise, Retail IMPACT applies a different form of forecasting: probability forecasting. In our retail industry studies, we found that sales for individual SKU's are often quite low. For instance, in the case of women's intimate apparel, men's work clothes, and many other types of staple merchandise, sales of about 90% of the SKU's averaged less than one unit per week. For many SKU's, sales did not exhibit a clear seasonal pattern at that level. Any underlying seasonal pattern was obscured by the nature of the SKU sales data and the variability of SKU demand.

While a partial solution to this problem was found through adaptive forecasting of grouped data, this technique did not yield good results in the case of low-volume, lumpy-demand items. In fact, the application of adaptive forecasting to such items often resulted in excessive stock.

We have found that the behavior of demand for low-volume, lumpy-demand SKU's (Fig. 2D) can be studied successfully by analyzing the frequency of sales or sales transactions, instead of relating sales pattern with time. A known or empirically established probability distribution can be used to describe the demand behavior. Demand for many low-volume items is randomly distributed over time. In other words, the chance that a particular item will be requested at a certain location during a particular time interval is about the same as for any other time interval. It is, therefore, most important to be able to forecast the likelihood and probable magnitude of demand for individual low-volume SKU's.

Another problem with low-volume, lumpy-demand SKU's is that establishment of the true demand distribution cannot be made easily from available data. For instance, the item might have been out of stock for a long time, very limited data on the item is available or the data is not in the required form.

Since available data for low-volume, lumpy-demand SKU's does not always yield a precise forecast of the true value of demand, other procedures had to be developed. The concept taken in probability forecasting is that it is possible to estimate the chances that an SKU will sell 0, 1, 2, 3, etc., units in any given time period. As an illustration, we might compute for a given SKU:

Chance of selling 0 in a given month	80%
Chance of selling 1 in a given month	10%
Chance of selling 2 in a given month	5%
Chance of selling 3 in a given month	5%

These probabilities can then be transformed into a forecast and used as inputs to simulation and decision rules in the same manner as the forecasts are derived through adaptive forecasting.

simulation

Simulation has been used in the study and design of management systems. Its extension by Retail IMPACT to the retail world in general, and to retail inventory management in particular, is supported by three major reasons:

Policy selection. Simulation is very useful in the study of the consequences of the inventory policy selected by management. Retail management, like any other management, is eager to choose the "best" policy from a combination of customer service, inventory investment and ordering workload. A mathematical derivation of the "best" policy is nearly impossible to obtain, however, because of the large number and characteristics of variables involved and the changing patterns of demand. Consequently, system simulation offers the only feasible solution.

System evaluation. After selecting a certain policy, management wants to know in advance the consequences of following that policy. Such an evaluation gives retail management a unique opportunity to "look ahead." If the results of the selected policy are not acceptable to management, another policy can be selected and tried out through simulation. Furthermore, management is provided with new insight into a system's performance, and the need for costly experimentation on the floor is eliminated.

Training. Simulation can be used as a new tool for training store personnel on the Retail IMPACT system. In a short period of time, it provides experience in inventory management, planning and decision making similar to that normally encountered by store personnel over a period of several years in actual business practice.

We have found that few retail managers will commit themselves to a new system without knowing in quantitative terms how much it will benefit them. It is therefore necessary to evaluate the policy and results of the present inventory system and to compare this with what the Retail IMPACT system will produce.

Information from a random sample of the items carried by a department is used to establish what the present inventory policy is, in precise terms. At the same time, the system simulates alternative policies which can be achieved through the installation of Retail IMPACT. In this way, simulation is used to evaluate the potential benefit from the new system.

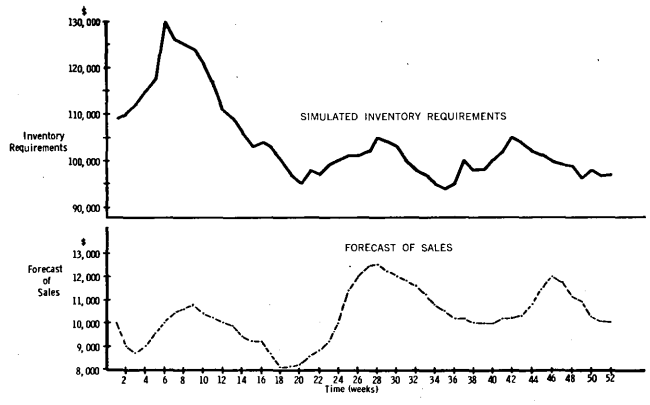
Use of simulation can provide answers to questions such as:

- How much investment in inventory is required to provide a certain level of service?
- For a given level of inventory investment, what level of service can be achieved?
- How frequently should stock be reviewed?
- What is the "best" ordering strategy?
- What will be the effect of reducing lead time?

Simulation assists management in selecting those policies that will yield the greatest profit potential from inventory dollars. Simulation also indicates what the performance is likely to be after installation of Retail IMPACT.

Fig. 4 shows graphically what is meant by simulation. Here, different forecasting models have been constructed

Fig. 4. Simulation



and combined together to give the overall sales pattern. From this information, through simulation, an inventory pattern is developed which fulfills management's desired level of service and level of average inventory.

This can be accomplished with the aid of a computer simulator. Before it can be instituted, however, management must first determine the range of levels of service under consideration. To aid in this undertaking, Retail IMPACT uses the forecasting models together with advanced simulation techniques to develop a set of answers in the form of graphical plotting showing different levels of service which can be achieved by different investments in inventory. A simplified example of this type of graph is shown in Fig. 5. The arrows indicate four of the many available alternatives (A, B, C, D) of level of service versus inventory.

Fig. 5. Level of Service vs. Inventory

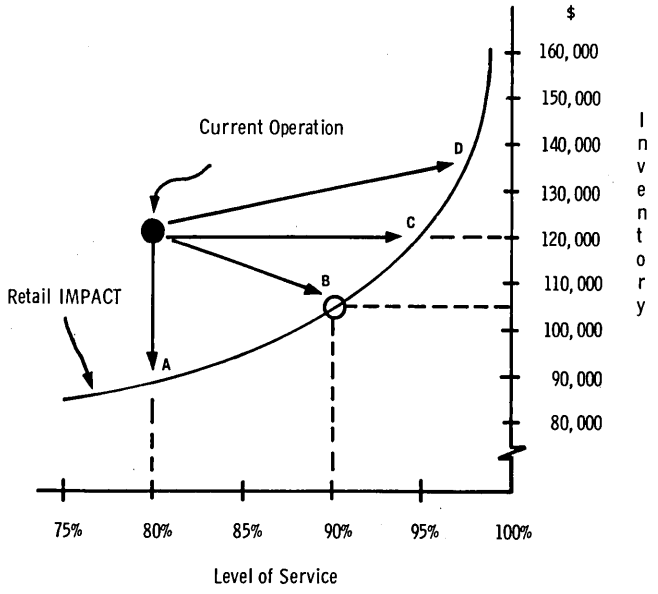
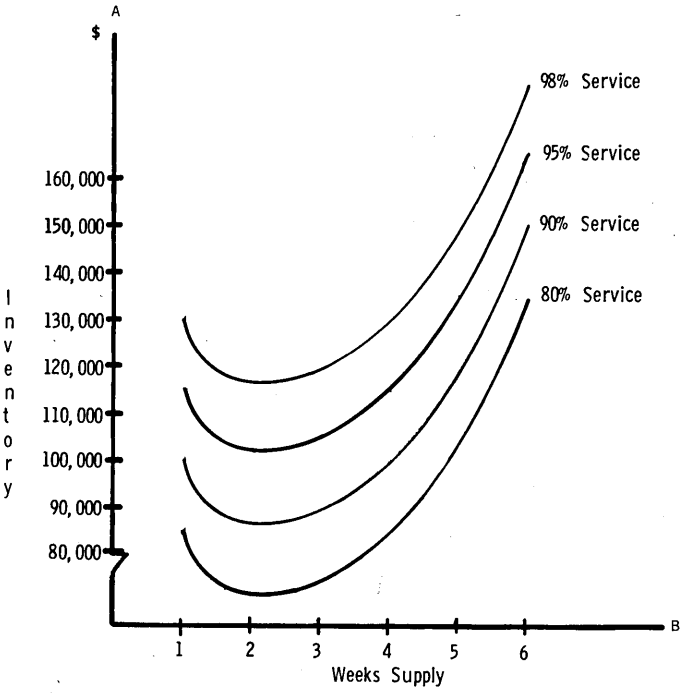


Fig. 6. Weeks' Supply vs. Inventory



Once a desired level of service has been selected by management, certain considerations must be applied, such as ordering strategy, lead time, and review time.

In Fig. 6, ordering strategies (and this can be for an item, a group of items or a department) and their effect on inventory have been simulated by the system. Axis A reflects the dollar investment in inventory; Axis B, the number of weeks' supply that would be ordered when a reorder decision is made. In other words, a decision can be made to order one week's supply, two weeks' supply, and so forth.

In this illustration, store management would obviously select the curve yielding the minimum dollar investment in inventory relative to the number of weeks' supply that should be ordered. If, for example, management chooses a 98% level of service and a two weeks' supply of inventory when reordering, they might have to invest approximately $120,000 in inventory. For a six weeks' supply ordered at each reorder period, a $160,000 investment in inventory would be required.

According to Fig. 6, a two weeks' supply appears to be the optimum strategy for every level of service. But, in reality, this is not necessarily true. Other factors must be considered. How, for instance, would changing the quantity of reorders from a four weeks' supply to a two weeks' supply affect other areas of business—receiving, for instance? Therefore, the lowest point on the curve would not necessarily be selected by management, but rather, another point on the curve taking into consideration other important factors not considered in the simulation.

Other factors which could be evaluated include frequency of the review period (how often will an item or a group of items be reviewed for possible reorder) and total lead time. Here, too, the simulator plays a major role by assisting management in the evaluation of important factors. Simulation is neither a cure to all the problems encountered in retail management nor a source of magic answers. It is a powerful management tool, and as with all tools, what it produces depends on the user—retail management. To use this tool effectively, an understanding of simulation principles is required as well as a down-to-earth grasp of how the retail business and inventory management systems operate as a whole.

The selection of the best alternative requires careful examination of the potential application. Consultation with experienced personnel to examine feasible alternatives, before a final decision is reached, is very important. Sometimes one of the alternate solutions generated by the simulator may work better on the floor than the mathematical "optimum."

decision rules and control

Once the simulation policies have been evaluated and selected by management, they are combined with the outputs of forecasting to formulate a set of decision rules. These rules, in the form of an order-point and order-up-to level, are supplied to the inventory control element of the system.

The actual operation of Retail IMPACT is made up of movement of merchandise, sales data captured at the point-of-sale or derived through stock counting, receipts from point-of-origin, order-point triggering and automatic purchase order writing. The status of the inventory is reviewed every week, and the record of sales activity is automatically channeled into forecasting every month. Any variations in the behavior of an item are reflected. As variations occur or as seasons change, order points and order-up-to levels are modified. This is a continuous feedback operation and is updated constantly.

The system requires little manual intervention for

regular staple items, with the exception of management's evaluation and changes in policy. For example, management may decide to reduce the inventory investment within a given department from $200,000 to $150,000. When such a management statement reaches the system, the order points and order-up-to levels are revised, either through a change in the operating rules (review period, ordering strategy, etc.) or through level-of-service modification.

This, conceptually, is the approach taken for staple merchandise management in Retail IMPACT. When we look at fashion merchandise management, however, we are talking about a completely different system.

fashion system

Unlike staple merchandise, which has a relatively long selling life, fashion merchandise has a short selling life with limited opportunities to reorder the successful styles. Specific items constantly compete with new introductions for customer acceptance, and it is not uncommon for an item's life to be much shorter than a season. Furthermore, future demand for new, untried fashion items is almost always unpredictable. Demand can, in fact, range from full customer acceptance to complete rejection.

Fashion merchandise also is highly obsolescent. At the end of its season, an item's value is substantially reduced. Carryover from one season to the next is virtually nonexistent. Consequently, markdowns, sometimes even to a level below cost, are common.

IBM's research in the problems of retail forecasting has also been directed to the vital area of planning. This is an extension of adaptive forecasting capabilities in the area of staple inventory management. In addition to the use of mathematical models at the SKU and group level, they can be used to describe the demand process on a corporate, store, department and merchandise classification (i.e., wool dresses, jersey knits) level. The higher level forecasts (merchandise classification and above) can be applied to either fashion or staple merchandise. The methodology of adaptive forecasting can thus be extended to the area of planning, utilizing the experience gained from staple inventory management.

The analysis of the entire planning process is beyond the scope of the present Retail IMPACT system. The goal of this system is to contribute an important input to the planning process: estimation of the future. This is a forecasting problem. Specifically, the role of Retail IMPACT in fashion planning is to gather historical data about the demand process and to generate a forecast for a desired planning horizon—say, a season or a year. The output of the forecast, which is based on the analysis of past data patterns, can be combined with additional information available to the fashion planner, such as economic trends, competition, market trends, etc., to yield a solid foundation for the fashion plan.

Our experience with forecasts for planning, at a department level, indicates that some departments may show only one or two peaks per year. Others display multiple peaks and valleys during the course of a year. In certain cases, departments may show clear trends, very slight trends or no trends whatever. Patterns vary from department to department and, even from store to store within department. All of these demand patterns can be described by the models of adaptive forecasting.

The purpose of fashion forecasting for planning is to produce monthly forecasts that can be used by the fashion buyers. The forecasts are revised monthly, so that they can react to current conditions and keep the buyer apprised of significant changes.

Monthly forecasts in dollars and/or units can also be produced for the merchandise classification level. As a result, the buyer is provided with a powerful planning tool for use together with the recommendation reports of the fashion system. In addition, forecasting for planning can break down the merchandise classification forecasts into a size-within-class forecast. The information can assist the buyer in determining the needs for future months.

The primary logic of the tactical reorder-return-transfer (inter-store transfers) decisions of the fashion system is independent of the strategic forecasting for planning and is based on quite different principles.

The main reason for this is the unpredictability of demand for new, untested and untried styles. At the style level, where the tactical decisions of reorder-return-transfer have to be made, no past data is available. If a style is carried over from one season to another and past data is available, such a style is not likely to be a fashion style. Thus adaptive and probability forecasting techniques, which essentially rely on extrapolating the past into the future, break down when applied to style-level fashion.

forecasting fashion style

Therefore, a different technique was developed to handle fashion style forecasting. This technique tracks current style sales on a daily and weekly basis so as to secure reasonable profits from fast sellers and to minimize losses on slow sellers. The primary input requirement is daily sales by style. On a daily basis, all transactions are entered into the system where a check is made to insure completeness and reliability.

Each style record is updated and analyzed to determine whether the style is fast or slow compared with competing styles (styles in the same group). Recommendations for

"I gather it chose his wife for him."

buyer action are printed daily for reorder, and weekly for return or markdown. These recommendations can be backed up by producing a stock status listing of recommended styles at the size-color level, if the store elects to support the size-color option by providing the necessary input at the SKU level.

The updated summaries also provide information for periodic analysis reports and inputs to the forecast for planning function. These are the forecasts of class, department and store, which can be used for open-to-buy determinations.

The recommendation of a style as a candidate for action is based on mathematically exact logic, taking into consideration rate of sale, inventory and mark-on. Essentially, the logic is an extended form of "acceptance sampling" as used in statistical quality control sampling plans. It follows very closely the procedure normally adopted by a successful buyer when she buys new, untried styles in small quantities to test their market potential.

By utilizing advanced statistical control techniques, derived from extensive research on the nature of the fashion process and the speed inherent in computer processing, the fashion buyer receives daily information that enables her to respond very rapidly, increasing the chances of successful action.

Fig. 7. Fashion System Logic (90% confidence)

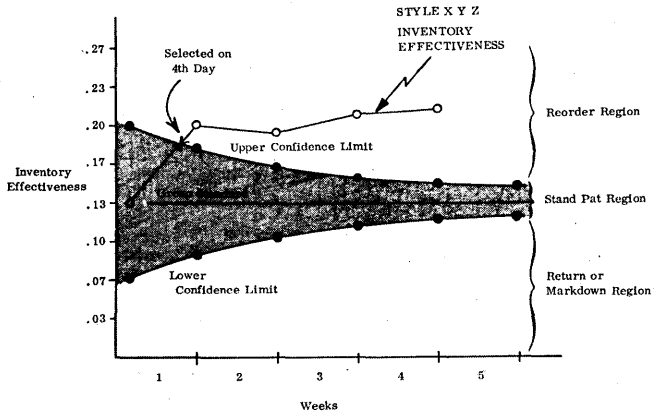


Fig. 7 shows time marked in weeks along one axis and inventory effectiveness on the other. We define inventory effectiveness as the gross margin rate per inventory cost dollar. It relates to return on investment or "profitability," and depends on two factors: style turnover and mark-on. Mark-on, as used in retailing, refers to the difference between cost and selling price, expressed as a percentage of the selling price.

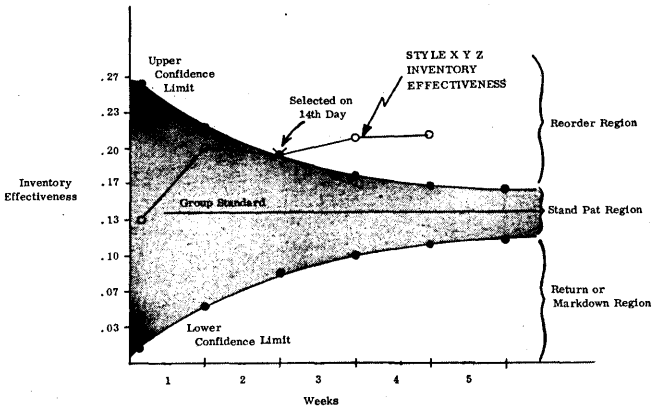
The fashion system automatically determines an average or group standard for a group of styles which are competing for the customer's dollar for a particular type of garment. Essentially, the system's logic is based on mathematically constructed limits around the computed standard. If a style's performance stays within the limits, no action is indicated—for the style is behaving in such a way that it is not significantly different from the other styles with which it competes. If the style breaks through the limits on the upper side, it is a candidate for reorder—for it is doing better than the styles with which it competes. Conversely, if the style crosses the limits on the lower side, the style's activity is poorer than competing styles. This means that the style is a candidate for markdown, promotion or possible return to vendor.

The width of the style limits is determined by the degree of confidence the buyer wishes to have in the system's recommendations. In Fig. 7 for example, the buyer can have 90% confidence that if the style "triggers" (breaks through the limits), it will be far enough above or below the group standard to be a candidate for action.

On the other hand, if a buyer wants to have 99% confidence in the system's recommendations, the limits are widened—as in Fig. 8.

Here, a penalty is paid for the additional degree of confidence—and the penalty is in terms of time. In this illustration, the style triggered on the fourteenth day. But in

Fig. 8. Fashion System Logic (99% confidence)



the previous illustration, in which 90% confidence limits were applied, the same style triggered on the fourth day.

Using inventory effectiveness as a standard for triggering exceptional items is a very useful and sound concept, and to a certain extent is applied intuitively in some manual systems. The major difference between the manual and computer systems, however, is one of dynamic response. This also applies to the staple system. With the Retail IMPACT System, management is always able to stay on top of customer requirements—something they were never able to do before. And Retail IMPACT does so in both fashion and staple systems. This, in turn, has brought about a marked increase in gross margin earnings.

For example, pilot stores using developmental versions of the staple and fashion systems report that level of service in departments presently controlled by the staple system has increased from 11 to 29%, providing a level of service of between 97 and 99%. Lost demand, the inverse of level of service, has decreased 80 to 90%. The turnover in these departments also has increased, ranging between 15 and 51%. Sales have also gone up, with improvements ranging between 11 and 28%.

The fashion system pilots report similar improvements. For example, gross margin dollars produced per dollar invested in inventory has shown improvement ranging between 12 and 42%. Furthermore, buyers have now found it possible to get into the marketplace sooner, thus securing the merchandise they need, at the time it is needed, and in a quantity which will maximize response to customer demand.

In summary, we believe that the best testimonial for Retail IMPACT forecasting as an aid to the management of staple and fashion retail inventories is in the pilot stores where the developmental systems are presently installed. The success of these installations is directly related to the degree of involvement of all levels of store personnel. Experience with the system to date shows that a properly organized and carefully directed program for implementation, together with a thorough understanding of basic system principles, results in a smooth and orderly transition into effective system usage. ■

STOCK CONTROL AT THE MAY COMPANY

by MALCOLM K. LEE

Department store operations begin with merchandise on the shelves, ready for sale. From our experience at the May Company, we are convinced that department store electronic accounting systems should follow the same basic approach.

In choosing the buying-inventory cycle as a focal point for the May Company's CLASS (Closed Loop Accounting for Store Sales) system, we did not mean to downgrade other areas of department store accounting. For example, accounts receivable for credit sales—the place where so many successful accounting systems have been launched in retail stores—can not, and should not, be neglected.

Rather, the point to be made is that our business is buying and selling merchandise. All other functions are just either a by-product or necessary support for this basic activity. For example, if we don't sell any merchandise we won't need any accounts payable. Therefore, our first step is to automate buying and inventory management.

The problem is really common to the entire department store industry. Actually, this field has undergone two major revolutions since World War II.

The first was the fashion revolution. Fashion became basic to just about all the merchandise we could buy or sell, not only in wearing apparel, but also refrigerators and other home appliances, automobiles, television sets, furniture and other lines. There is fashion in all merchandise we sell today.

From a data processing standpoint this fashion trend has multiplied operating problems through increases in the number of separate items which a store must stock. As an example, take the matter of bed sheets. At one time, the merchant had to worry about two sizes and one color. Today, he must stock a whole rainbow of different colors in up to six different sizes.

The second revolution was the movement into the branch store business. Most stores were successful when they operated one unit. But the mass move into the branch stores created an entirely new problem which many merchants were not geared to cope with: running several stores from one location and adequately providing the merchandise that customers wanted at each of these stores.

A third operating revolution in retailing is in the making right now. This is the electronic revolution. This involves the acceptance, installation, and day-to-day use of modern tools which will enable retail management to face the realities created by the first two revolutions. The electronic revolution is really going to make our people operate from computer-produced data. That's what they're going to have to use to be successful. The days of eyeball stock control in a multiple-store operation are over. This approach simply doesn't work anymore.

The operations of the May Company offer a prime example of how these factors have affected retailing over the past two decades. The company's divisions operate in 12 cities across the country. In virtually all of these, decentralization has set in. That is, each of the May Company divisions still has a downtown location for its main store. But, in virtually all cases, the real volume growth has come in the suburban areas where the people now live.

This situation is highlighted on the West Coast. The May Company of California, for example, is headquartered in downtown Los Angeles. But its operations extend from San Diego to San Bernardino. In the East, an area with such a span—some 125 miles—supports two or three separate locally-managed divisions. By comparison, we have semi-autonomous divisions in Cleveland, Akron and Youngstown—all closer together geographically than the California Division's stores in San Diego and Los Angeles.

To be sure, this represents an extreme in decentralization, but it also serves to highlight the real need for management-by-exception capabilities in retailing. The plain fact is that merchandise buyers in Los Angeles are expected to—actually, they must—control buying and support sales activities in San Diego just as effectively as they did when the departments they ran were on the other side of the partition from their offices.

These geographic and operating factors played a major role in the selection of the May Company of California for pilot operations and installations for our CLASS system. In describing both the concepts and operations of this system, it should be emphasized that we are not talking about classification in the traditional department store sense. A classification system is a program under which management is exerted in groups of merchandise items. We are still vitally interested in this aspect of retail management. But CLASS is designed to go further. It deals with merchandise in individual stock-keeping units (SKUs) or separate merchandise items.

improving supply of staples

With an operation of the magnitude of the May Company of California, this, in itself, brings the electronic

Mr. Lee is corporate director, systems, for the May Department Stores Co. An industrial engineer by training, he has specialized in retail control systems since 1947. He was with The Dayton Company, Minneapolis, for 17 years on the BIZMAC project, a detailed study of computerized retail systems by the Associated Merchandising Corporation.

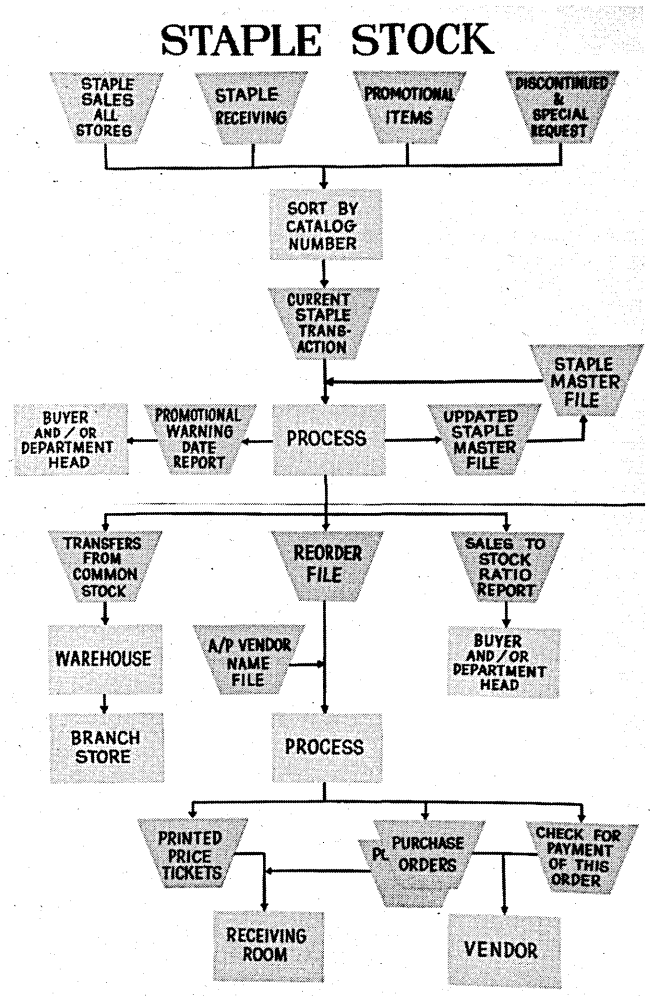
system into contact with some pretty impressive numbers. All told, the 12-store Southern California chain handles more than a million separate items of merchandise. Of these, 300,000 are what we call staple items.

By staple, we mean items which the customer can logically expect to find in any of our stores at any time. Staples range all the way from toilet tissue through linens, golf balls, men's shirts, house dresses, and diapers.

In the past, a correlation between buying merchandise and controlling stock inventories was achieved in the staple merchandise areas almost entirely through periodic physical counts of the merchandise itself. Even when stores installed computers, there was no way to get around the need to have dozens of people climbing on ladders, crawling into back rooms, or taking up valuable selling space on the showroom floors themselves, counting items on hand, one-by-one.

At the very best, this procedure was inaccurate. The most anybody could rely on in the way of accuracy from such tallies was to allow for a 15 per cent error factor. Another factor was that it took so long to get visually counted data to the merchandise manager or buyer that, at best, his activities would always be well behind the fact.

Another problem with manual counting lies in keeping up stock-taking schedules. If the system is going to work, it has to be pre-planned and executed on schedule. If someone gets sick, or, as is more likely, is put on another job because of heavy store traffic that day, the system falls down.



Even when buyers were willing to risk complete reliance on the figures they got, there was always room to wonder—to hedge a little bit. This introduces other problems. The minute a buyer substitutes intuition for fact, he'll have no system at all.

The same factors of human unreliability enter systems which attempt to count merchandise by saving tags removed at the time of sale. For one thing, by the time a garment or other item has been on the department store floor for several weeks, there is no way of being sure that the tag will not have fallen off the garment before it ever gets to the salesperson who takes the customer's money. Then, too, a merchandise tagging system provides no assurance that a store's financial and inventory information will be correlated. That is, a department store manager can be sure that sales will be rung up on sales registers. It is his business to make sure that sales are recorded this way. In addition, he makes it known to all of his salespeople that their performances will be measured in terms of cash register ringups. But there is no realistic way to supervise or measure the turning in of tags.

The CLASS system has been designed specifically around this basic fact of department store life—that almost every transaction affecting the movement of goods is bound to be reflected on a sales register somewhere in the system.

capturing sales data

The CLASS system, therefore, centers around the capturing and processing of transaction data captured at our sales registers. Specifically, we mean that we intend to implement a capability for capturing complete data, on the exact item purchased, the salesperson and type of transaction, every time someone buys anything at a May Company store. We do this with registers which imprint journal tapes in a type font which is readable for computer input. To take advantage of this compatibility, we now capture more data on each sale. The amount of time which a salesperson spends at the register will be greater than in the past. However, with an automatic sales check feed to imprint data that used to require manual entry, the amount of writing that is required by the sales person has been reduced. Therefore, the overall time is not any greater to complete the sale than it was in the past.

The register that we will use in our system will be an NCR Class 53 with NCR Optical Font (NOF). The register has only three totals: a merchandise total, a deposit total, and a voids memo total. All other totals will be generated on the computer. This way, the register costs less because we're not paying for all the totals. This is important because we are talking about a system which will employ a thousand registers or more in California alone.

From a data processing operations standpoint, this approach gives us a vast input network. Data for our computer is being captured wherever and whenever we conduct business—at any of our stores, from 10 a.m. through to 10 p.m., six days a week. All of this transaction data is input-ready. It can be read directly into our central computer system on a daily basis via a high-speed (NCR 420) optical journal reader.

For each sale, the information captured in this way includes a department number, a classification number, a four-digit catalog number, salesperson's number and price. When the data gets into the computer, it is sorted according to catalog number and analyzed daily from the standpoint of adjusted stock on hand in each store and our central, common stock facility, lead time for replenishment, seasonal sales trends and promotional sales campaigns. This last item is particularly important. Every time a store plans a special sale—and this is the lifeblood of the depart-

ment store business—plans must be made so that there will be enough stock on hand to support the promotion before, during and after the sale is over. The matter of stock on hand after the sale is particularly noteworthy, since we are, as indicated, dealing with merchandise which we expect to sell year round.

additional reports

As a daily by-product of this computer processing (on an installation consisting of an NCR 315 and an NCR 315 RMC computer), the CLASS system will generate a series of management-by-exception reports, pinpointing all items where stock levels have, on a daily basis, dropped to points where the factors of current sales and projected vendor performance indicate that some buying action is necessary. Periodically, each buyer will also get a complete report covering inventory and sales data on all staple items for which he has the purchasing prerogative.

This report, in effect, will be a computer-produced purchasing recommendation. He can, at his discretion or judgment, add to, delete from or alter the data from this listing in any way. When he has done this, he simply returns the listing to the data processing department, where it serves as a source document for an automatic series of procedures which:

1. Issue purchase orders to vendors.
2. At the same time, issue checks to vendors in payment for purchased goods. This gives us an absolute maximum in anticipation discounts, which are an important facet of department store probability. It is customary in this industry for a retailer to discount bills at the rate of 6 per cent annually between time of payment and due date.
3. As part of the same purchasing procedure, the computer will also issue merchandise tickets and receiving room documentation. This will be waiting and ready for the goods when they arrive, minimizing the work of tagging and distribution. This will also reduce the total elapsed time from the moment the goods hit the receiving dock at the merchandise center to their availability for sale on the department store selling floors.

Spinning off from the same computer run will be a complete, current-on-daily-basis accounts receivable system for charge sales. Our accounts receivable procedures, then, will be automated in basically the same way as our stock control program. As a matter of fact, we are using the same basic data, taken from the same magnetic tapes.

From a data processing standpoint, the development of the systems and procedures to implement CLASS became relatively simple once the optical input equipment and computers with high enough sorting speeds became available to make operations economically feasible. But, throughout our plan, there was one question which couldn't be answered except on the selling floor of actual department stores: can department store salespeople, in reality, create source input of a high enough caliber to make a system like this work?

Our reasoning, in taking the calculated risk, is that, if they can't, we had better look for a better method of handling our money. This same sales force handles hundreds of millions of dollars annually with a rate of accuracy which is well above 99 per cent. As a basis of the CLASS system, then, was a solid belief that the same people could learn to input stock numbers just as easily as they could dollar figures.

However, there is still a big difference between believing it would work and making it happen. When it came to implementing the input phases of CLASS, the ultimate burden was carried by the May Company of California's training department. This staff analyzed the problem, isolated its elements, wrote manuals and then worked out face-to-face implementation routines for acquainting salespeople with what had to be done and making sure they did it.

As it happened, we had an advantage in launching CLASS implementation. The May Company of California was opening a brand new store in Costa Mesa. So this was chosen, in cooperation between the data processing and training departments, as the place to begin the new system. This created an opportunity to teach salespeople the new system right from the beginning.

In doing this, the training personnel themselves gained valuable, firing-line experience. From there, they were ready to tackle the established, operating stores. By then, however, we were coming into our busy Easter season. Under this pressure, the plan evolved was to implement system conversions at two geographically-close stores at a time. That is, beginning on a given, designated day, during which our data processing people held their collective breath, two stores converted entirely from the old system to CLASS.

For a full month before the actual conversion date, small groups of salespeople were given classroom indoctrination by training people. This was done in a facility set up with actual CLASS 53 registers. Then salespeople were permitted to come back during slow or leisure hours to practice further. The idea was to give every person in the store 10 hours of training on the new register before the actual cutover date. At any time during this practice cycle, any salesperson could turn to a training specialist—there was always one on duty—to have questions answered or to have special help.

forecast

At this writing, then, CLASS is well beyond the blue sky stage. Five department store outlets are using some 500 registers. The optical tapes from these registers are being processed daily on a computer system in our central data processing department. In other words, implementation is well along toward realization—well enough so that some concrete results can be forecast:

1. Turnover of merchandise will be improved because stock on hand will more closely reflect consumer buying trends. This, in effect, means that return on investments, from a corporate standpoint, will be improved.
2. The number of customer walkouts should be decreased substantially. In the department store field, we refer to a customer walkout as a situation where the customer leaves the store without buying something he intended to purchase because we didn't have it. The built-in protection features of CLASS should assist this performance factor considerably.
3. Sales productivity will be improved. For one thing, each transaction will take less time in total because more data will be rung up on registers. In addition, however, the common-language communication now made possible between registers and computer make it feasible for us to permit salespeople to engage in inter-departmental selling. That is, theoretically, any salesperson should be able to ring up a sale on any register in the store where he works. The computer, then, will tally his daily performance. In this way, we can have far greater flexibility in moving our service capacity to where customer demands are, at any given hour.
4. All of these transactions, and others which may have not been listed here, will be carried out with greater accuracy and will be easier to audit than has ever been possible since the beginning of the post-war retailing revolution. ■

caution is the by-word

IS RETAILING READY FOR OLRT?

by MILDRED PASS

There is great appeal in on-line real-time systems, and at first glance OLRT would appear to be the ideal solution to a retailer's data processing problems. With visions of Sabre, we think of the instantaneous updating of thousands of records with tremendous savings in cost and time. This tremendous appeal does not hold up under careful scrutiny. As a matter of fact, OLRT systems have been built, tested, and the approach discarded as impractical for retailing *at the present time*.

the primary problem

Improved profit through enhanced merchandise techniques is the retailer's primary goal. Merchandising offers potential for profit far beyond the reduction in cost in all the clerical areas combined. For airlines—where the product (the seat reservation) is extremely perishable, and where break-even point economics prevail—minute-by-minute statistics are invaluable. The retailer, however, turns his inventory three to four times a year.

A dozen pair of socks delivered in February will sell down to zero in May. Under prevailing systems these sales will probably be recorded in a conventional inventory control system once every 30 days or possibly once a week. OLRT would let us record these inventory deletions immediately, but this speed is not necessary to provide better control of retail inventories. Decisions are not made on a minute-to-minute basis. There is a need for daily sales information on the more volatile fashion items and weekly data on staple items, but we don't need OLRT for this.

The retailer must first improve his *use of information* via mathematical techniques so that when the day of OLRT arrives he will be able to make intelligent use of the instantaneous information. As these merchandising systems work in closer interaction with the merchants, there will be an extended period of training, proof, and improved sophistication before merchandising systems are truly accepted and used. An OLRT system will do nothing to shorten or assure the success of this vital training period. Rather, it will add confusion and dilute systems effort in pursuit of a false goal. OLRT should not be a goal in itself. It must be measured against its ability to solve the retailer's most significant business problem, more sales from a smaller inventory. In this relationship OLRT has no special appeal.

If it is conceded that merchandising will not be materially improved by OLRT we should continue to evaluate it as a method of cutting cost and giving better service.

Perhaps the best way to evaluate OLRT on this basis is to hold it up to the characteristics prescribed by the point-of-sale environment. A retail point-of-sale system should be centralized, reliable, available, simple to operate and should not inconvenience the shopper.

Centralization. A $100-million department store has typically about 800 points of contact with its system, each equipped with a cash register. Some of them have an activity of 30 to 40 transactions an hour, and some are extremely slow, with 1 to 2 transactions an hour.

We should rely on the computer to handle as many as possible of the point-of-sale functions now in the cash register. The terminal would then be stripped down with no other functions than recording, printing, protection, and indication, to keep the cost down. A complication caused by multiple points of contact is the need for line concentrators to handle the traffic going to the computer (using a simplex network and stripped down terminals).

It would be desirable to have the computer communicate back to the terminals, prompting, checking and guiding. This will add costs to the terminals, lines, concentrators and to the cpu. This problem is an interesting one, but at this point only academic even using the hollow shell

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terminal, since it appears that there is little money to be saved in removing features from the cash register as we know it.

Reliability and Availability. The system in a retail store must be "up" more than 99% of the time. In order to assure this kind of high reliability, it will be desirable to duplex the cpu complex so that two processors have the ability to monitor the data transmission requirements of the systems. In addition, the processors will need very large core capacity and direct access storage to support the duplexed mode of operation.

This requirement for system reliability should be understood in light of the traffic demands that will be placed on the system. The peak-peak in December is six times the normal peak. In an average week, a high percentage of the business is transacted in 18 out of the 50 to 60 hours the store is open. Even a short period of "down-time" in these critical periods would create chaos on the sales floor and extra expense in capturing lost sales from hand-written documents on an "after-the-fact" basis.

Let us assume a store complex of 10 branches tied into a parent store. Each branch store has a concentrator feeding into the central cpu. Let us assume a 98% rate of reliability and availability—of the terminals and the computer—with communication lines available 100% of the time. If we consider 26 working days per month in a department store, we can see that approximately six days out of a month, one branch store is required to revert to a handwriting procedure. And consider the problems involved in training sales clerks in two procedures.

Simple to Operate. A point-of-sale terminal can be designed to lead a clerk through each transaction on a programmed basis. The equipment to provide this guidance can be built into each terminal or can be placed in a centralized remote computer using data transmission to communicate with each terminal. *Without regard to cost,* this kind of control simplifies training, eliminates many errors and requires little if any after-the-fact correction.

off-line o.c.r. approach

By way of contrast, the off-line optical character recognition approach relies somewhat on cash register interlocks, but relies most heavily on computer monitoring of the journal tapes with reporting of clerk errors on a follow-up basis. The degree of unprocessable keying errors has been proven to be small (2% to 3%), which is tolerable for merchandising and accounting purposes. Furthermore, after-the-fact correction is very attractive on a cost basis, when compared with real-time programmed keyboards at each point of sale and the duplexed back-office computer complex required to support it.

Customer Service. Retailing is a competitive service business. A point-of-sale system that inconveniences customers will affect sales. Conversely, speedy service is a distinct competitive asset. There is little evidence that there is much to be gained in speed on the selling floor by OLRT systems. It is important to remember that there are many point-of-sale environments (notions to fur salon) and in many of them, the time spent at the register is only a fraction of the time spent consummating the sale.

Cost. The on-line real-time systems built or proposed to date have failed to meet the tests of marketability from a financial point of view.

Each dollar added to the point-of-sale terminal is multiplied by the number of terminals (800 in the hypothesized $100,000,000 store). Here is where the retail systems people pushing the OLRT solution make an assumption. They assume the cost of a point-of-sale device can be cut from $2,000 to $1,000. They assume further that this will be a full duplex terminal with a media reader for prepunched tickets and credit cards. Such a terminal costs more, not less, than the traditional cash register. This is borne out by the cost of the NCR Salestronic, the original Unitote terminal, and the Remington Rand Point-O-Sale Recorder, all with media readers. None of these was marketable.

And any approach we take—media reader, or keying in on the point-of-sale device—assumes that there is accurate and complete ticketing of merchandise. Since receiving and marking is now an area marked by shoddy practices and there is a wide degree of latitude in the level of inventory control, much more cost must be absorbed here for all merchandise lines.

The ability of the typical retail firm to install an on-line real-time system is subject to much doubt. Even with extraordinary manufacturer's systems support, the demands of programming and the conversion techniques required by OLRT add a risk of failure not present in off-line systems.

Should the retailer completely discard OLRT *as a retail solution? No!* We must wait for on-line real-time in retailing for the cost of the point-of-sale terminal and the computer to be cut in half, and in the meantime we must prepare ourselves for the complexity of installing such a system.

The retailer must improve the use of the information now provided through automated reporting. The merchandisers must be trained to intelligently use the reports.

The practices in receiving and marking must be improved and changed in anticipation of an OLRT information system.

Attitudes and abilities must be developed for recognition of the level of accuracy required for OLRT. We have recognized here that OLRT will not reduce cost, but we know there is advantage in a complete, timely and accurate information system and we must get ready for it. ■

THE BIG HYBRID • • • • A NEW DIMENSION IN COMPUTATION -OR HEADACHES?

WHICH WILL IT BE FOR YOU?

The day of the Big Hybrid is unquestionably here. The top simulation labs in the country are investing more dollars in hybrid computers than they have ever invested in analog.

Why?

The answer is simple—because the Big Hybrid potentially offers more simulation power and efficiency than ever previously available.

But—some of the Big Hybrids are already in trouble.

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Many people fail to understand the dimensions of hybrid computation. Analog plus digital doesn't double the complexity, it squares it. You're handling a new order of magnitude of computational power.

Suppose you've contracted to apply a hybrid system to the solution of difficult engineering and scientific problems. And all you're allowed is a "low budget" system. That's when your problems can really begin.

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And who will be responsible for your software?

SOFTWARE—THE HIDDEN DIMENSION.

It's easy to overlook the dollar value of hybrid software.

You need a powerful, efficient software system for programming, debugging and control of the complex hybrid computer.

Without it you can't get the operating smoothness you need or the computational return on your invested dollar.

The Big Hybrid needs operational software that's significantly different from a pure digital computer. Languages such as FORTRAN have to be rewritten for efficient hybrid programming. Hybrid monitors, diagnostics and simulation languages have to be created.

As for the shotgun approach of mating different makes of computers—software systems are generally not transferable. Your WX hybrid isn't going anywhere on software developed for WY or WZ.

If you can't get satisfactory hybrid software from either manufacturer (analog or digital) you have no choice but to do it yourself. To fully develop an operational hybrid software system can take upwards of two years.

The stress of software development comes just at the time you need the machine most — right after installation.

The total of direct development and hidden costs for software can be astonishing. And if you're committed to fulfilling a contract during this period, your financial commitments may not end here.

All these troubles are avoidable.

WE DEVELOPED THE EAI 8900 TO TAKE THE HEADACHES OUT OF HYBRID COMPUTERS.

The EAI 8900 is not a low-priced hybrid computer. It's a high-performance, high-production, system-engineered computer supported by superior software. Before you finish reading this you'll know why it's worth every penny of your investment.

By the end of 1966 EAI will have delivered and installed seven of these large hybrid systems.

Our customers know what it means to buy from the only manufacturer who produces both analog and digital computers.

The EAI 8900 Hybrid is made up of the EAI 8800 Analog Computer, the EAI 8400 Digital Computer, and an interface of advanced design.

These units, which are large, powerful systems in their own right, were designed by us from scratch. They're not warmed-over versions of old systems. We designed them to work together.

THE VALUE OF STANDARDIZATION.

All three were standardized so that we could provide the same combination to customer after customer. That's why they could only be ultimate, no-compromise designs. That's why they could only use the most expensive components and the most advanced circuitry. Nothing else was worthwhile for the goal we had in mind—the highest degree of usability.

We price an 8900 hybrid at $750,000 to $1,500,000. Standardization makes it a bargain.

Standardization means complete system engineering. It allowed us to pour money into the design. Our investment for development could be far greater than for a non-standard "one-shot" hybrid system.

We've already worked out every stage of development from design to actual production of the finished machine. We're not selling a product which has never gone beyond the prototype stage.

The time we've spent on the 8900 is time saved for you. It means assurance of delivery, fast installation, and minimum time to bring your Big Hybrid to running condition on site. (Add at least 6 months for the "one-

shot" machine—maybe much more.)

Standardization means you get full documentation. Operating manuals, diagrams, spare parts lists. In a uniform notation. Complete. It's worth tens of thousands of dollars to you.

Standardization means more and better training programs. They assure that your operator, maintenance and user personnel are "ready to go" right after installation.

Standardization means there's just one manufacturer who answers for the entire system. You get the full range of field service from one source.

Standardization gives you direct support with exactly the same machines as in our own computation centers. (Two EAI Centers in the U.S. are equipped with 8900 systems.) You always have this alternative for overflow work or application assistance.

But above all standardization means an unsurpassed availability of hybrid software.

SOFTWARE—HYBRID'S THIRD DIMENSION

Our software is a complete operating system at time of delivery.

We not only give you a complete hybrid software system ready for immediate use, but continue with follow-on software developed by a growing list of users.

Electronic Associates will act as a clearing house for the 8900 User's Group. Every customer will be able to share in software developments as they are completed.

The integrated design of the 8900 eliminates the software problems you have with one-shot machines. (Who will supply the software? The analog manufacturer? The digital manufacturer? Or will you be forced to develop your own?)

We've already spent the million dollars necessary to develop a really good hybrid software system. Any lesser investment is inadequate. Why shouldn't you benefit from that development?

To a great extent, because of adequate software, the 8900 is not only the most productive way to go, it's the only way that will give you an effective "Big Hybrid" capability without the accompanying "big headaches."

THREE POWERFUL COMPONENTS

Do you want an advanced digital computer specifically designed for simulation and scientific computation? Buy just the 8400. It's economical to install as a powerful processing facility. Both simulation and background programs reside in core memory so you can do background jobs on the digital computer whenever the simulation programs are not in operation.

Or go the other route. Buy yourself the most advanced analog system, the 8800. And then go hybrid later with the 8400.

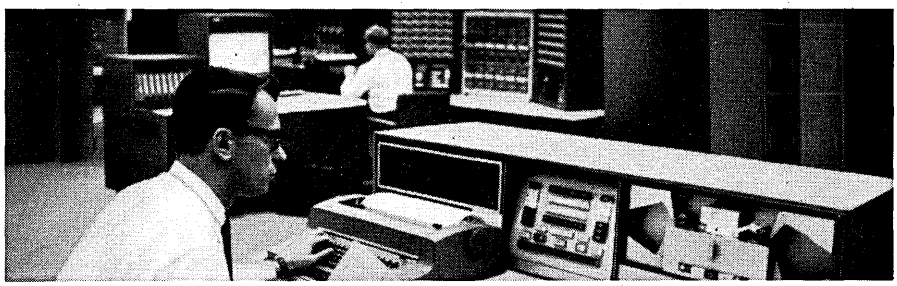
A word about the interface. It gives you an ease of control you'll get from no other machine. It's been designed to make maximum use of the computer's time and permit maximum information transfer. The interface allows an exceptional number of ordered interrupts and smooth processing of multiple programs.

We'd like to tell you more about the intimate details of design that make the 8900 the finest Big Hybrid computer you can buy. The brief table of specs that follows will have to suffice, but we hope you will write to us and ask for a detailed description.

Some of our customers have called the 8900 the Cadillac of hybrids. While we're pleased by this analogy it's really not accurate, since even a low-cost car can get you to your destination. With the wrong hybrid, you might not make it at all.

They say: "the bitter taste of low quality lasts far longer than the sweet taste of low price."

It was never truer than for the Big Hybrids.



EAI 8900 SCIENTIFIC COMPUTING SYSTEM CHARACTERISTICS

THE EAI 8800 ANALOG COMPUTER
60-integrator capacity, 125kc bandwidth, 2mc synchronous logic.

THE EAI 8900 INTERFACE
32x32 expandable to 128x128 conversion channel capacity.
65kc analog-to-digital word rate.
Single or double-buffered digital-to-analog channels.
Sample and hold multiplexed analog-to digital channels.
Expandable interrupts, function lines and status lines terminated on the logic patch panel.

THE EAI 8400 DIGITAL COMPUTER
32-bit word length plus 2 executive bits.
7.35 usec typical floating point multiply.
64K memory capacity, 7 hardware index registers.

THE EAI 8900 SOFTWARE
FORTRAN IV
Macro Assembler.
SPECTRE On Line Assembly System.
Monitor and Real Time Scheduler.
HYTRAN sm Simulation Language.
HYTRAN Operations Interpreter.
Function Generation Programs.
Numerical Integration Programs.
Analog Control and Readout Programs.

sm Service Mark of Electronic Associates, Inc.

CIRCLE 21 ON READER CARD

95 nanoseconds. That's the full cycle time of Fairchild's new μCELL™ Memory System. It uses micro-circuits throughout—including storage "cells". It's designed for scratchpad, read only, non-destructive read-out, table look-up, index register, index memory and program store applications—and for speed. Sizes from 64 words/16 bits and up.

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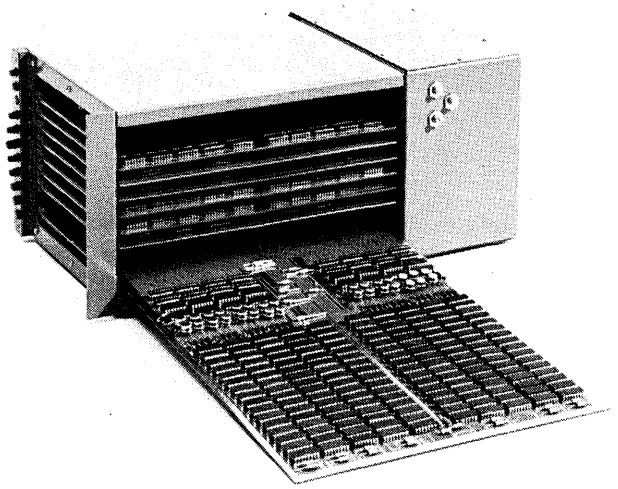


Hurry. They're going fast.

CIRCLE 22 ON READER CARD

THE VOICE RESPONSE SYSTEM

at the stock market

by JAMES W. PROCTOR JR.

Devices for the conversion of electrical impulses into meaningful human speech have been on the drawing boards for years, and now such a technique has been perfected and an operating system is in operation to provide stock quotation information from the American Stock Exchange.

Automatic voice response systems like these are in the planning stages or are in operation in other fields including retail sales, banking, air transport and communications. Information on bank account balances fed into a computer system can verify credit for persons desiring to cash checks. Bank balance and account number are fed into the system, and a phone call to the automated system produces a verbal "okay to cash" or indication of insufficient funds.

At department stores, similar systems can maintain a running record of an individual's charge account balance. By dialing the amount of the sale and the individual's account number, the store instantaneously verifies the customer's credit rating.

The Federal Aviation Agency is currently testing a voice-response system that plays back announcements on up-to-the-second changing weather conditions when the system is interrogated by an approaching airline pilot.

And the telephone companies across the continent are currently intercepting erroneous calls with voice-response systems that tell the caller why his call cannot be completed. The computer-oriented system tells the caller that the number he has dialed is not a working number, or is temporarily disconnected, or is out of order, or that trunk lines are busy—call again later. In systems like these, the computer selects the vocabulary for the particular voice response.

In certain parts of the country, telephone maintenance personnel need only connect their handsets into telephone systems to be certain that the number they have just installed is correct, or to trace the wires and their terminations in certain automatic telephone exchanges. In each case, the service technician dials a code and receives an instantaneous voice response with the information he wants.

Voice-response systems are also providing route and rate information to long distance telephone operators. The input is the operator's dialed or push-button interrogation; the output is a series of spoken digits with the information the operator seeks.

at the exchange

The system at the American Stock Exchange makes it possible for stockbrokers to dial four-digit codes on their regular office telephones and receive stock quotations in the form of an electronically-controlled human voice, without having uttered a single verbal request for the information.

The last-sale and the bid-asked ticker reports from the American Stock Exchange are automatically fed into Bunker-Ramo Corp.'s TeleCenter in New York.

Ticker tapes are automatically read and the digital information is fed into the center's Telefile computer, which immediately compares it against earlier information stored in the computer. To guard against possible discrepancies in the stored information, arbitrary yardsticks that make comparisons to detect wide fluctuations will catch any out-of-the-ballpark information. When the computer detects any apparent errors in the available information, it prints out the questionable data on a standard teletype-

Mr. Proctor is national sales manager for Cognitronics Corp., Briarcliff Manor, N.Y. He previously was with Bunker-Ramo Corp. as marketing manager for on-line dp systems for hotels. Prior to that, he was with Raytheon. He is an economics graduate of Duke University.

writer at the Exchange. There the teletypewriter is constantly monitored by a supervisor, who determines what the error was and sends out a new ticker message to re-enter the correct information.

After processing by the Telefile computer, the information is stored on a magnetic drum with each security assigned an address code for subsequent retrieval. Each address code applies to an individual security's information and that data consists of such items as the stock symbol, bid price, offer quote, last sale price and all the other information that is necessary. The information on price and trading volume is constantly changing with the result that the information retrieved from them will be accurate up to the very second they are queried.

The magnetic drum provides information for display on a cathode-ray tube, for printout or for talk-out by the voice film recording—"Am-Quote," the automated quotation service of the American Stock Exchange, built and operated by Bunker-Ramo. Separate interfaces are used to provide the information from the magnetic drums and convert them to visual displays or printouts.

The amount of space occupied by the program that drives the voice-response system is directly proportional to the number of securities that are quoted by Am-Quote. The drum memory is expandable to accommodate the number of stocks the system handles. In operation, the information stored on a number of drums is removed from the mass memory onto an active buffer, and then fed sequentially word-by-word into the audio system.

It is at this point in the explanation of the system that the conversion of electrical signals into human speech takes place as hundreds of stockbrokers who subscribe to the Am-Quote system begin to make use of this talk-out capability, through the automatic speech output.

Assume that a broker in the New York metropolitan area requires the latest quotations from the American Stock Exchange on shares being traded on Bunker-Ramo Corp., designated with the symbol BKR. From a directory he obtains the four-digit code number for the security, which in this case is 2997, and dials this on his regular office telephone through his direct line to Am-Quote.

The stockbroker's call is received at the TeleCenter through an audio processor, which addresses the drum storage that is constantly changing to reflect the latest figures. The audio processor retrieves the information, which is still in digital form, and transmits it to the Speechmaker.

The Speechmaker, developed by Cognitronics Corp., and modified for this application to meet the system's requirements, converts digital commands to human speech. The system was designed to provide a direct and flexible means of computer-to-man audio communications. The unit at the TeleCenter has a vocabulary of 63 individual message segments, spoken back singularly or in any group sequence on computer command. Vocabulary selection is by means of individual semiconductor switch closures for each of the 63 words.

motion picture sound track

The heart of the unit is a pair of 7⅞-inch-diameter photographic film audio memory drums with a total of 64 tracks—one track for each word and one for a timing pulse. Each track is like that used for a motion picture sound track. A light source and aperture provide a narrow light beam that is directed through the sound tracks on the rotating memory drum. This light beam is modulated by the pre-recorded audio on each track and in turn detected by silicon photo-sensitive cells located within the memory drum with one cell for each track. The output of the photocells is amplified and fed directly to the stockbroker's telephone line.

As the film memory drum rotates 1.6 second per revolution, the words are extracted by the photocells at the rate of 400 milliseconds per word. This approach results in a high degree of voice fidelity and quality with a minimum of maintenance over a design life-time of at least ten years.

The center employs the model 673 Speechmaker which weighs 40 pounds and measures less than 20 inches in its longest dimension. This unit was installed late in 1964, replacing a magnetic drum unit used in the Am-Quote system during its first six months of operation.

The stockbroker, who has communicated with the audio processor, has in effect interrogated the storage drums at the TeleCenter and received his answer on command from the audio processor directly from the Speechmaker. With its digital output, the audio processor selects the photocells in their proper sequence that will respond in the Speechmaker to answer the stockbroker's call.

The vocabularly includes the entire alphabet (for the stock symbols), all numbers from zero through nine, and the most frequently used fractions—⅛, ¼, ⅜, ½ and so on. Also included on the film drum are such words as up, off, open, high and low.

A typical response to this stockbroker's query on Bunker-Ramo might run as follows: "B-K-R (stock symbol), ONE-ZERO-AND-ONE-EIGHTH (10⅛)—(bid price), OFFER THREE-EIGHTHS (10⅜), LAST ONE-ZERO-AND-ONE-QUARTER, UP ONE-EIGHTH, VOLUME FIVE (500 shares), OPEN ONE-ZERO-AND-ONE-EIGHTH, HIGH ONE-ZERO-AND-THREE-EIGHTHS, LOW ONE-ZERO-AND-ONE-EIGHTH."

The Am-Quote system can do this far more quickly than ever before. The system is completely multiplexed to permit the simultaneous readout of the same or all different words to any number of lines. The voice responses can be overlapped to the full extent of the number of incoming lines. Because of this, Am-Quote can answer 1,200 telephone inquiries a minute, up to 72,000 an hour, amounting to over a half-million inquiries during the average business day.

The Speechmaker, developed over a number of years, brings new speed in providing information for investors, greater accuracy in handling important market data, and new areas for using that data.

the future

The more advanced voice-response systems of the future may give the businessman the capability of retrieving the current status of inventories and production schedules in audio form. They may permit engineering and supervisory personnel to obtain, in audio form, the current status of engineering changes in a particular project. A simple, direct interrogation for a specific part number in a missile on the production line could provide an instantaneous voice response with this information.

A telephone call to a central airline facility of the future could provide an automatic voice readout answering the caller's query on a specific arrival or departure time for a specific flight. Or, a passenger or travel agent could obtain the necessary flight information on all flights with all airlines for a specific time period with a single call to a voice response system—a sort of computerized Official Airline Guide that talks. At airports, a computerized voice response system could make all flight announcements on arrivals, departures and delays, freeing flight personnel for more rapid processing of passengers' tickets. Similar possibilities present themselves with other modes of transportation.

These and other more sophisticated applications for voice-response systems are the inevitable result of the coming revolution in business communications. ■

our man in da nang

DATA PROCESSING GOES TO WAR

by MAJOR HENRY W. TUBBS, JR.

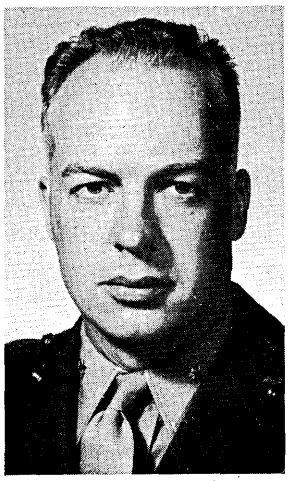
A large force was waiting on the beach at Da Nang when the first data processing platoon landed in The Republic of South Viet Nam (RVN) on 23 March 1965. Instead of the enemy, however, it was faced with a large accumulation of requirements for data processing work, and all on a priority basis. Yes, even the front-line infantry units such as the 3d Marine Division are in need of and expect their data processing facilities to be available at all times. Why such dependence in only a few short years?

The Marine Corps has had some form of data processing equipment since World War II. Along in the late '40's and early '50's its facilities were expanded so that each Base-type activity had its own machine records installation doing supply, fiscal, and personnel accounting. In 1958 this was extended to the field by forming a mobile data processing platoon based on punched-card accounting machines. One of these platoons was planned for each Marine Division, Air Wing and Force Service Regiment. In 1958 and '59 the Marine Corps turned to the computer, leasing six large-scale systems. Three of them were Univac File computers for supply inventory work, and three were NCR 304's to accomplish a service-wide personnel accounting system. Both supply and personnel departments established East and West Coast computer centers with the third computer system integrating the work of the other two at a Headquarters installation to present the "big picture" in both fields.

Gradual conversion of the Base machine records installations to IBM 1401 card systems began in 1962 with a follow-on for mobile type installations in '63 and '64. Late 1963 saw the Marine Corps exchange its File computers for Univac III's in order to keep up with its increasing worldwide supply operation. Already programmed for installation at the major supply activities in 1966 is a new third generation of computers.

So the platoon that landed across the beach at Da Nang is not just an afterthought. It is the result of careful, practical consideration and evolvement over a period of years.

Organizationally, the first platoon ashore was structured as follows: the officer in charge acts as the data processing adviser to the local commander, manages his platoon installation, does some systems analysis, and attempts to keep the people he provides services to satisfied. He has another officer as his assistant who takes over in his absence. His senior enlisted man is the installation chief who also helps manage the installation. Next in line is the operations chief who arranges the schedule and



Holder of the DPMA's Certificate in Data Processing, Major Tubbs is assistant division operations officer for the Da Nang sector, 3rd Marine Division. He was formerly officer-in-charge of the Marine Corps West Coast Computer Center at Camp Pendleton, Calif.

coordinates the old and new work to meet it. The other member of the managing element of the platoon is the machine room supervisor. The balance of the platoon consists of programmers who also double as systems analysts, keypunch personnel, and machine operators. Actually, the programmers can and do operate, as they are in most instances ex-operators. Another and very important member of the platoon is the data processing equipment repairman who performs maintenance duties and keeps the machines up.

All members of the platoon also occupy defensive positions or perform guard duty during unit defensive drills. An additional platoon arrived in August. It was similarly staffed except that it had five personnel accounting analysts who code incoming unit personnel reporting documents preparatory to keypunching and entry into the various personnel accounting programs. Neither platoon matches the normal table of organization for such an installation, largely because of the specialized nature of their individual missions.

Work scheduling between the two platoons also differs because of the type of programs and workload. The supply-oriented platoon has two 12-hour shifts broken only by maintenance periods. The platoon doing personnel work is on a one-shift basis except for the monthly report cycle, during which it works around-the-clock until finished.

the configuration

Necessarily held to a minimum, the equipment configuration includes an IBM 1401, 1402 card reader/punch, 1403 printer, 084 sorter, 557 interpreter, 088 collator, and last but by no means least, two keypunches and one verifier. The 1401 system is installed in an air-conditioned van, mounted on a 2½-ton truckbed; the unit record equipment shares another such truck/van arrangement; a third contains the keypunches; and a fourth similar vehicle stores the program decks, card stock, and paper. The platoon has a couple of dehumidifiers to use when other storage means without air-conditioning is used. Power requirements are adequately filled by one 60-kw diesel-powered generator with another on standby.

Environment and age of equipment have always played a large part in any installation's processing experience. The RVN is an area that would give an environmental engineer nightmares, and the speed-up in the aging process of all types of equipment approaches the extraordinary. Constant high temperatures and high humidity are normal for the area.

The mobile platoon concept, necessitating a maintenance capability in the field at all times, required the Marine Corps to train technical personnel for maintenance and repair of the accounting machines and later the 1401 system. The maintenance problems of the platoons in the RVN have been diminished by the fact that they are located near each other in the Force Logistic Support Group area. This is a combat service support unit from which they draw their administrative support and where the platoon performing supply work obtains most of its input.

The mission of the platoon, which was first to land, was in the main supply accounting, and remains so. However, as is common in most installations, the workload keeps growing as more manual systems are mechanized and the availability of the computer and its capabilities become known. Examples of present applications are the daily update of the five supply inventory decks (one deck for each class of supply) which also produces automatic buy requisitions, recomputation of reorder points which reflects new usage experience, and the output of advice cards to customers on the status of their orders. Other collateral programs include: list of problem-type items; special management reports for the Force Logistic Support Group such as the performance of the requisitioning system report; priority utilization report; and maintenance of a warehouse locator system. Centralized fiscal accounting is done on Okinawa, but the platoon in the RVN produces a statistical cost card as a byproduct of its supply runs which is sent to Okinawa and entered into the fiscal system there. A new program for the mechanization of medical supply items was implemented during October 1965 by the installation, after a period of on-the-spot analysis.

As noted before, the personnel data processing platoon joined the Marine force ashore in August 1965. So far its mission has been in the personnel accounting field and doing relatively unsophisticated work as compared to the supply installation. Its jurisdiction includes the personnel of both the 3rd Marine Division and the Okinawa-based 1st Marine Division.

personnel reports

The type of personnel accounting utilized in the military is unique because of the large amount of data kept on each individual throughout his entire career. Locally, the origin of this information is his unit and the individual's service record book. Certain items used by the command and which comprise the input to personnel data processing programs are also kept on punched cards at the mobile dp installation. New items will eventually end up in his master record on tape at the West Coast Computer Center at Camp Pendleton, Calif. The jobs being done by this platoon in the RVN, in most cases, reflect the needs of this particular area. Examples are: listing of personnel rotation tour data and attrition by military occupational specialty (MOS); officer assignment listing by unit; casualty reporting; mechanized combat award system (listing of awards requested and awards presented); locator listing of all Marines in RVN; and listing of unit distribution of MOS's.

Currently this platoon has excess capacity and remains capable of absorbing a workload expansion or working on special one-time programs if necessary. Its mission, to provide detailed personnel data, is and will remain a field type and will be flexible to meet the local commander's needs.

The mechanized casualty reporting system is just getting off the ground. Although tested in the past during peacetime maneuvers, this is first use of the program with "live" input. A total of seven reports from this system will go not only to the personnel planners but also back to the medical agencies for diagnostic purposes. Non-battle casualties are also included in this program which begins with a casualty reporting card at the unit level where the casualty was sustained.

To produce the foregoing reports and listings under combat conditions in the RVN, the two installations have encountered a number of problems. They are for the most part the result of the extreme climatic conditions and great distances from sources of spare parts, yet are not necessarily unique. Many are similar to those found in any installation in the U.S. but are present en masse in the RVN. A steady power source is available when the generators are working, and they have held up well. If necessary, however, both platoons could use the same generator with some care to prevent an overload. Since both platoons are situated near each other, with identical equipment, down-time on any one component causes only temporary halts in production. The work can be carried over to the neighboring platoon, and if scheduling

permits, continued to completion.

Air-conditioning seems to be causing its usual problems. Each van has adequate air-conditioning but due to the extreme heat and humidity, they must operate at peak capacity at all times with no shut-downs. Needless to say, the heavy use of the air-conditioners has taken its toll and the need for spare parts is well above normal. To overcome this problem, the pool of standby air-conditioners at the Force Logistic Support Group was doubled for each installation. The constant, heavy monsoon rains in October and November in the RVN have merely aggravated the climatic conditions, again emphasizing the importance of preventive maintenance procedures on the part of the repair technicians.

the c.e. from okinawa

The dp equipment repairmen have been equal to their task but now and then a marginal "bug" has shown up and rather than risk a long down-time period searching for the elusive cause, reinforcements have been requested from IBM representatives in Okinawa. They have cooperated to the utmost and have dispatched a customer engineer to the RVN for on-the-spot assistance. Air shipment of critical spare parts from Okinawa or the U.S. has been of great value to continued operations, since carrying a complete inventory of spare parts is not feasible in the RVN. Instances of emergency requests for parts support from the U.S. have fortunately been rare and then only for an unusual item.

Both the supply and personnel systems depend on card input. Not only are cards vulnerable to the weather but also to poor handling conditions. Kept in tub-files which are located in tents, the supply inventory decks accumulate dust, sand particles, and grime while being manually processed. Much of this foreign matter, therefore, gets into the machines during the updating and reporting cycles. Reproducing new cards can eliminate some of this problem, but card stock must also be conserved because of limited storage capacity. This situation has, as usual, called for ingenuity on the part of the machine operators to get the most out of the material at hand.

Mounting the equipment on trucks has at times caused some problems. Of course, during over-the-road movement, no operations are possible, and some leveling and machine adjustments must be accomplished before going back to work. However, in the near future it is planned to convert to expandable trailers for housing the equipment which can be hauled with a prime mover. Air-conditioning will consist of one large unit, which will reduce some of the problems in this respect also. Introduction of the trailers should at once alleviate many of the problems associated with a truck-mounted operation.

Hindsight enables one to easily draw conclusions from the foregoing description of a first-of-its-kind data processing operation. Certainly, the experience gained will be invaluable to the Marine Corps in future endeavors of this type and in correcting the problems involved in the current operation. The fact that a digital computer and its peripheral components, a very complicated set of equipment, can be placed in an operating situation unlike any known before and produce in spite of local conditions, should be a source of pride to American industry. Probably the most surprising aspect of all is that there has been no questioning of the presence or usefulness of such a system in the war zone. Indeed, there is respect for its contribution to the successful prosecution of the conflict. ■

ACM NATIONAL CONFERENCE

Under the air-conditioned austerity of Los Angeles' Ambassador Hotel, three long summer days (August 30-September 1) will host the wits and warlocks of the edp world at the 21st ACM National. Papers and panels and lunch-time loquacities overflow the daylight hours of the mid-week sessions; in the evening, there's SIGMEET (pour your own and bring $10); for the ladies, SIGWIVES (bring your own—tours to Disneyland, Marineland and movie studios).

Opening-day conferees will hear keynoter Russell W. McFall, president of Western Union Telegraph, speak on "New Partners in Progress—Communications & Computers." Following the keynote address, Dr. Alan J. Perlis, director of the computation center, Carnegie Institute of Technology, will give the first annual A.M. Turing Invitational Lecture on "The Synthesis of Algorithmic Languages."

SIGLUNCH soliloquies (two take-your-choice sessions per day) will begin on Tuesday, August 30, at 12:00 noon with Dr. H.R.J. Grosch, GE TEMPO, discussing the data base dilemma (Wilshire Ballroom, Sheraton-Wilshire Hotel). Opposite Dr. Grosch, Victor Azgapetian, North American Aviation, will speak at the Cocoanut Grove on numerical analysis. High noon on Wednesday will present Jackson Granholm, Wolf Research & Development, "The Historical Development of Programming Languages" (Wilshire Ballroom); and Ray Stanish, consultant, "Giant Nincompoops" (Cocoanut Grove). Last-day luncheons will feature Reed C. Lawlor, attorney, "Literary Property and Computer Technology" (Cocoanut Grove); and Guy Dobbs, System Development Corp., "R&D Problems in Time-Sharing" (Wilshire Ballroom).

Papers and panels in 22 sessions will review social responsibilities, numerical analysis, educational curriculum, real-time systems, time-sharing, new on-line languages, and file management.

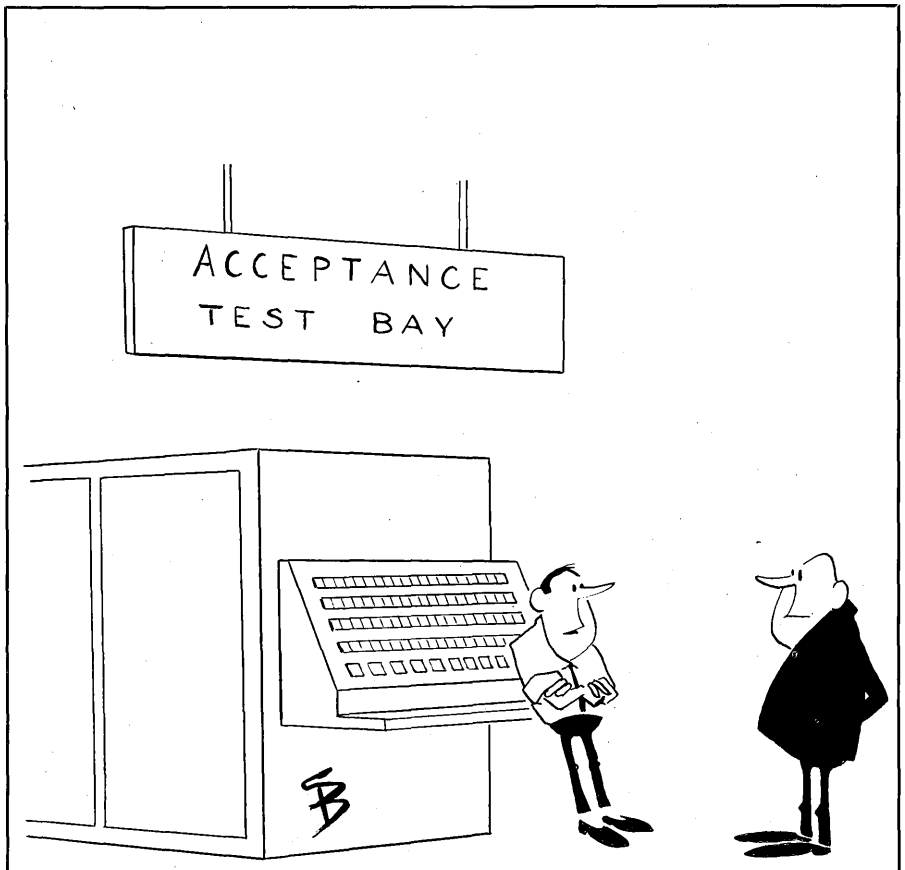
Side-showing at SYSTEMS 66, the conference exhibit, will be, among others: Computron, CalComp, Pacific Tel&Tel, AT&T, Control Data, Informatics, Applied Data Research.

Under the general chairmanship of D. F. Weinberg, TRW Systems, the conference program includes daily tours to Jet Propulsion Labs, TRW Systems, System Development Corp., IBM Data Center, California Federal Savings & Loan, and CalTech.

Tuesday, August 30
2:00-3:30

Recent Developments in Computer Science Curriculum; W. E. Atchison, Georgia Tech, chairman. Reports from the School Mathematics Study Group, the Curriculum Committee on Computer Science and the Committee on Computer Science in Electrical Engineering. Venetian Room.

Computer / Communications Systems for Business; W. F. Bauer, Informatics Inc., chairman. Panel: Robert Grisetti, Western Union; Herbert Mitchell, Bunker-Ramo; John W. Wyle, GE; L. E. Donagan, IBM. Discussion of information handling systems characterized by large-scale communication networks and large-scale data bases. Embassy Room.



"We rely on faith, hope and parity."

Numerical Analysis; Samuel D. Conte, Purdue Univ., chairman. The influence of the computer in numerical analysis, including a class of Newton-like methods for finding the roots of non-linear systems of equations. Colonial Room.

4:00-5:30

A Three-Ring Tutorial; Robert W. Rector, Informatics Inc., chairman. Review of current work in three fields: computer-assisted instruction, advances in computer hardware, and recent developments in symbol manipulation. Venetian Room.

File Management; J. A. Postley, Informatics Inc., chairman. Some approaches to producing working systems, each with its own special developments, in a variety of contexts. Embassy Room.

Computer Simulation: Organization and Forms; Martin Greenberger, MIT, chairman. Examples of current simulation work: in the space program, freeway diamond interchange, on-line simulation. Cocoanut Grove.

Wednesday, August 31
8:30-10:00

Time-Shared Scheduling; Joseph W. Smith, RAND Corp., chairman. Questions of system loading and conversational responsiveness, and theoretical scheduling structures. Embassy Room.

Business Data Processing; Solomon L. Pollack, North American Aviation Inc., chairman. Analysis of real-time systems, description of electronic point-of-sale/updating system, management controls. Venetian Room.

Undergraduate Student Papers. Chairman James R. Oliver, Univ. of Southwestern Louisiana, will present papers written by student ACM members. Prize-winning manuscript will receive $100 offered by Southeastern chapters of ACM. Cocoanut Grove.

10:30-12:00

Program Structure for the Multiprogramming Environment; Arthur M. Rosenberg, Scientific Data Systems, chairman. Various considerations in area of program structure aim at stimulating further efforts toward effective programming. Embassy Room.

The New Partnership—EDP and Management—in the 1970's; Robert G.

ACM CONFERENCE . . .

Scherer, 1st Western Bank & Trust Co., chairman. Panelists: Smith B. Davis, Southern California Edison; Robert Head, Computer Sciences Corp.; Robert Clayton, Ducommon Inc.; Harold Koontz, UCLA. Can executive management effectively utilize the new partner? Is edp moving too fast for top management? What organization changes does edp require? Venetian Room.

Engineering, Medical and Scientific Applications; G. H. Kuby, Aerospace Corp., chairman. Applications papers on speech synthesis and recognition, bio-med research environment, engineering simulator. Colonial Room.

2:00-3:30

Social Responsibilities of the Computer Professional and the Industry; Richard W. Hamming, Bell Labs, chairman. Speakers: Walter W. Finke, president, Honeywell EDP; Emmanuel G. Mesthene, executive director, Harvard Univ., Program on Technology and Society; Robert H. Ryan, president, Regional Industrial Corp. of Southwestern Pennsylvania. Examination of the charge that the industry has disregarded the adjustment of society to the new technology in the context of the report of the National Commission on Technology, Automation and Economic Progress. Embassy Room.

4:00-5:30

Symbolic Processing of Source Languages; Mark Halpern, Lockheed Missiles & Space, chairman. Advanced workers are now turning their attention to the application of quality control and management engineering to the production of programs. Cocoanut Grove.

Development in File Manipulation Techniques; M. C. Bachman, GE, chairman. Experiments in sorting, report generation, and the use of small auxiliary associative memory to assist in the processing of a large data base. Venetian Room.

Social Responsibilities of the Computer Professional and the Industry, a continuation. New panel members for this session are: Paul Armer, RAND Corp; Edmund C. Berkeley, Berkeley Enterprises; Anthony G. Oettinger, Harvard Univ.; Richard I. Tanaka, CalComp. Embassy Room.

Thursday, September 1
8:30-10:00

Invited Papers; Herbert S. Bright, Informatics Inc., Chairman. Kenneth Janda, Northwestern Univ., "Features of an Information System for Congress;" Richard G. Canning, Canning Publications Inc., "Coming Changes in System Analysis and Design;" Fred Tonge, Univ. of California Irvine, "Artificial Intelligence." Embassy Room.

10:30-12:00

Compiling Techniques; Thomas Cheatham, Computer Associates Inc., chairman. Discussion of the mechanical analysis of programs in SFD ALGOL and ALGOL-like languages for describing the functions of a synchronous system.

Custom Design of a Digital System; John C. Alrich, Compata Inc., chairman. Three real-time systems whose complexity is such that formalized design procedures are replaced by the intuition, judgment and experience of the designer. Colonial Room.

Statistics in Numerical Analysis; R. W. Hamming, Bell Labs, chairman. Probability and multinomial acceptance sampling. Venetian Room.

2:00-3:30

Programming Languages for Symbolic, Numeric and Hybrid Computation; Christopher J. Shaw, System Development Corp., chairman. Descriptions of new languages that are oriented toward on-line interaction with users who are not professional programmers. Embassy Room.

Information Retrieval; Robert M. Hayes, UCLA, chairman. Papers discuss programs for computer-based document retrieval, issues involved in total systems, techniques and theories. Colonial Room.

Applications of Computer Graphics; Joseph Behar, IBM Corp., chairman. Three speakers will describe applications and techniques followed by a panel. Panelists: J. J. Lavick, McDonnell Automation Center; T. Moffet, Lockheed; H. Freitag, IBM T. J. Watson Research Center. Venetian Room.

4:00-5:30

Future Trends in Programming; D. F. Weinberg, TRW Systems, chairman. Panel will discuss new programming languages, time-shared systems, copyright laws, availability of mass storage devices. Panelists: Victor Azgapetian, North American Aviation; Jackson Granholm, Wolf Research; H.R.J. Grosch, GE TEMPO; Guy Dobbs, System Development Corp.; Reed Lawlor, attorney. Embassy Room. ■

IMMEDIATE ACCESS AND THE USER

checklist for language designers

by DR. MURRAY TUROFF

The computer community today is in greater danger than at any time in its short but distinguished existence. It is hard to believe that so few individuals are aware of the existence of an element in our community, a dangerous element, which would bring the non-programmers back to the computer. After years of effort to interpose the programming and systems people between the user and the computer, the foundations of our system are being undermined. Time-sharing, or immediate access, is not the villain; those who would misuse it are. Fortunately, it is encouraging to note that we have good examples of immediate access systems that can only be effectively utilized by experienced programmers. We may give thanks that the danger is still in its infancy and the systems that currently exist are a negligible threat. The real danger lies in many of the subversive ideas fostered by these seemingly innocent systems being incorporated into one package.

In an exhaustive investigation of this area, many items exhibiting subversive characteristics have come to light. The clarity and simplicity of the JOSS language, for example, is quite disturbing. The proponents of this system should be drummed out of the community. The on-line self-teaching routines of TINT are a horror to any self-respecting member of our group. The fact that this language has been used by school children only gives further evidence of its subversive character. The on-line updating bulletins of the Dartmouth BASIC system are a direct blow at our guiding rule of late, complex and confusing documentation. It is a relief, however, that the above systems restrict themselves to computational problems. Our counterattack here should be to see to it that FORTRAN be implemented as the only on-line computational language. Its original development as a batch operational language, its current inertia as the most widely used computational language, its demanding grammar structure and inflexibility, give us hope that it will serve as a useful vehicle for keeping the non-programmer away from the on-line console.

It is not the computational systems alone that threaten our existence; it is the possibility that someone will merge these with such things as the data association features of SIMSCRIPT or the logical representation and manipulation features inherent in the GPSS world view. Such a merger might result in a language which would allow non-community members to tackle sophisticated problems. Even MAC, who has occasionally brought joy to our hearts, has some abominably simple editing features that even secretaries are capable of using. The recent emergence of OPS at MAC gives rise to the fear that this project faces complete subversion by undesirable elements. The data massaging techniques exhibited by ODAPS at SDC point out that even a non-academic institution can be subverted. One of the worst culprits is the STL system where many complex physical problems are easily treated by the non-programmer with the aid of visual display. We have come to realize over the years the importance of reserving such problems for special machine language codes requiring years of programming effort.

The tremendous danger that faces the structure of our

Dr. Turoff is a member of the research staff at the Institute for Defense Analyses, Arlington, Va. He has also been associated with the MIT Computation Center as a research assistant and with IBM as a systems engineer and scientific programmer. He holds a BA in physics and math from the Univ. of California and a PhD in physics from Brandeis Univ.

* The opinions expressed in this article are the responsibilty of the author and do not necessarily reflect the views of the Institute for Defense Analyses.

community is therefore apparent. In order to counteract this subversive element we have gone to great lengths to establish an extensive set of guidelines. Any individual called upon to work on the development of an on-line system for the non-programmer should keep in mind and act on as many of the following pointers as possible.

The possibility of a specific, problem-oriented language should be investigated. For example, if a group of microbiologists want to do statistical analysis, the grammar and terminology of the language should be such that no one but a microbiologist can use it. This approach is especially fruitful when the subfield of the technology is a developing one; this insures years of revision for the system. There is, however, some danger in using this approach in a well developed field as evidenced by the success of STRESS at Project MAC.

Look for a language developed in a batch environment. The older the language and the smaller the machine for which it was originally developed, the more likely that it will be extremely rigid—a sought-after characteristic.

Make sure the on-line user has no way of telling how much effort the time-sharing system or computer is expending on his problem. He should have no idea if it is sitting in a queue or tied up in an endless loop.

Through careful construction of the executive overhead and scheduling features one can reduce the response of the system to the level of a hand calculator. In addition, one can localize all the on-line consoles in a single room, preferably containing card punches and printers. Lack of response, noise, and lack of privacy are three features which will surely drive away the competent, established researcher who must think out his approach at the console and who may be shy at exhibiting to his colleagues some awkwardness with the system. However, in order to avoid problems with regular members of the community, complex loop-holes in the system, through which the sophisticated programmer can circumvent the scheduling routines, are a desirable feature.

Constant revision and confusing documentation are traditional mainstays that should be fully exploited.

Make sure the language has a good many long words (i.e., DIMENSION, SUBROUTINE) which must be spelled out completely. Commas should be used frequently and require exact placement without any semblance to the structure of English. Words like CALL must always be repeated even when not logically required (i.e., CALL A, CALL B, CALL C, instead of CALL A, B, C). Avoid using both upper and lower case letters and any simplified English-like structures. If, however, you are required to take an English-type approach, fall back on the lengthy English structure as typified in the COBOL system.

The FORMAT features of FORTRAN are rather clumsy on the typewriter and therefore quite desirable; avoid such intuitive features as those found in JOSS.

At all costs avoid those system characteristics which are necessary to a user-oriented system.

desirable features

There are a minimum of seven such features that have been found necessary to create a versatile system for the non-programmer. These are as follow:

Education. The ability of the user to extend his knowledge of system at the on-line console without interfering with whatever work he may have in progress.

Communication. The means of establishing the user mode and interaction for his work by providing a clear record of who is talking and doing what, whether it be the system, his program, or himself.

Editing. The ability to modify the program or any segment of it without interference to corrected and operating portions.

Logical Composition. The means of providing a logical framework to the segments of the program which are not restricted to internal logic of the system but which can reflect the logic the user feels his problem possesses.

Computation Ability. A numeric ability which does not contain any illogical restrictions such as no mixed mode statements.

Data Manipulation. The ability to manipulate data (numeric or symbolic) in various formats or pieces with respect to internal representation or input and output devices. Flexibility so that the user can extend his control down to the bit level if desired.

Data Association. The ability to associate data by common elements. The establishment of sets, classes, groups, and the ordering of data by list processing techniques.

If you cannot avoid some of the above, try to insure that they exist as disjointed entities. The necessity of a change of grammar, variables, or even compilers in moving from one of these features to the other is an extremely rewarding situation. If you are forced into the opposite approach where many of these features have to exist in a common base, then a construction of grammar and syntax, where the user must understand the whole complex system before he can do a simple problem, is also quite desirable.

Avoid an interpretive mode of operation or any other technique which would tend to eliminate any sharp distinction between debugging a program and solving the physical problem the user is concerned with. The user must be kept painfully aware of such items as compilation and debugging. The lines between writing, debugging, and execution of the program should be kept clear and distinct.

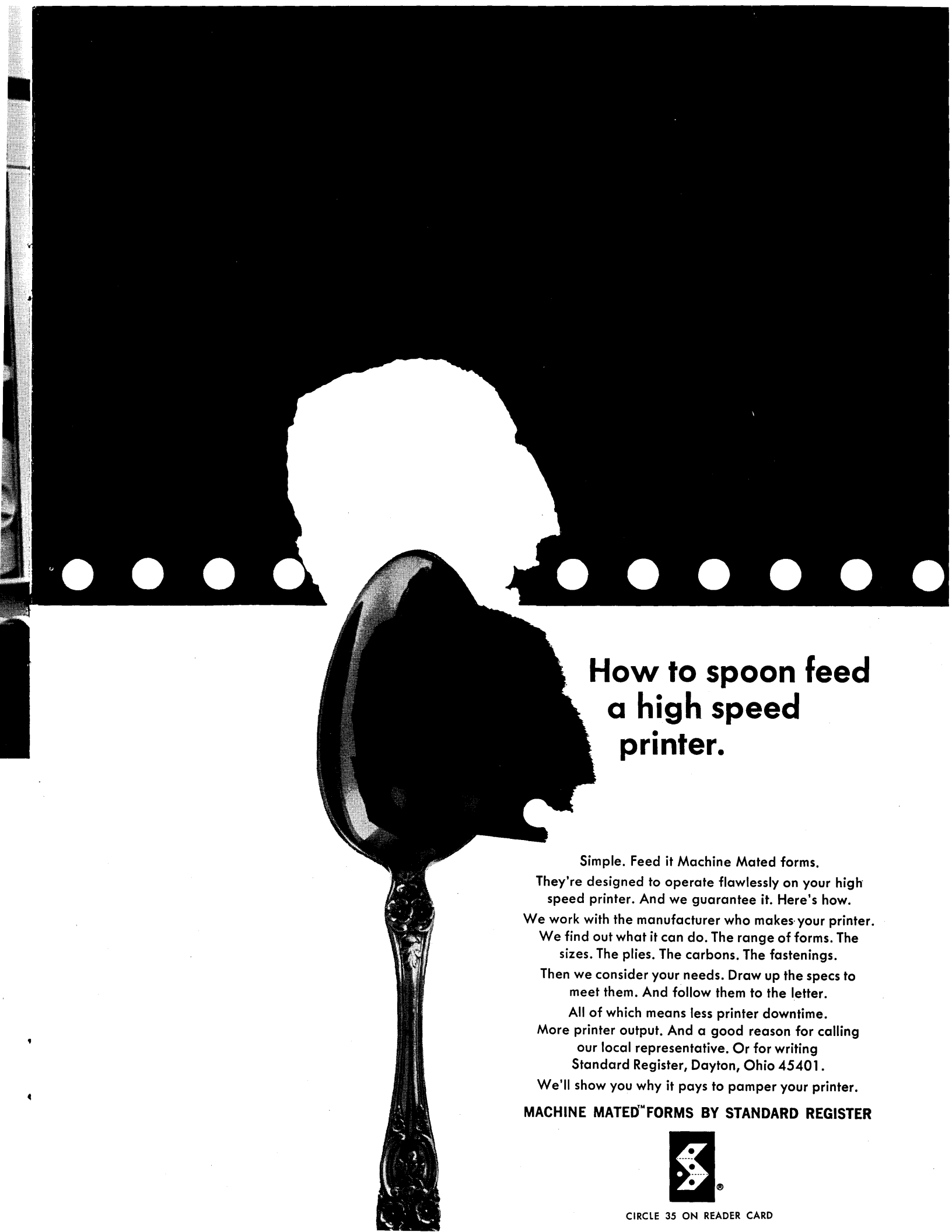
Take care to retain the sequential nature of the computer in your system. The fact that time-sharing allows the user to tackle segments of the problem in parallel should be neglected as far as possible.

the golden rule

If there are any individuals in a group who would incorporate some of the ideas found in other systems, it should be tactfully pointed out to them that recognition is synonymous with originality and that they would only be accused of plagiarism if their system is not different from all other systems.

The list of possibilities is endless. If only the following golden rule is kept in mind: The user must conform to the system and not the system to the user. Then a host of items (such as extra operations at the keyboard to distinguish lines of input) come to light in the development of the system. It is fortunate that many of these annoyances have slight justification on either an economic or systems basis and that only a small subset is needed to thoroughly annoy and confuse the non-programmer who does not have the years of experience in a batch environment necessary to accustom and harden him to such things.

Fortunately, to date, the only successes that have been demonstrated for the non-programmers are either in highly user-oriented or computational type systems. Our most important observation of this subversion taking place under the very noses of our community is that the bits and pieces of an on-line system which would allow the non-programmer to tackle sophisticated problems exists only in scattered form. While it is still possible, we must do our best to stamp out these ideas and exorcise their proponents from the community before a serious danger is created. ■



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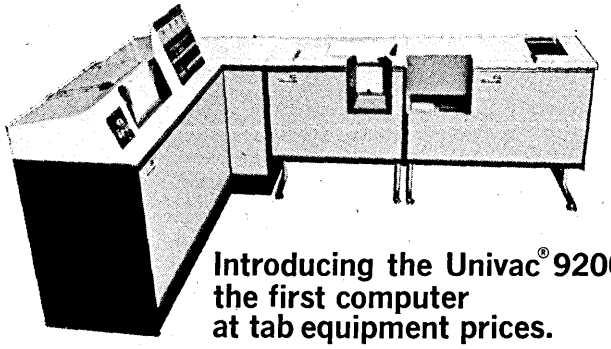

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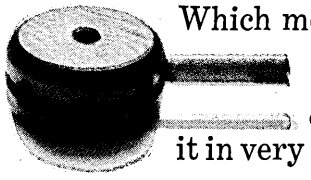
You can rent the 9200 for about $1000 a month. Or own it for less than $45,000. Tab equipment prices.

But the 9200 gets you out of the tab equipment class.

In fact, it can produce things like management reports, payrolls, invoices, inventory records, and scientific computations *eight to ten times faster* than the tab equipment you may be using right now.

The 9200 is a true computer. With a large, high-speed internal plated-wire memory. And the latest in micro-circuitry. And a complete software library.

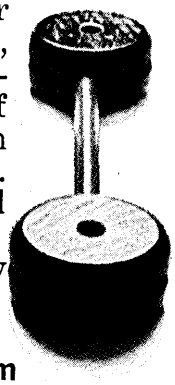
What's more, it can be converted into a 9300 high-speed tape system. Right in your office.



Which means you won't have to replace it when your business grows. You can just keep adding to it in very low-cost modular steps.

Or some peripheral steps.

One of which might be the UNIVAC 1001 Card Controller, which rents for $475 a month. Add it to the 9200, and you've got a high-speed, multi-file system that will do the work of *six punched-card machines:* An accounting machine. Calculator. Collator. Sorter. Reproducer. And a summary punch.

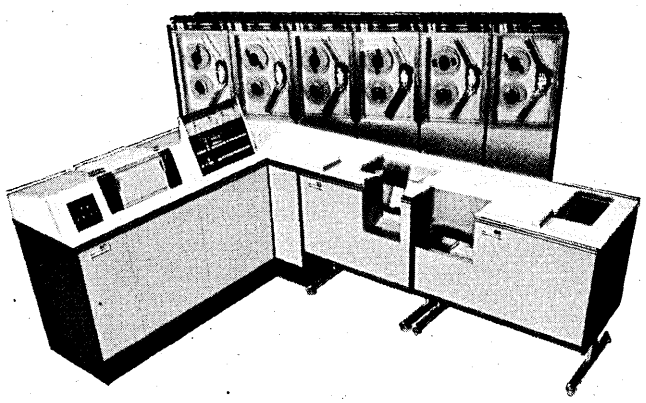


If you need more capability than that, read on.

Introducing the Univac 9300: the first high-speed tape system the small computer user can afford.

The 9300 brings you from punched-card data processing to a magnetic tape computer in one small inexpensive step.

It can read, write, and compute at the same time.

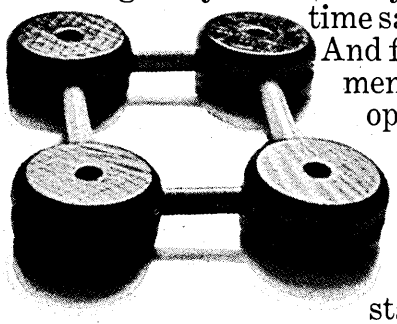


Univac announces computers.

on it as your computer needs grow.

It can run one or two peripheral tape programs and the main program at the same time.

It gives you reliability, efficiency, and a time saving of up to 50%. And far faster management control. Plus the opportunity to grow smoothly, without disturbing your business in the process. The 9300 is powerful. It starts with two tape drives, and can be expanded to sixteen.



Its effective tape read or write speed is 34,160 characters per second. This can be doubled by adding another control unit.

But the 9300 does more. It brings you complete UNIVAC software support: Tape assembler. Sort/merge. Report Program Generator. Fortran IV. Cobol. Control Stream Operations for unscheduled batch processing. Et cetera.

In other words, the opportunity to benefit from every major advance since UNIVAC invented the first electronic computer in 1946.

And, the 9300 is just a small step away from the next higher model in the series.

And, introducing some things to come.

The UNIVAC 9200 and 9300 are here right now.

But you might also like to know about some things we're working on for delivery in the very near future.

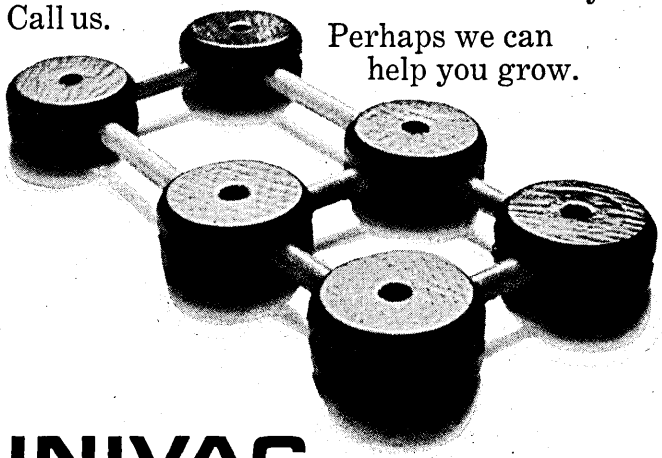
Like our UNIVAC 9500, which will combine real-time with batch processing and scientific capabilities never before available in a medium-scale computer. The 9500 will be able to serve even a large organization's entire data processing needs. Watch for it.

And watch for the other computers in our 9000 series. They will be as advanced in their class as the 9200, 9300, and 9500 are in theirs.

One thing more before you go.

UNIVAC has been the technological leader in the electronic computer business since we started it. We believe the computers in the 9000 series will help to demonstrate this fact. We'd like to discuss them with you. Call us.

Perhaps we can help you grow.



UNIVAC

DIVISION OF SPERRY RAND CORPORATION

CIRCLE 29 ON READER CARD

canadian
graphics conference

COMPUTERS IN DESIGN AND COMMUNICATION

Are you becoming aware of the latest sleeper in our industry: computer graphics? Would you like to have seen computer-produced movies by most of the organizations actively exploring this area? Would you include MIT, Bell Telephone Laboratories, Lawrence Radiation Laboratories, Boeing, General Motors, Ford? Would you believe Marvin L. Minsky? Would you believe all this in Canada?

University of Waterloo's annual Design and Planning Conference was devoted entirely to the uses of computers in design, with a large proportion of the "invisible college" of computer graphics in attendance. Three days in residence at the delightful Student Village on a rapidly-developing and architecturally-interesting campus brought the experts together with some 100 interested practicing architects, industrial designers and others.

Steven A. Coons, director of the Computer-Aided Design Project at MIT[1] started out with the historical background, showing early films from the pioneer system, Sketchpad, developed in 1963 by Ivan Sutherland.[2] The graphical man-machine communication this type of system offers (by means of a display tube with light-pen or voltage-pencil) provides the designer with a magic pencil on magic paper, the computer providing the magic by its storing and manipulating capabilities. A. Michael Noll of Bell Labs extended three-dimensional stereographic projection techniques to project the movement of a four-dimensional hypercube. Not only does the result consist of fascinating shapes, but it allows us to visualize mathematical concepts. A movie displaying the movements of the basilar membrane in the inner ear demonstrated the power of graphical presentation of physical theories, replacing hundreds of tables. An example of computer art followed: three-dimensional kinetic sculpture, composed of wire-like lines that changed their length and position randomly, now slowly, now rapidly. Mr. Noll has done more active exploration in this area of computerized visual art than anyone else I know of. He also showed a computerized ballet sequence with stick figures, a technique which may help the problems of choreography, which lacks a notation system.

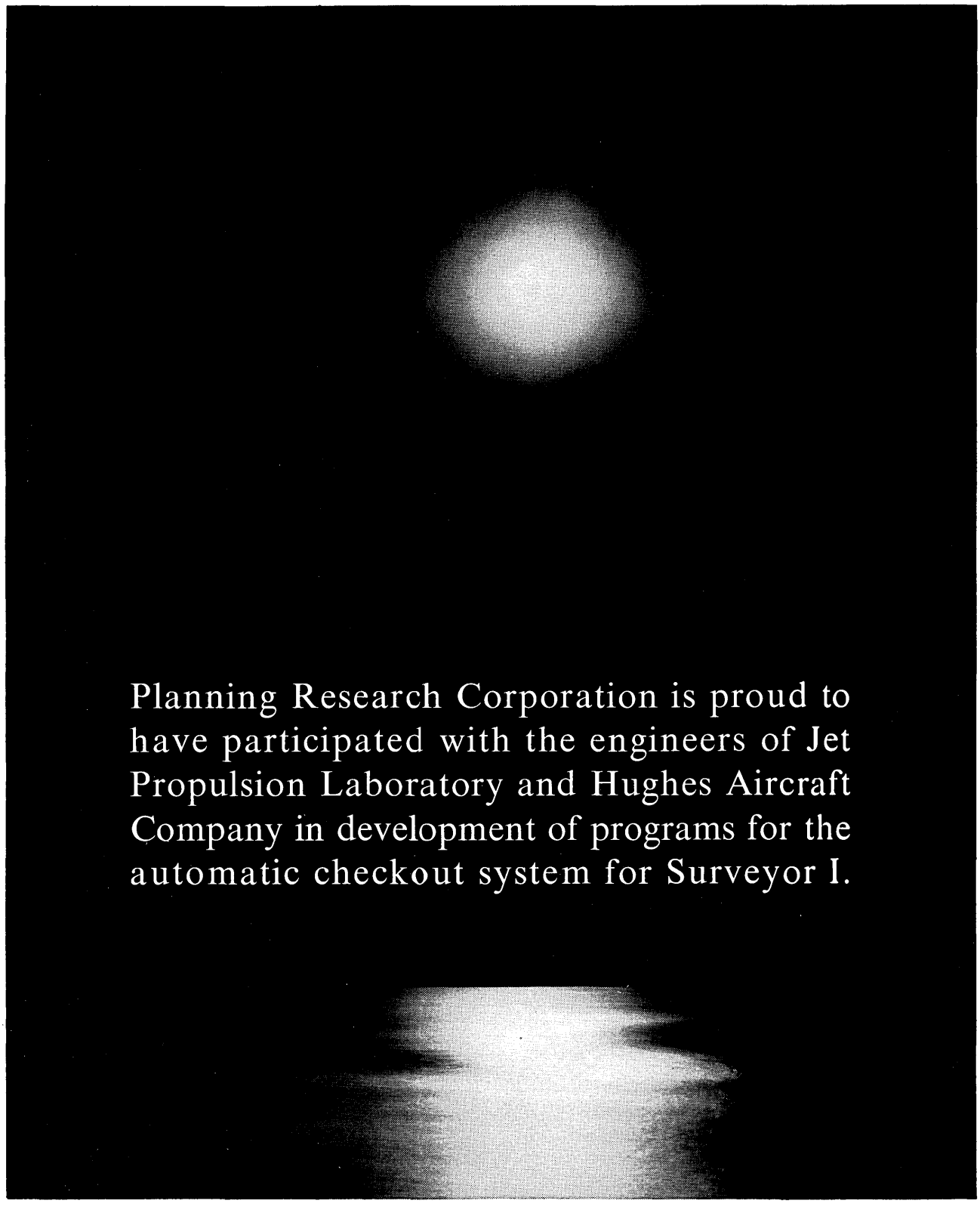
Barrett Hargreaves related some of the experiences of General Motors with the DAC I (Design Aided by Computers) systems. The major problem that requires solution is the structuring of graphic data for computer manipulation. Imposing a new language on the designer—a form of descriptive geometry in their case—does not work out too well. Bertram Herzog of the Univ. of Michigan, previously with Ford, thought that the computer will help the designer in the "bookkeeping of ideas" and in overcoming "piecewise design." It is not clear to this reviewer just how far automobile manufacturers have actually gone in design automation.

George Michael and Robert Cralle showed us a number of fascinating computer-produced color displays of scientific problems—such as hydrodynamic flow past an obstruction, the behaviour of a square balloon and three-dimensional molecular models. Some of their comments are worth recording here: The design process is not really so unstructured and diverse, it just seems so. A unifying language of design and visual expression is needed. Parachute folders should be made to jump with their own product—and so should computer specialists. Time-sharing technology is not yet adequate enough to service graphics. Their movie making language, about to be published, was used to produce a film with various artistic effects, mainly color line drawings of the mathematical type.

William A. Fetters,[3] supervisor of computer graphics at Boeing, demonstrated computer simulations of the pilot's view on landing. You feel you are right in the plane, an excellent training device. The simulation of flutter—with the movement of the parts considerably exaggerated—made many of us worried about flying. Frank Sinden of Bell Labs suggested that a mathematical formula such as a difference equation is nothing but a precise instruction for a motion picture. His "Force, Mass and Motion" not only makes you see Newton's laws of motion, but even shows what would happen if the laws were different. These techniques are bound to revolutionize educational movies, at least for the sciences, and they are beginning to be cheaper than conventional animation methods. Sinden uses line drawings, Knowlton a mosaic method, Coons surfaces, while Carol Bosche—also at Bell Labs—uses dots. She programmed the computer to "paint" surfaces with random dots of varying densities. Introducing a repetitive element, she obtained numerous lacework-like works of "art," and by the use of symmetry the effect is that of oriental rugs. The final member of the Bell team, Kenneth Knowlton,[4] designed the BEFLIX language, which uses a 200 x 250 mosaic over which "bugs" can crawl and change the shading, using eight levels of gray from white to black. It has commands like: DRAW LINE, PAINT, ZOOM. He prepared a movie using this to demonstrate a list processing language (Bell Telephone Laboratory Low Level Linked List Language). The movie shows the way a sample program is built up, and then what actually happens during the execution of the program. Little bugs, crawling along, (I kid you not) pushing and pulling boxes into which the words of the text being processed are stored, add an element of humour. I have never seen a more vivid explanation of a program.

Maurice Constant—who organized the conference together with Martin Krampen, both of Waterloo Univ.—outlined some of the requirements of the graphic artist: lines of varying thickness, gradation of shading, varied brightness, economical color, for example. He showed some of the brilliant animation films of the Canadian

1. *Datamation*, May, 1966. p 28.
2. *Datamation*, May, 1966, p 22.
3. "Computer Graphics in Communication," McGraw-Hill Engineering Graphics Monograph, 1965
4. Computer Technique for Producing Animated Movies, 1964 Spring Joint Computer Conference.



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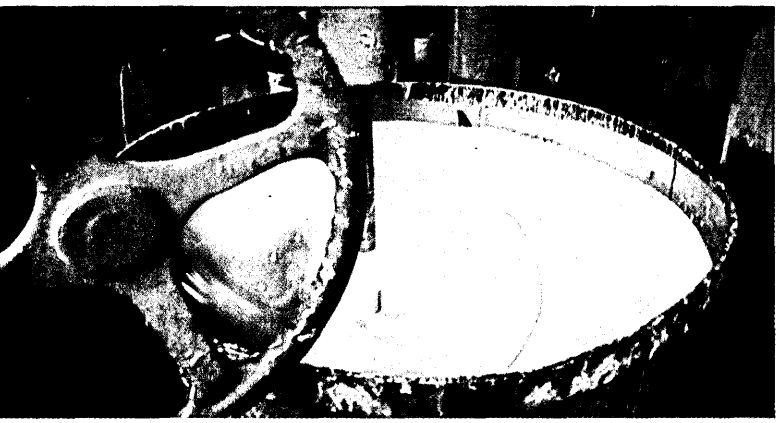
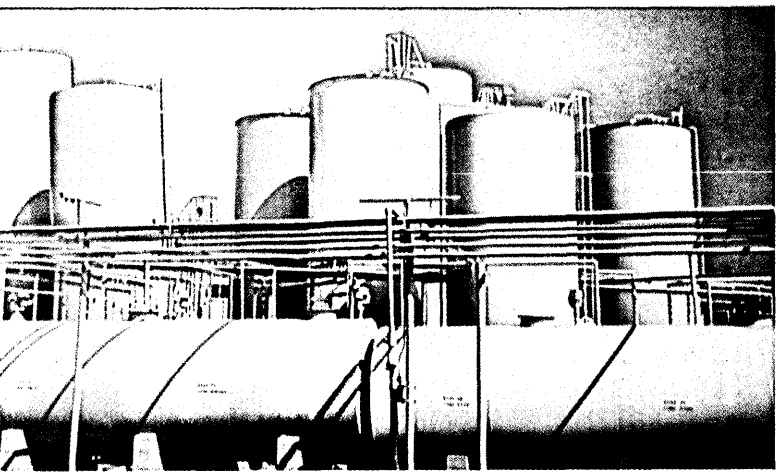
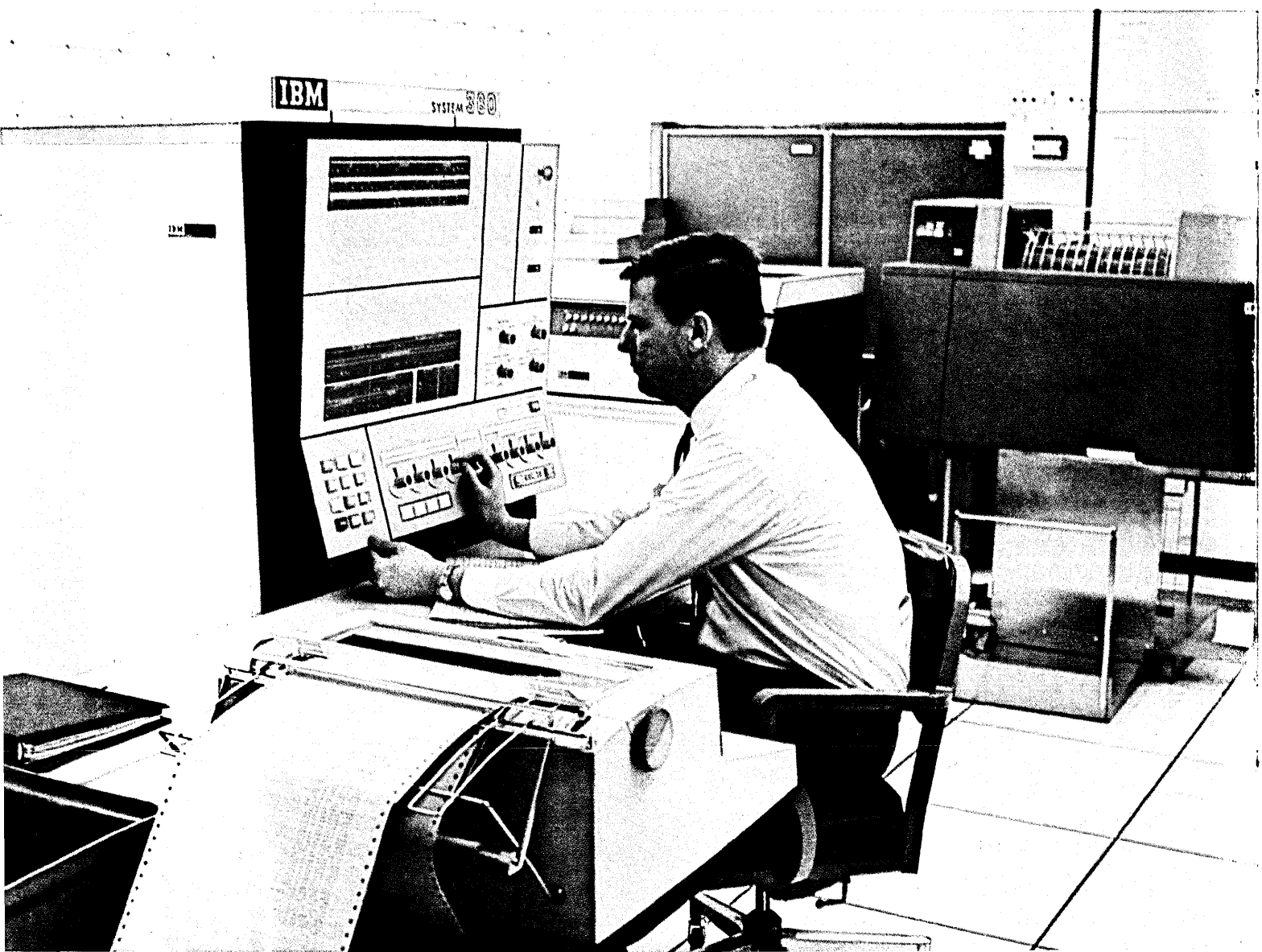
FOR IBM CIRCLE 33 ON READER CARD →






IBM
SYSTEM 360

SYSTEM/360 stirs things up at Pittsburgh Plate Glass...

SYSTEM/360 takes over as soon as an order comes in. Starts processing. And, in just seconds, information from direct-access disk files integrates all phases of production.

The IBM SYSTEM/360 at Pittsburgh Plate Glass schedules production. Determines priorities. Then, goes on to produce shipping tickets and bills. Automatically.

Operations weren't always that precise. Before this Model 30 SYSTEM/360, paint making could vary slightly from the laboratory, to production, to cost accounting. Now, production never deviates, and neither does the cost. So, the price is right. And the chemist, the cost accountant, and production people all agree.

Paint and people in harmony is just what Frank Hoffmann, Factory Manager, wants. Harmony that shows up in the end product and price—consistent quality at constant cost. Sales show it along the entire West Coast. That's the distribution market for this Torrance, California, Coatings and Resins Division.

Pittsburgh Plate Glass converted from a manual system to SYSTEM/360. SYSTEM/360 Basic Operating System (BOS/360), and Disk Operating System (DOS/360), did the job according to plan. Key managers and programmers spent a few weeks at an IBM Customer Education Center. Came back ready to put their SYSTEM/360 on the air.

And they did, right on schedule, with more help from IBM Systems Engineers.

So, when you hear or see BOS/360 and DOS/360, you'll know what they mean. That's IBM lingo for planned programming action.

That's why SYSTEM/360 works so well for so many other companies in all kinds of industries.

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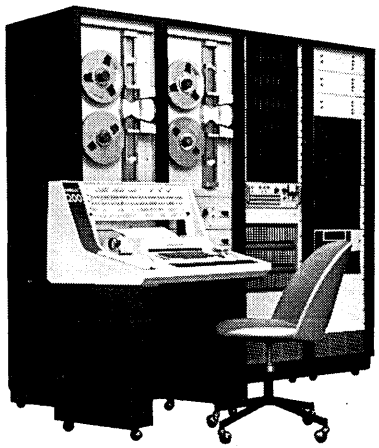
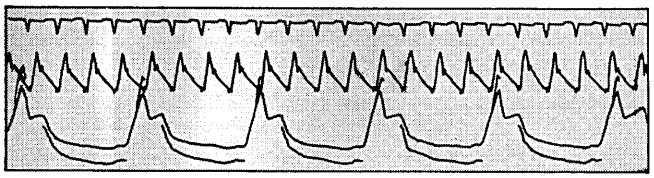
and colors never looked so good.

AMBILOG 200 the only computer designed especially for signal processing



Using the best of both analog and digital techniques, the AMBILOG™ 200 Stored Program Signal Processor is designed from the ground up to handle the "floods of data" generated in test and research programs. Although such programs cover many fields — biomedical monitoring, geophysical research, test stand instrumentation, automatic weapons checkout, speech analysis — all require complex *signal processing:* multiple input acquisition and output distribution, monitoring, editing, arithmetic, analysis, recording and display. Because of its high processing speed and extensive input/output for both analog *and* digital data, AMBILOG 200 is ideally suited for such tasks. Here are some examples.



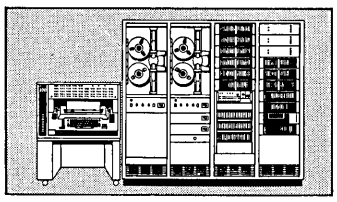
Real Time Waveform Measurement

Peak values, axis crossings, ratios of successive differences, and other characteristics of analog signals are measured in real time. Incoming signals are monitored for events of interest, using complex programmed detection criteria. In a typical biomedical application, the result is a 100-to-1 reduction in the bulk of magnetic tape output records.

$$A(n,w)=\int_0^T W(t)F(n,t)\cos(wt)dt$$
$$B(n,w)=\int_0^T W(t)F(n,t)\sin(wt)dt$$

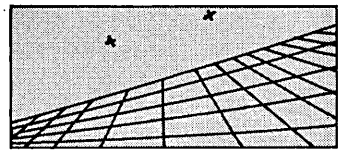
Spectrum Analysis

Parallel hybrid multiplication and summing, 2 microsecond 30-bit digital storage, and a flexible instruction format providing efficient list processing combine to make the AMBILOG 200 powerful in statistical signal analysis techniques such as Fourier transformation, auto and cross correlation, power spectrum density analysis, and generation of histograms of amplitude spectra.



Digitizing and Recording

Multiple inputs, from up to several hundred sources, are routed through a multiplexer switch array under stored program control. At no penalty in sampling rates over conventional systems, the AMBILOG 200 converts incoming data to engineering units for recording or monitoring. An analog-to-digital converter performs a complete 15-bit conversion in 4 microseconds for digital storage, recording or outputing.



Display Generation

Multiple analog outputs facilitate close man-machine relationships in systems involving visual displays. Points of an image stored in memory are rotated through three space angles and projected on a CRT at a 50 Kc rate. Co-ordinate transformation is accomplished simultaneously with digital-to-analog conversion.

For technical reports describing in detail these and similar AMBILOG 200 applications, write I. R. Schwartz, Vice President.

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CIRCLE 34 ON READER CARD

National Film Board's Norman McLaren to illustrate this. He felt that anything which reduces the large production team now interposed between the artist and the final edited film would be welcome.

Other presentations deal with a model of the problem-solving process; the need for using more up-to-date psychology in man-machine interaction studies; computer-aided design of a house, where you can simulate walking through it before it is built; typography; computers and the practicing designer. Marvin L. Minsky, of MIT, described some recent artificial intelligence programs and declared that once we provide computer programs with sufficiently good learning techniques these will improve to the point where they will become more intelligent than humans. Frightening? True? Only time will tell.

A symposium including all of the speakers proved, among other things, that you cannot have a panel of 14 people. The discussion centered about the question of the amount of detailed knowledge and programming facility required by the designer to use the computer. Both sides were amply defended. Your reviewer can only remember his own point of view: that what is most important is not programming knowledge but an understanding of what the equipment can do and what it cannot, as well as the type of complete unambigous definition necessary for the problem, the data and the method of solution—in short, the "algorithmic" approach to problem solving.

The meeting summarized the state of the art of a frontier area of the computer field in a superb manner, making the participants feel that "tomorrow is already here."

—L. Mezei
Univ. of Toronto

THE NAME GAME

some computer history—randomly accessed

by BILL WILLIAMS

One rainy Sunday, a woodcutter named Uni, who was on his vacation in upstate New York, and who could think of nothing better to do, built a machine out of string, burnt matches and bits of colored glass. He named it "Univac" and finished his vacation playing tic-tac-toe with it. Less imaginative programmers have since used it mainly to calculate the operating losses of data processing centers.

The Maniac computer was not designed by a convention of schizophrenics as is commonly believed, but was created in a hostel for unemployed actors. It has been estimated that as many as 500 thespians contributed time and materials to its construction. Many, many actors were involved. Red suspenders, a pair of baggy pants, a collar from a deceased trained seal, several well-worn G-strings, 12 turtle doves and a dog-eared copy of "Love's Labour's Lost" are among the typical things used to construct the Maniac, making it a very sophisticated machine, compared to the first crude Univac.

All of this probably explains why a Maniac, used to report the results of lengthy mathematical calculations, ends each report with lines like, "Exit, with flourishes and trumpets."

New computers usually have numbers for names. Some of the numbers are confusing and hard to remember. Perhaps an imaginative manufacturer will come up with a series of numbered machines having mnemonic associations. The 1492 would have an attractive ocean-blue colored cover. The compact, high-mean-time-to-failure machine used by the nation's fighting forces would be called the 54-40.

A large scale 1776 would have to have a satellite called the 1812.

A lot of research goes into the selection of the proper number for a newly born machine. The number must have consumer appeal and contain no more than four digits. If a letter of the alphabet is used as an affix, this is a quick clue that the computer was built by a small company that can't afford the research staff required to come up with an euphonious set of numerals and has taken the easy way out.

The people who raise horses quite often use a combination of the names of the dam and sire for the name of the progeny. This approach might be used by computer makers.

To illustrate this idea, if the Eastwest Distillery, Inc. (who acquired a small computer manufacturer in a complicated merger with Northsouth Breweries) decided to combine their R14, a process control machine, with their 26S, a small computer designed for business applications, the product of the wedding could be named the R364S.

This might work fine, until the marrying of two machines like the 7761 and the 1216 took place. About the only place the 9437376 could be used would be in a large prison, for rehabilitation of the inmates. They'd be accustomed to numbers of that size.

It might be helpful to computer purchasers if the manufacturers would be as honest as the military, who prefix the number-name of aircraft with an "X" if the ding-bat is still experimental. Probably a lot of systems men would still have their old jobs if the machine they recommended had been labeled this way.

The history of some of the computer manfacturers is a lot like the biographies of film stars that their press agents dream up. The story that IBM was founded by Thomas J. Watson and grew from an organization making scales and time clocks is a tissue of lies. T. J. Watson, in the first place, is not one man. He is 32,000 identical men in black suits, wearing sincere ties and carrying gray briefcases. These men stole the company from a little old lady.

The little old lady was really a Welshman from New England, in disguise. Before he, or she, left the Old Country, she, or he, had invented a process involving weaving cloth on a loom controlled by holes in cards that had been stepped on by him, or her, while wearing golf shoes. Just incidentally, he, or she, or they, had to invent the game of golf just to get some way to punch the holes in the cards—and so set the foundation for a bad joke that made the rounds a century later.

They were going steady by the time they tired of the weavers' life and moved to New England to invent the automatic, water powered, flour mill.

The mill flourished, until the drought set in and the source of power disappeared. The mill fell into Disuse, which is a tributary of the Suwanee (later moved to Florida by a drunken geographer). The Weaver-Millers were destitute, having nothing left but a suitcase full of cards with golf-spike holes in them.

Ingenuity wins out, however. They promptly invented a machine to count the holes in the cards and sold it to the U. S. Census Bureau, which was about to make the 1890 head count. Since no one had invented a machine to punch holes in cards, the Welsh couple sold the Bureau their collection of cards at a nice profit, so the machine would be kept busy.

The census reports got out in record time and showed that 90% of the population was female and under 30.

And this is why we call them the gay '90s. ■

Mr. Williams is manager of systems and accounting for the Oklahoma Publishing Company and previously taught machine accounting at the Univ. of Oklahoma. He developed the computer-based typesetting system at Oklahoma Publishing.

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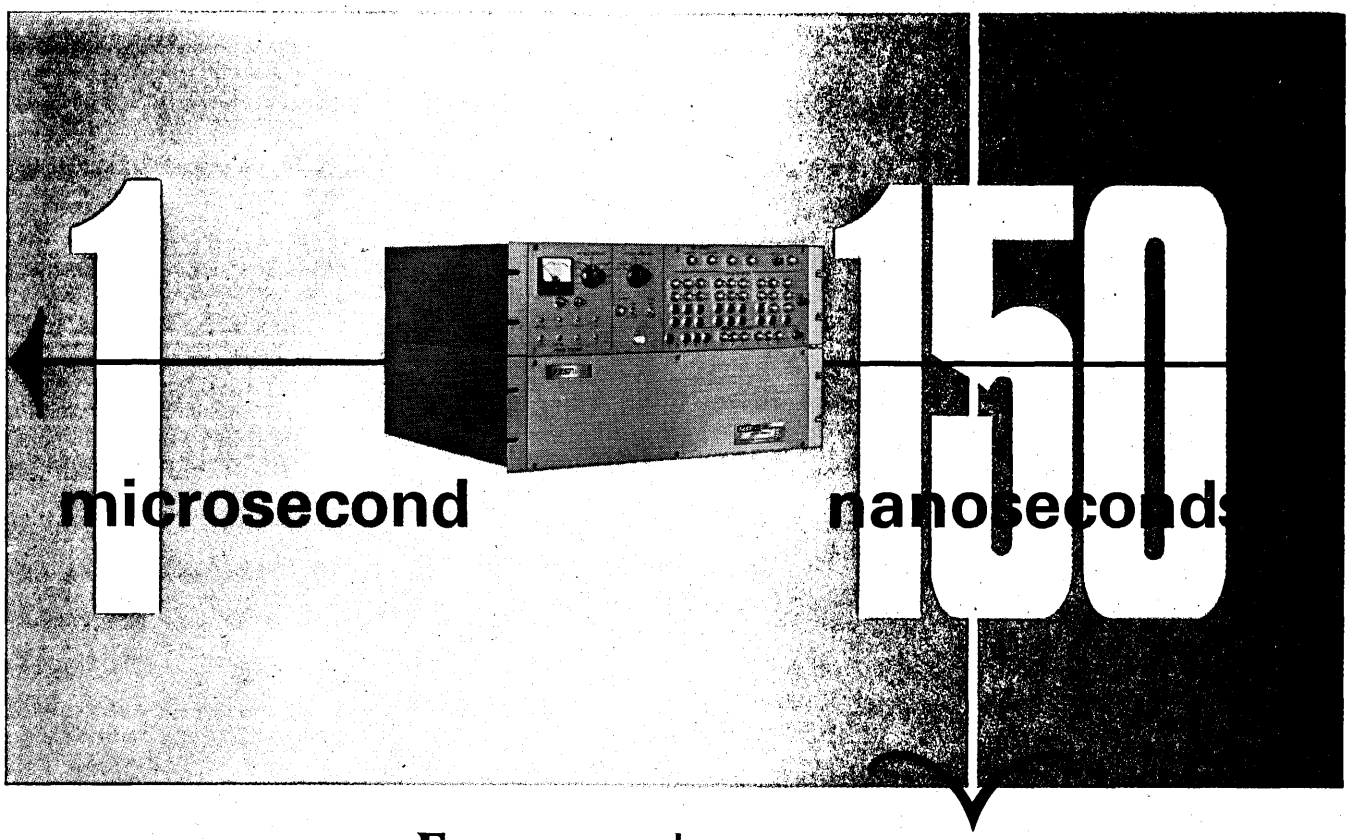


For your *FAST* Line memory requirements in the 250-500 nsec range

At the 300-nanosecond band in the FAST Line spectrum you'll find the new FAST Line 300 magnetic film memories. Designed to the FAST Line concept, this series of film memories lets you specify the exact cycle time and capacity you need in the 250 to 500 nsec speed range. All-silicon discrete components. Integrated circuits in the logic, decoding and timing sections for optimum reliability. "Big board" packaging and standard manufacturing techniques for low per-bit price.

Remember, FAST Line means value-engineered memories with a speed-cost evaluation which always results in the lowest ultimate cost to you. Check out FAST Line before you specify a memory for your next EDP application! Call: 612-935-8811, TWX: 910-576-2913 or Write: Fabri-Tek Incorporated, 5901 South County Road 18, Minneapolis, Minnesota 55436.

FAST Line 300 film memories:
Operational Summary

Cycle time: Choose any speed between 250 and 500 nanoseconds

Access time: 125 to 250 nsec, depending upon cycle time chosen

Access modes available: Random, sequential or sequential interlaced

Capacity: To meet your requirements

Optional operating modes: Read only, write only, read-restore, read-modify-write, parallel write

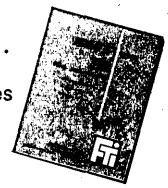
Input/output levels: Standard +2.5 and —0.5 volts

Control panel options: Address and data register indicators, voltage monitoring, and adjustment, self-testing controls and error checking, and data retention "Data Saver".

Power required: 115 or 220 vac., single phase, 48-63 cps.

Packaging: Relay-rack modules or free-standing cabinet

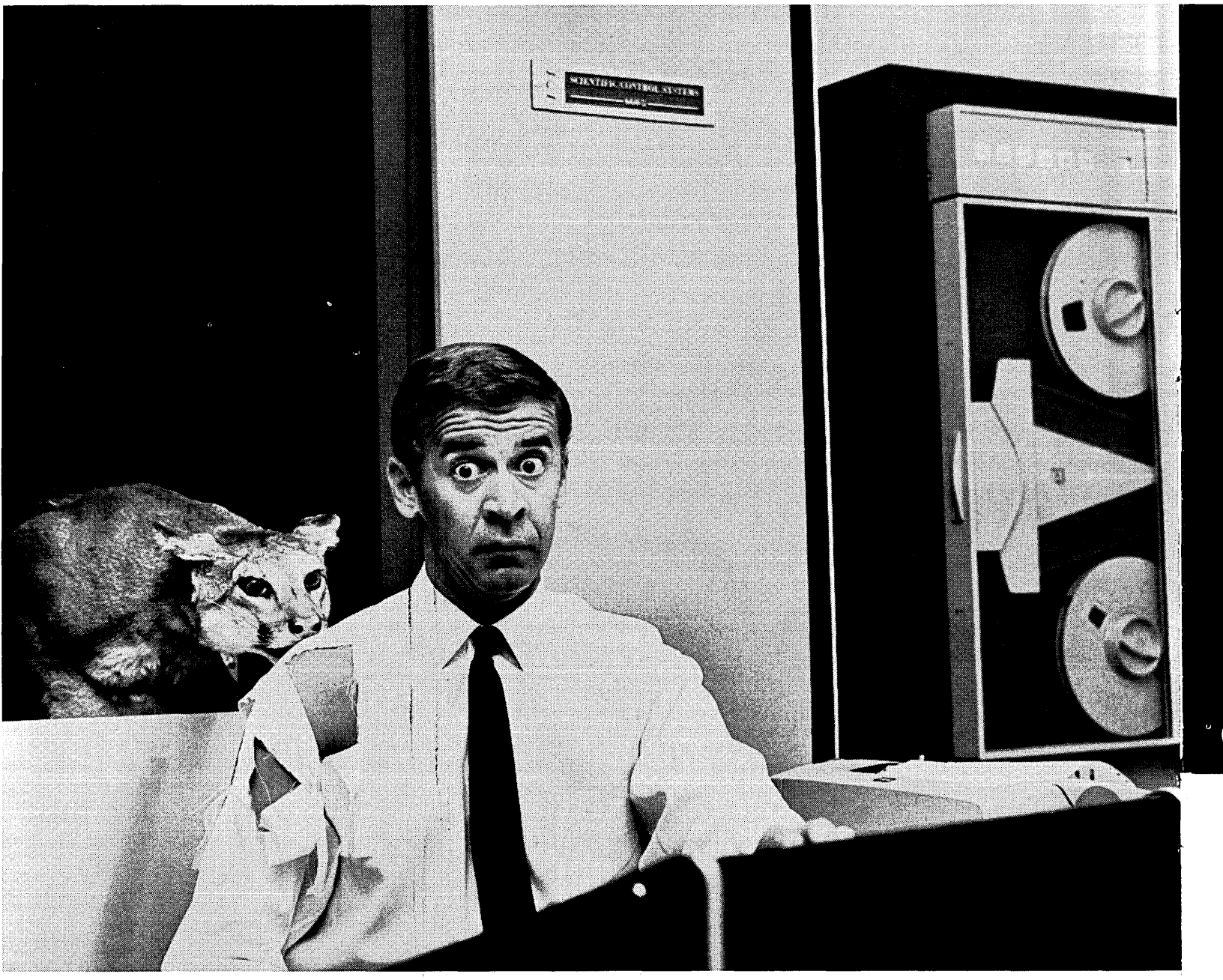
Available now . . . new FAST Line 300 film memories product bulletin. WRITE TODAY.



The Leader in Memory Technology

*T.M.

CIRCLE 37 ON READER CARD



"GULP!"

I didn't expect so much power from SCC Computers!

	MEMORY (MICROSECONDS)	CORE STORAGE (THOUSANDS)	WORD LENGTH (BITS)	PROGRAM OPERA-TORS	INDIRECT ADDRESS-ING	PRIORITY INTERRUPT	CONSOLE	HARDWARE INDEX REGISTER	HARDWARE M/D	DELIVERY (DAYS)	PRICE (WITH 4K MEMORY)
650	2	4-32	12		x	x	x	x	x	30	**$14,800**
660	5	4-32	24	x	x	x	x	x		30	**24,600**
655	1.75	4-32	24	x	x	x	x	x	x	45	**27,800**
660	2	4-32	24	x	x	x	x	x	x	45	**57,000**
670	1.75	4-32	24	x	x	x	x	x	x	60	**64,000**

Direct memory access, memory protect, parallel operation, microinstructions and your specific requirements are designed into SCC Computers.

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CIRCLE 38 ON READER CARD

news briefs

NASA MARSHALL SPACE FLIGHT CENTER GOES UNIVAC

By late 1968, the Univac label will be on almost all the units in the computer complexes at NASA Marshall Space Flight Center in Huntsville and Slidell, La. (Slidell supports the Michoud Assembly Facility and Mississippi Test Facility.)

The five-year $30 million contract calls for five 1108 II multiprocessing systems (three for Huntsville), with 5.5 billion characters in random access storage, and 80 remote terminals. The center, which is involved in production and testing of equipment for the Apollo program, will use the systems for scientific, commercial, data reduction (all batch and on-line), data acquisition and on-line process control applications—multiprogrammed and/or multiprocessing in all combinations.

The equipment will be installed in three phases, beginning with one 1108 at each facility early in 1967. When completed, the two locations will have a total of seven 65K-word core modules; more than 50 Fastrand II units and FH432 and 1782 drums; 34 tape units; a 1005II system; paper tape and card readers and punches; and communications control units. Remote devices will rang from keyboard and card I/O hard copy devices to crt displays, plotters and scientific remotes.

Making their exits from these centers are 39 computers, including 16 IBM systems ranging from 7094II's to 1620's, five Honeywell (1800, 800, 200), nine GE 200 series, four SDS 930's, Burroughs 5500, CDC 3200, and others. Many systems are used 400-500 hours/month. Forty-eight IBM remotes also go.

EUROPEAN GOVERNMENTS PROMOTE COMPUTER ACTIVITY

Western European nations show signs of efforts to spur their lagging computer activity, noted Ralph Weindling, managing director of the Diebold Group in Europe, at a recent press conference. A reason for the lag has been lack of government support, he said, but observers should look for developments in this area in the next few months.

The United Kingdom has already set up a special department of computer services and issued a loan to ICT. The French government is talking of a $100 million subsidy to support its computer industry, made all the more poignant by the recent U.S. refusal to let a CDC 6600 go to France for use in its nuclear research. And West Germany has two top-secret studies on the state of its industry which could elicit some action.

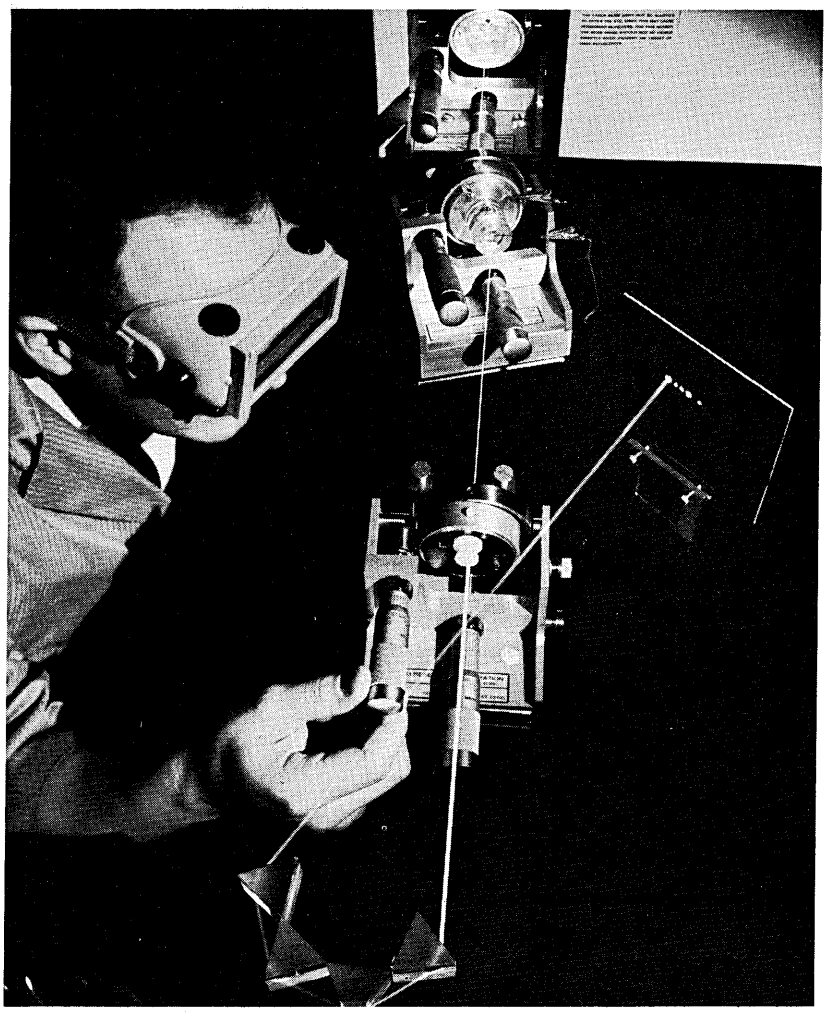
Many problems account for the lag, noted Weindling. European investment in computer research and development is far below the $19 billion/year the U.S. spends. (IBM spends more than any single nation.) As a result, relying on U.S. technology, Europe has not developed its own manpower in this area. There is a general severe shortage of dp person-

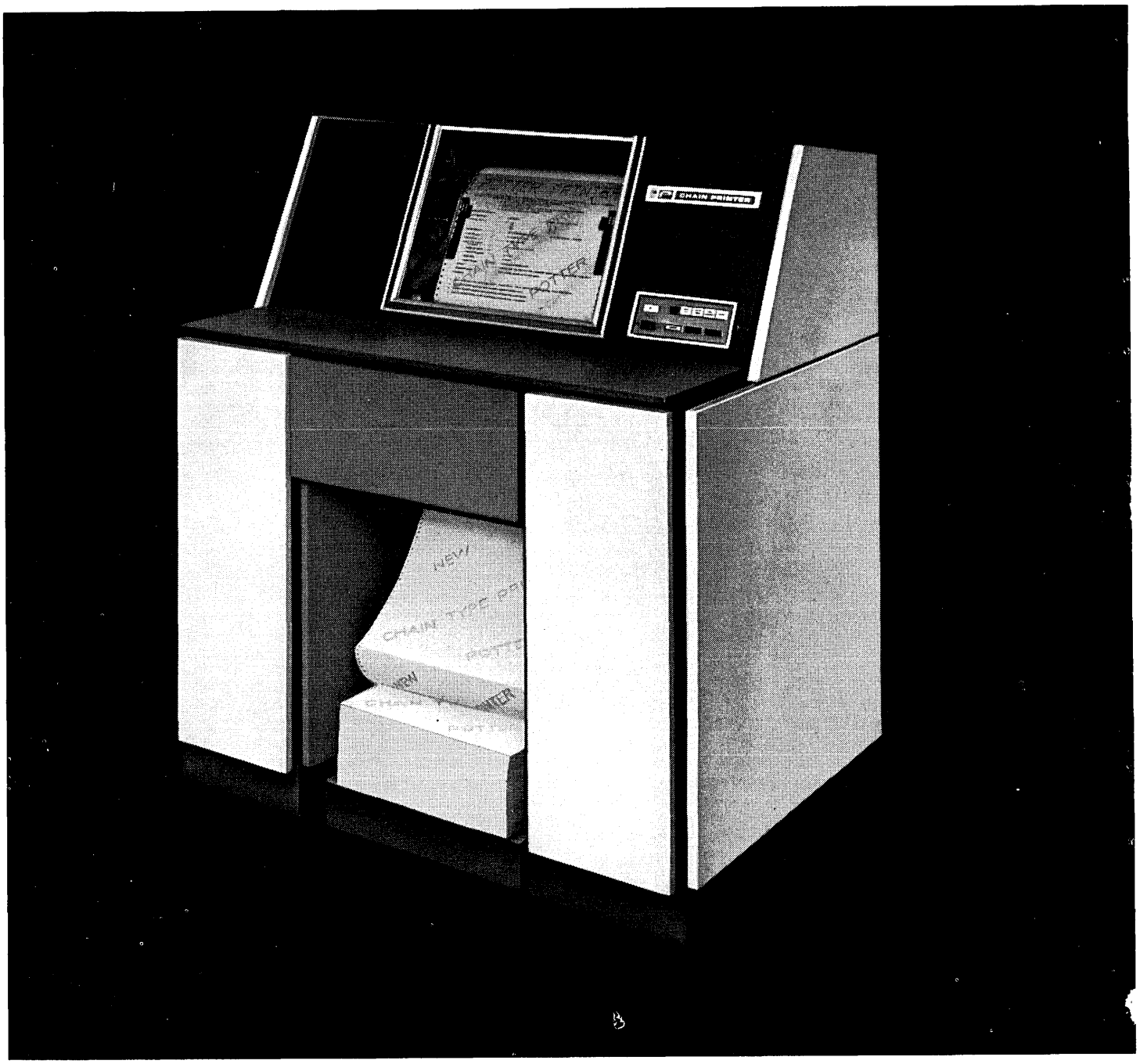
MEMORIES POSSIBLE WITH LASER WAVELENGTH SELECTOR

An experimental device that changes the color of a laser beam at high speed could lead to development of color-coded computer memories with a capacity of 100 million bits per square inch of film, according to IBM's Systems Development Div.

Crystals and prisms are placed within a laser and applying voltages to certain crystals blocks all colors except the one selected. Color selections at a rate of 125,000 per second are said to be feasible. Bits would be stored in layers in the film emulsion, according to color. With a reversible photosensitive medium, such as photochromic glass, the selector could be applied to operate a high density memory with one color recording, another reading, and a third erasing.

The wavelength selector also shows promise for use in optical communications.





How can Potter offer a chain printer priced so low?

This new Potter printer provides the combined benefits of high reliability and lowest cost of any line printer now available. Potter made it all possible by taking a completely fresh approach to printer design and construction . . . producing a 600-line-per-minute unit with only a fraction of the parts used in a conventional drum printer.

Take a look at these features:

- Speed to 600 lines-per-minute; up to 192 characters in 80 to 132 columns
- Precise vertical registration
- Sharp character definition—up to six copies
- Integrated circuit electronics
- Minimum maintenance—fewer parts to replace or service

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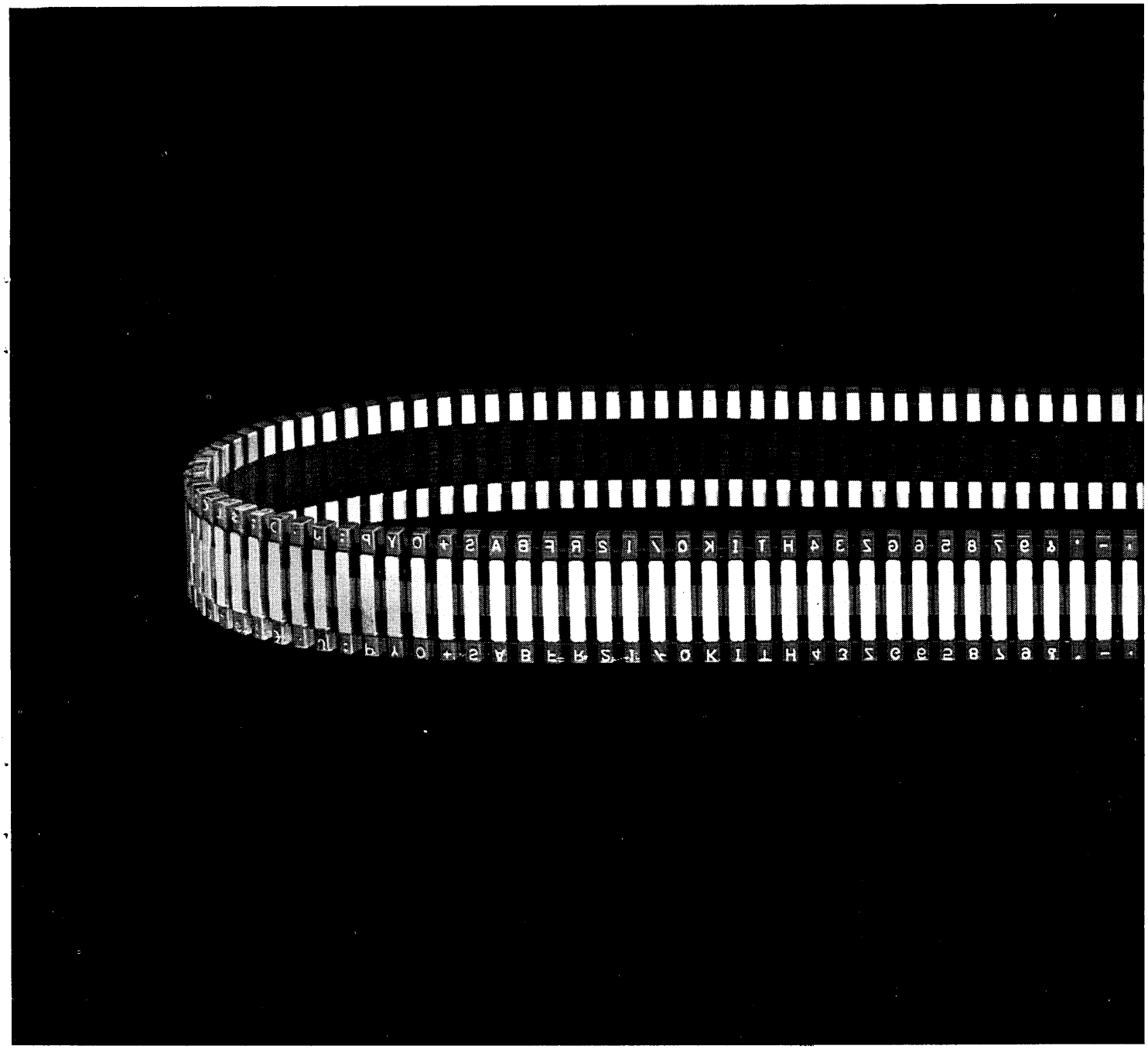

The answer's a radical new design starting with the chain.

The chain? It's completely different from any you've ever seen. A continuous rotating belt with individually attached, easily removable type slugs.

This newest of line printers is available to you at an unbelievably low price. So send this coupon today. Or better yet, phone or wire us for complete specs and price. You'll be glad you did.

PI-107C

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CIRCLE 39 ON READER CARD

news briefs

nel. Too, firms themselves, each battling U.S. manufacturers for the computer market (7K European installations) and selling mostly in their own countries, cannot adequately support R&D. Mergers are being encouraged since a national market can't generally support competition, but without government subsidy even that won't solve the problem, Weindling said. Pouring in American dollars has not always proved a solution, as illustrated by the GE-Bull multi-megabuck loss last year. Another factor is that political (i.e. Italian left wing strength), tight credit, and currency (England) conditions have discouraged capital expenditures.

European management concepts, differing and complicated national laws, and severe communications problems impede the implementation of on-line systems and networks. In communications, the quality of lines is poor, archaic regulations on rates make them prohibitively high, and data communications standards among the European systems (most government controlled) are nil. However, CCITT, a union of telephone companies, has been formed to try to establish such standards.

ITT WORLDCOM ANNOUNCES RATE-CUTTING PLANNED

In the wake of the FCC's request that communications carriers review their rate schedules, ITT World Communications has announced a plan to establish lower rates for alternate voice/data communications.

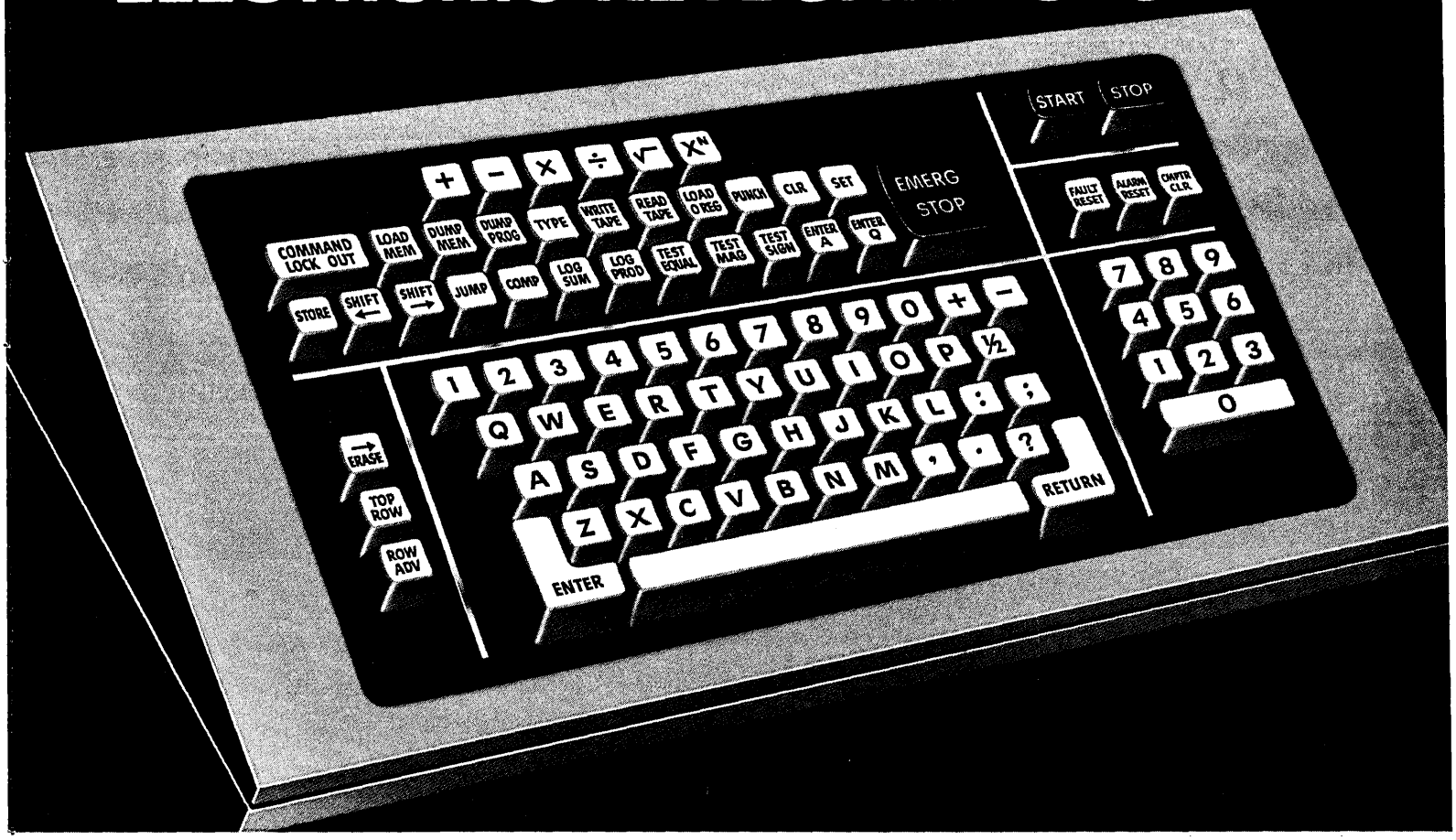
The ITT subsidiary said that the new rates it proposes to establish would apply to both satellite and cable circuits; the FCC had asked the carriers to see that their prices fully reflected the economies of leasing circuits in the satellite system. The firm had previously filed a rate reduction in May.

TECHNICAL SESSIONS SHAPING UP FOR FJCC

Evaluation of papers for the Fall Joint Computer Conference in San Francisco Nov. 8-10 is well under way, resulting in plans for as many as 24 technical sessions. More than a dozen are already set, with several others proposed.

Time-sharing, apparently the subject of the decade, will get its full share of attention. Examples: "Time-Sharing Processors and Executive Systems," Dr. Gene M. Amdahl; "Some Communications Aspects of Time-Sharing Systems," Paul Baran; "For and Against Time-Sharing," Prof.

NEW TEC-LITE
ELECTRONIC KEYBOARD SYSTEM...



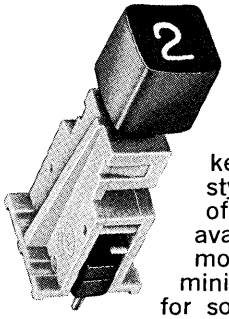
NOW YOU CAN HAVE A COMPLETELY UNINHIBITED KEYBOARD SYSTEM... CUSTOM DESIGNED for FUNCTION AND STYLE

Far cry from conventional keyboards! Here's a completely new, completely flexible data entry and control device which can be incorporated into any computer or industrial control system.

The new TEC-LITE Electronic Keyboard System can generate any code up to eight levels or more and, in addition, provide command controls and indicators on the keyboard console itself. Key and control arrangement is determined by your requirements.

Compact, simple . . . fast. The new TEC-LITE Electronic Keyboard System features pulse or momentary key switches virtually identical in feel and action to electric typewriter keys. Pulse switches *make and break* on the *downstroke.* Typing speed can be as fast as the operator's normal typing ability. No mechanical linkage to cause jam-ups or noise.

When custom designed, the new TEC-LITE Electronic Keyboard System is built for your particular system, both electrically and mechanically. Its keys can be styled to complement your console design. From stock you can select standard typewriter or 10-key keyboards compatible with popular computer languages. Keyboards can be mounted in desk tops, rack mounted or be portable.



Key to the TEC-LITE Electronic Keyboard System is this snap action SPDT pulse or momentary switch which virtually duplicates the feel and travel of electric typewriter key action. Two key styles are standard . . . special styles, including most button designs offered on electric typewriters, are available. The molded plastic body mounts on .750 x .780 centers, minimum. Standard terminals provide for solder-mounting on printed circuit boards or solder-plated, quick-connect types, with other terminals also available. Switch life is 1,000,000 operations, minimum. Operating force is 2.5 (±.5) ounces, with other pressures optional. Button travel is 5/32" and the switch will withstand a 50-pound downward force.

Write for complete information about the versatile TEC-LITE Electronic Keyboard System and individual Keyboard Switches.

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CIRCLE 41 ON READER CARD

news briefs

Harry D. Huskey; and a proposed session, "Management of Time-Sharing Centers," Prof. Richard Mills.

Hybrids are also getting increased attention. Some sessions already scheduled: "Hybrid Applications and Techniques," Walter Brunner; "Monte Carlo Methods Using Analog and Hybrid Computers," A. C. Soudack; "Error Analysis in Analog and Hybrid Computers," Dr. Robert Vichnevetsky.

Among the planned sessions announced by the chairman of the technical program, Dr. William H. Davidow, are "Natural Language," H. R. J. Grosch, and "Impact of Computers on Government," Norman Ream.

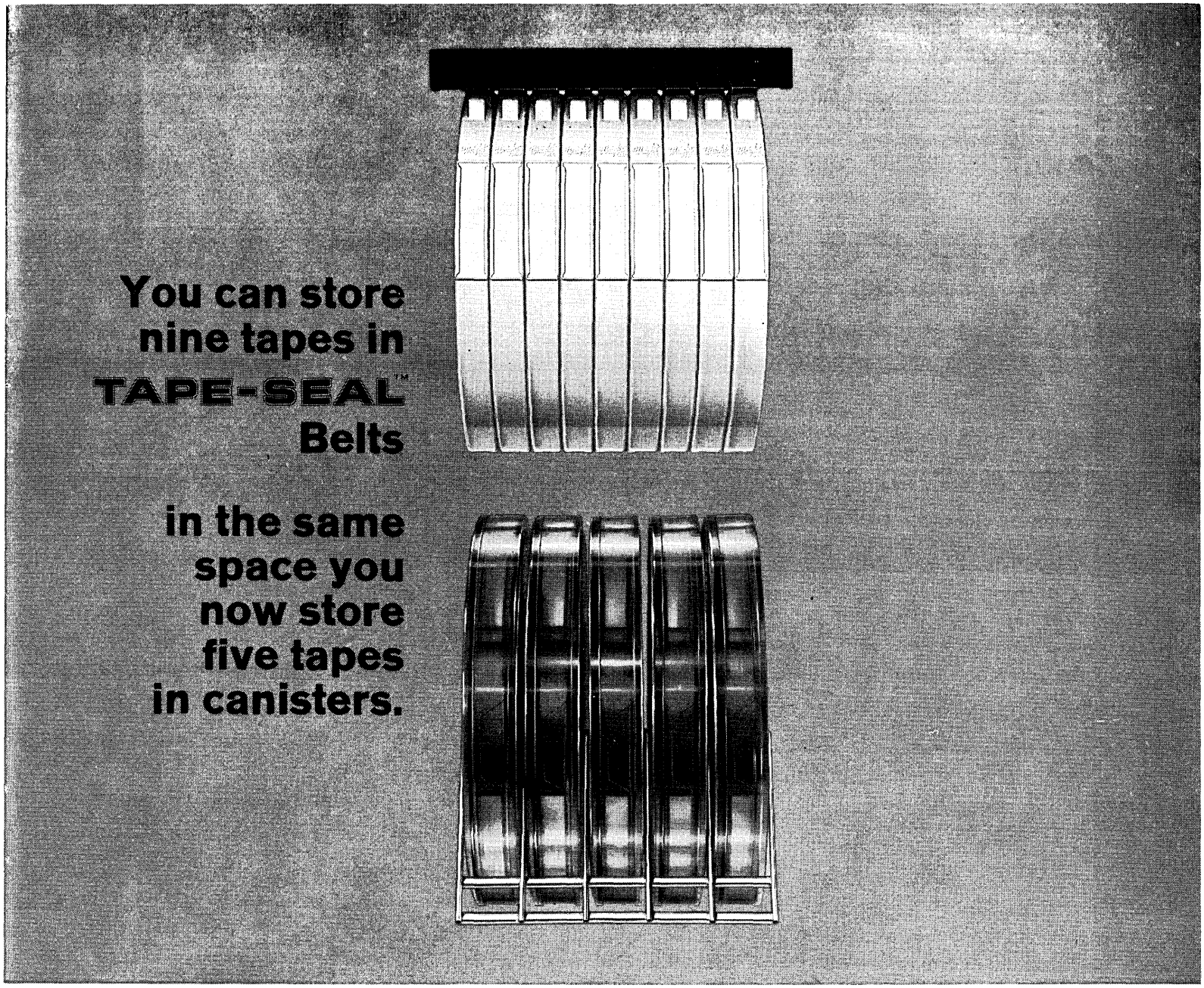
NASA COSMIC WILL DISSEMINATE PROGRAMS

The Univ. of Georgia has been awarded a contract by the National Aeronautics and Space Administration to establish and operate a Computer Software Management and Information Center (COSMIC) as part of the NASA Technology Utilization Program. The contract will be administered by Marshall Space Flight Center, with technical direction and management provided by the Technology Utilization Office of MSFC.

Through COSMIC, NASA will make certain computer programs available, to be announced periodically. Announcements will refer the reader to either the Univ. of Georgia or the responsible NASA installation. Either documentation or the program itself on cards or tape will be furnished by the university for a nominal duplication and mailing cost.

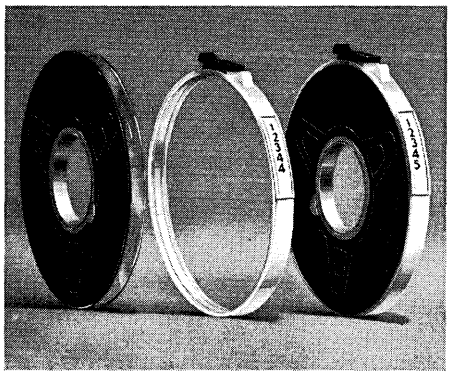
The COSMIC dissemination center evolved from an experimental NASA program at the Universities of Indiana and Georgia under the direction of Roy A. Bland of the Technology Utilization Office at the Marshall center.

● IBM, whose giant software efforts for the 360 line are swallowing an estimated $60 million in 1966, has taken on the development of another language compiler—ALGOL. Particularly aiming to meet the needs of the large ALGOL user group in Europe, the firm will deliver an F level, or 44K, compiler during third quarter 1967. It will meet the standard adopted by the European Computer Manufacturers Assn. and the International Federation of Information Processing. Said C. B. Rogers, director of systems marketing, "We believe System/360's PL/I and FORTRAN offer greater flexibility than ALGOL to scientific users, and we are encouraging conversion wherever it is practical."



How's that for increased storage capacity?

With the Tape-Seal Computer Tape Storage System*, you use unique new polyethylene belts that hang in storage rather than sit between space-wasting wire supports. You store nine of them in the space five canisters fill. In Tape-Seal Cabinets, the ratio becomes 200 to 96, with no increase in floor space. And the tapes are better protected, easier to handle, and more conveniently labelled.



The Tape-Seal System is the only complete tape storage system available today. We'd like to tell you about it soon. Write now for a free demonstration in your office. We bet you nine to five you'll go for the Tape-Seal System — and start increasing storage capacity and saving space.

(When you order new tapes, insist that they be shipped without canisters. Buy Tape-Seal Belts and save.)

*Patents Pending

Wright LINE DATA PROCESSING ACCESSORIES

170 GOLD STAR BOULEVARD, WORCESTER, MASS. 01606 A division of Barry Wright Corporation BW

CIRCLE 45 ON READER CARD

Why Photocircuits' tape readers were selected for...

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LEM
MINUTEMAN
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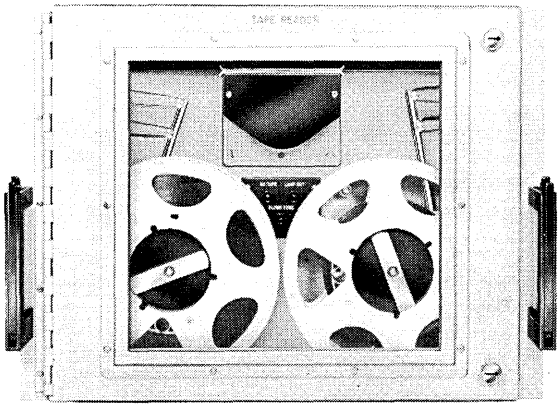
GSM 133
CENTAUR
DIMATE
LCSS
TEAMS

... because of the simplicity and reliability of the printed motor single capstan drive, with the electronic control of all tape movement. Troublesome, high-maintenance components such as pinch rollers, brakes and clutches have been completely eliminated.

The fully militarized 500RM was specifically designed as a military unit ... not a "beefed-up" version of a commercial tape reader. It has successfully passed mil specs, MIL-E-16400 Class 3, MIL-T-21200 Class 2 and MIL-T-945; tests for shock, vibration, RFI, altitude, salt, sand, dust and heat and cold.



The 500RM reads bidirectionally at up to 1000 char/sec., has eight inch reels with proportional reel servos, accepts 5, 6, 7 or 8 level tape and has a MTBF of 5000 hours.

For full specifications on the 500RM, or on Photocircuits' complete line of commercial tape readers, contact: Photocircuits Corporation, Tape Reader Division, Glen Cove, N.Y.

Photocircuits CORPORATION

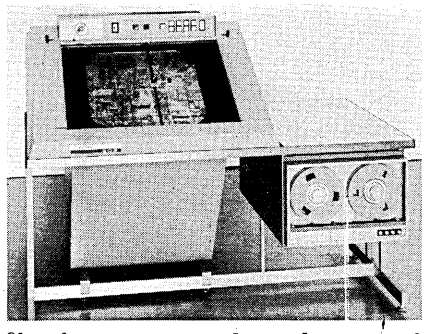
PC **TAPE READER DIVISION**
Glen Cove, New York 11542

CIRCLE 46 ON READER CARD

new products

film digitizer

An accessory to the firm's model 302 digitizer, the model M film projection system enables data to be reduced from 35-mm and 70-mm film. Film reels with up to 1,000 feet are accommodated. The section of the film being projected is kept flat by a solenoid-actuated glass pressure plate that is automatically raised before the film is driven in either direction. The



film frame, projected on the rear of a high-gain Polacoat screen, can be viewed and digitized under normal ambient room light. With a "floating zero" feature, each frame need not appear in the same position on the screen as the preceding frame. CALMA CO., Santa Clara, Calif. For information:

CIRCLE 150 ON READER CARD

punched card gear

Finally making the switch from 90- to 80-column cards, the firm introduces a line that includes a keypunch, verifier, sorter, and interpreter. Both the model 1501 keypunch and 1150 verifier have core storage, which holds keyed data until the entire 80 columns are completed; punching or verifying then proceeds at 60 cpm. This is said to facilitate error correcting and automatic card duplication. There's also a movable 64-character keyboard, for centralized control, and a lighted column indicator. Use of program control cards is also simplified. The model 2001 sorter, with 14 output stackers, operates at up to 1,000 cpm. With an input capacity of 1,200 cards (3,000-card capacity is optional), the unit stops when an output stacker is full or the input magazine is empty. UNIVAC DIV., SPERRY RAND CORP., Blue Bell, Pa. For information:

CIRCLE 151 ON READER CARD

time-sharing terminal

A two-piece remote terminal that can be carried around and merely plugged into an electrical outlet is Dataport. For those who know the right phone numbers, access to a time-sharing system is available by placing the phone receiver into the control unit (which weighs 39 pounds). The other component of the terminal is the typing unit (37 pounds), which is a teletype device that accepts data at 10 cps. The latter also operates when it's unattended. The system was developed at Carnegie Tech. ELECTRONIC SYSTEMS INC., Pittsburgh, Pa. For information:

CIRCLE 152 ON READER CARD

punched card reconditioner

The Carditioner reportedly makes mutilated punch cards machine readable. It handles up to 250 cpm, rejecting and collecting those with staples on them, and takes 51, 66, 80

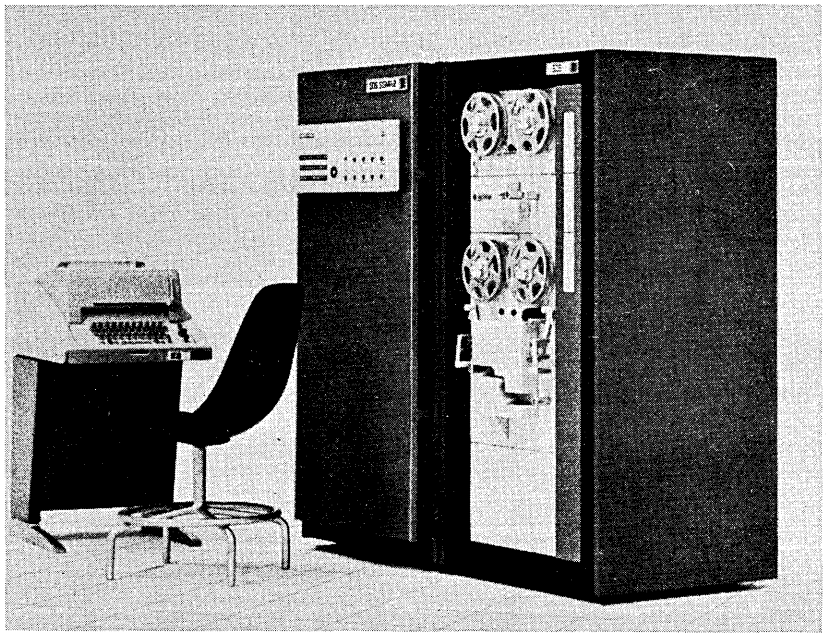
PRODUCT OF THE MONTH

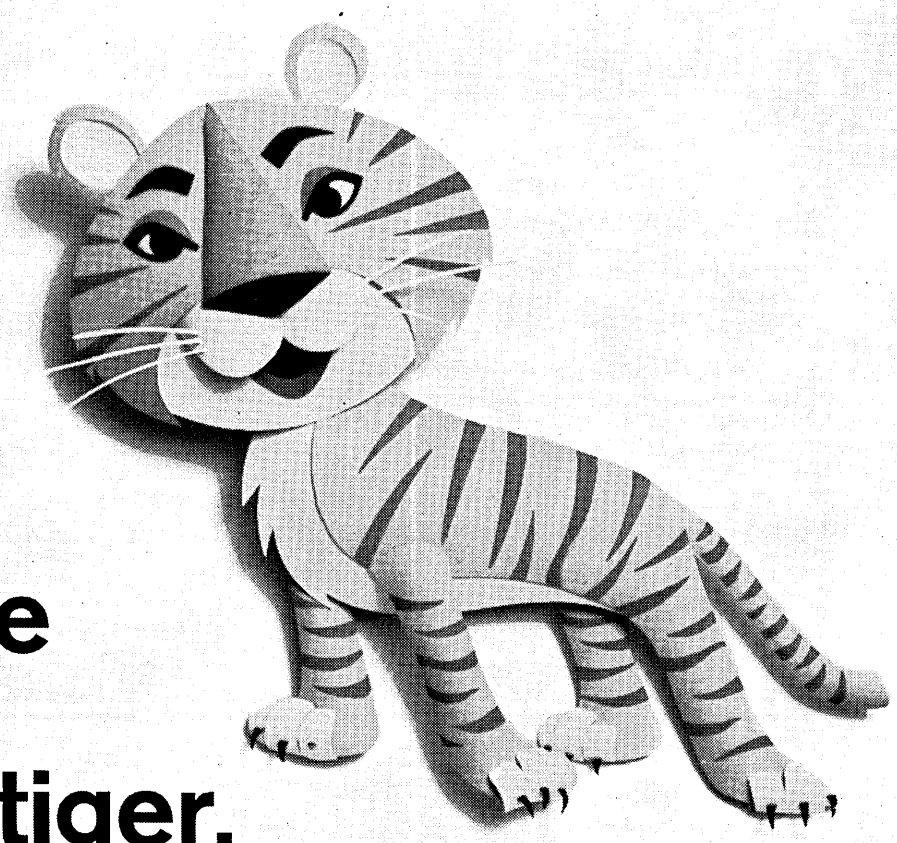
The Sigma 2 Computer is a small-scale sibling to the Sigma 7 (see March, p. 53). Designed for control applications and scientific computation, it can be operated as a stand-alone unit, as a multiprocessor system, and as a satellite to the larger 7. In the systems field, it competes with the PDP-8, CDC 1700, IBM 1800, DDP 116, ASI 6130, and Honeywell H-21. None of these has a sub-usec cycle time.

Using monolithic IC's, the Sigma 2 has a memory cycle time of 900 nanoseconds, add time of 2.25 usec, and multiply time of 10.35 usec. Word size is 16 bits (two 8-bit bytes) plus parity, and core memory is expandable from 4K to 64K words (8k to 128K bytes), all directly addressable. It can also share memory with a Sigma 7, as well as having some of memory private to itself. Peripherals announced with the 7 can also be used with the 2, but the two are not program-compatible. Using EBCDIC encoding internally, it is ASCII compatible.

Although the new processor competes with the firm's models 92, 910 and 920, no simulator or emulator for these is available. The software, however, will include FORTRAN IV, a real-time compiler and monitor, and a basic control monitor. Other hardware features: an index register, priority interrupt, multiple real-time clocks, memory protection, and program change-over in four usec. A 4K system with paper tape reader and punch and a mod 35 Teletype costs $26K. Deliveries begin in the first quarter of 1967. SCIENTIFIC DATA SYSTEMS, Santa Monica, Calif. For information:

CIRCLE 153 ON READER CARD





Beware the paper tiger.

Tread carefully through the jungle of roaring promises. You can get nipped on some Fortran IV claims.

But you can trek on confidently with NCR's Fortran IV. You have more mathematical formulation flexibility with NCR's one-pass Fortran IV than with any other version. And our customers have established a cost-per-statement of only three-tenths of a cent.

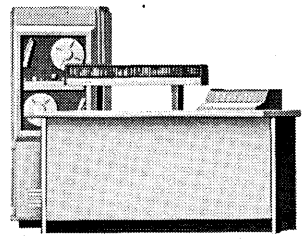
Specifically, NCR offers unlimited variable name structure. Use as many characters as you like in commands. You don't have to abbreviate. In fact, every individual element of NCR's Fortran IV meets or exceeds standards established by ASA X3.4.3. Like N-dimension subscribing.

An Executive monitor system sequences read, compile, library, and run processing without operator control or intervention, and performs them in any order. And handles the assignment in jig time. On the RMC, you compile at 250 statements per minute.

NCR is the king of the jungle in other areas of scientific software too. It's no empty roar when we say we have off-the-shelf linear programming, multiple regression analysis, time series analysis, PERT, sales forecasting and order analysis, statistics library, engineering library, and Fortran II. And we have them today, right now, for the RMC, the 315, and the 315-100.

So get the real story. Call your NCR man, or write NCR, Dayton, Ohio 45409 for full information. Don't let the paper tiger get you.

NCR



THE NATIONAL CASH REGISTER COMPANY, DAYTON, OHIO 45409 ®

CIRCLE 47 ON READER CARD

and 90-column cards. CUMMINS-CHICAGO CORP., Chicago, Ill. For information:

CIRCLE 154 ON READER CARD

source data collection

The source record punch is designed to combine transaction reporting and keypunching for computer processing into one operation. The desk-top unit records on a Zipcard, which is a multi-copy form set containing an 80-column tab card and paper copies. The punch, which can be used in such areas as material and production control, will merge onto the Zipcard: constant information from a prepunched 80-column master card inserted into the unit at time of transaction; semi-variable data (such as date, location, department) from slides located in the machine; and variable data entered from the machine keyboard. STANDARD REGISTER CO., Dayton, Ohio. For information:

CIRCLE 155 ON READER CARD

memory control unit

CTM-4550 enables any computer to use the RAM mag tape random access memory system. The unit accepts a 15-bit RAM address from a computer interface in a read or write command. It will locate and read a sector, word-parallel, from the RAM into the interface or write a sector of data from the computer onto the RAM, providing error-checking in both instances. Accessories available include a sectorization control unit, an interface between the CTM unit and computer, a search unit (for files with numerically ordered identification words), a directory unit (for files with i-d words without track address), a multiple-RAM unit that ties several into one system, and a buffered-channel unit. POTTER INSTRUMENT CO., INC., Plainview, N.Y. For information:

CIRCLE 156 ON READER CARD

computer-use recorder

The Data-Printer is a computer-use recorder which prints out a record of elapsed job time and computer processing time (in hours, tenths, and hundredths) for each task. The unit does not identify the job but prints on cards prepunched with this information. The printer can be hooked up to "most" computers by plugging into an outlet from computer circuitry. Three models are available—PJ2-C3, D3,-E3; the latter two also provide a visual record of total elapsed and

New **8+8 Total Surface Tested** tape is worth more because it saves *much* more — saves man hours, lost data, computer time, dollars. Available from stock for all compatible systems in 200, 300, 600, 900, 1200 and 2400 ft. lengths. Each reel individually registered and guaranteed by the U.S. Magnetic Tape Company.

Study the chart at the right to see why **8+8 Total Surface Testing** is at least eight ways better than the techniques most widely used today.

Order today from your nearest U. S. Tape distributor, or write for your *free copy* of a new booklet entitled "The *facts* about testing magnetic tape for digital computers."

Here's why 8+8 testing is at least 8 ways better

	7-track	9-track	Full-width 7/9-track	**Total Surface 8+8**
1. Usable area tested Usable area untested	52% 48%	76% 24%	88% 12%	**100%** **none**
2. Head alignment compatibility (of user's tape transport and tape manufacturer's test equipment)	critical	critical	critical	**not critical**
3. Untested edge	25 mils	10 mils	10 mils	**8 mils**
4. Track width	30 mils	40 mils	30-40 mils	**32 mils**
5. Possibility of missing migratory particles	yes	yes	yes	**no**
6. Possibility of undetected permanent dropouts	yes	yes	yes	**no**
7. Possibility of errors in recording channels caused by dynamic skew	yes	yes	yes	**no**
8. Test track overlap	none	none	partial	**complete**

US TAPE

U.S. MAGNETIC TAPE COMPANY

A Subsidiary of Wabash Magnetics, Inc.

HUNTLEY, ILLINOIS 60142

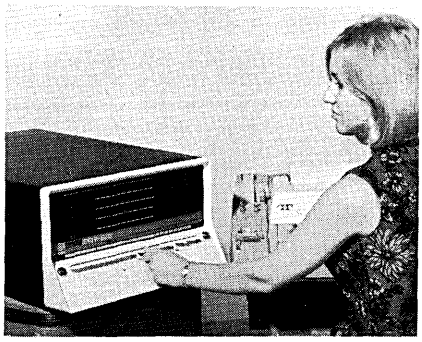
CIRCLE 49 ON READER CARD

processing time for calculating monthly use. STANDARD INSTRUMENT CORP., New York, N.Y. For information:

CIRCLE 157 ON READER CARD

gp computer

The PDP-8/S is scaled down from but compatible with the PDP-8. It's slower, smaller, and cheaper. A 4K (12-bit) system with ASR-33 tele-



type sells for less than $10K. The core memory is also expandable, but a 4K FORTRAN is available. Delivery is in 90 days. DIGITAL EQUIPMENT CORP., Maynard, Mass.

CIRCLE 158 ON READER CARD

data set

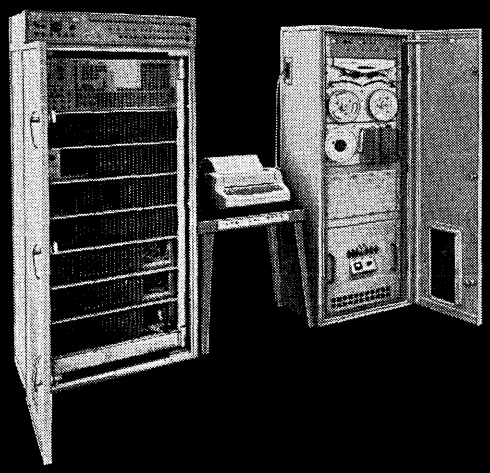
The GE-TDM 210 data set converts binary serial data from peripheral computer devices into FM signals for transmission over leased wire or microwave voice channels at up to 1800 bps. The unit, compatible end-to-end with Bell 202D data sets, plugs into a 117-volt receptacle and interconnects with the peripheral unit and telephone circuit by wire. GE, COMMUNICATIONS PRODUCTS DEPT. Lynchburg, Va. For information:

CIRCLE 159 ON READER CARD

investment computer

ISEC-250 is a solid-state analog computer designed for stock analysis. The desktop unit, selling for under $500, indicates on a meter scale the buy, sell, or hold desirability of a stock. Analysis is based on input of the following data: price earnings ratio, current price of a stock related to others within its industry, earnings and earnings trend of corporation, trend of the market, current Dow Jones average, and price of stock. ISEC, registered investment advisors, will supply the first three data on 1,100 New York and American Stock Exchange issues to the user for one year. After input, which is via five

New Westinghouse data processor features militarized design and integrated circuits for high reliability



The Westinghouse DPS-2402 is a general purpose digital data processor for real-time control applications. Typical uses include tactical control, air traffic control, communications switching, weapons control and navigation.

Silicon integrated circuits assure high speed, high reliability, low power consumption and small size. No air conditioning or heating is required in the range from 0°C to 50°C.

The DPS-2402 is a parallel, 24-bit-per-word, binary, single-address, stored-program machine. Design and construction are based on MIL-E-16400 and MIL-E-4158. A variety of memory options or input/output configurations are available for specific applications, such as NTDS compatibility.

Delivered production models are now working with radars, displays, other computers and most types of peripheral equipment.

If you have an application for real-time digital data processing, write for Bulletin SD-2. It describes the Westinghouse DPS-2402 in detail. Write to Marketing Manager, Surface Division, Westinghouse Electric Corporation, Box 1897, Baltimore, Maryland 21203. J-02389

You can be sure if it's Westinghouse

CIRCLE 51 ON READER CARD

potentiometers and a switch, evaluation takes less than one minute. Tests of the unit's decisions on various groups of stock resulted in up to 44% profits, excluding commissions and reinvestment of profits. The 250 is manufactured by Data Instruments, Philadelphia; deliveries begin in September. ISEC CORP., Princeton, N.J. For information:

CIRCLE 160 ON READER CARD

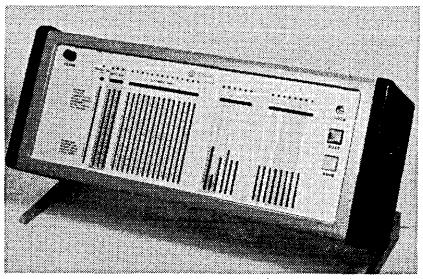
drum memory

The 1175B drum, aimed at time-sharing applications, has an 8.6-msec average access time, 3 Mc data rate, and 30-megabit storage capacity. The system, which can be interfaced with "most computers," also features a nickel cobalt plated drum with a 15-inch diameter and 800 tracks, i.c. modules, and phase modulation recording with internal parity generation and checking. VERMONT RESEARCH CORP., Hanover, N.H. For information:

CIRCLE 161 ON READER CARD

input terminal

The Data Message Composer can be linked to a computer by a standard teletypewriter line for 100 wpm



transmission. Applications include inventory, production and document control, accounting, and order entry. RIXON ELECTRONICS INC., Silver Spring, Md. For information:

CIRCLE 162 ON READER CARD

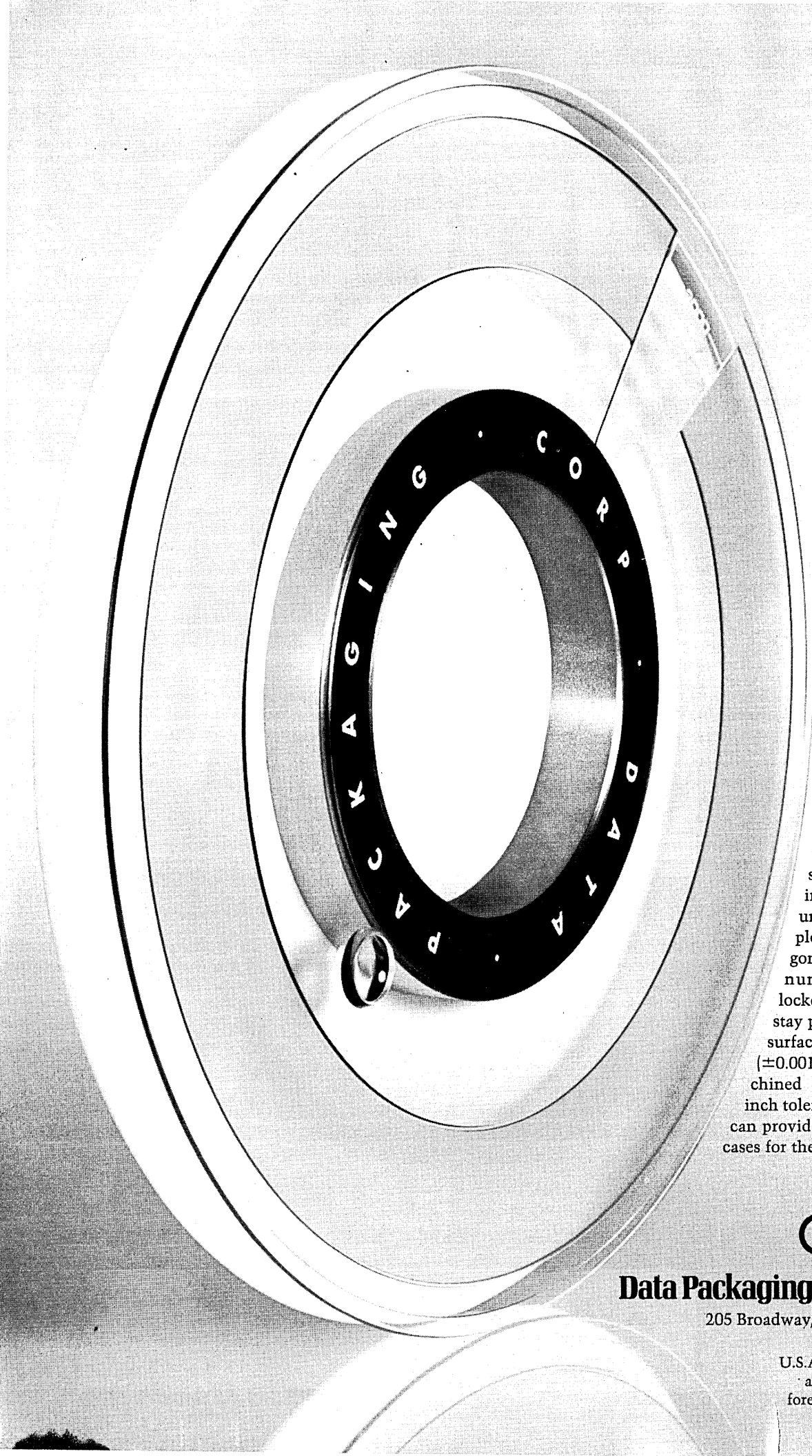
data communications

The DLT-9 communications adaptor permits Univac 1004 and 1005 systems to be used as terminals to non-Univac computers. The unit uses the 4-out-of-8 code and format at synchronous transmission rates of 2,000 and 2,400 bps. Using Telpak, a higher speed model will transmit at up to 40,800 bps. UNIVAC DIV., SPERRY RAND CORP., Blue Bell, Pa. For information:

CIRCLE 163 ON READER CARD

high-temperature tape

Addition to the firm's PYROTRAK line of mag tape is a line of tapes with



Be choosey.

The best reels for computer tape have aluminum hubs and winding surfaces. The best way to get them is to ask for them. / This is why you should. / Aluminum winding surfaces don't compress under tape pressure, don't explode when the pressure is gone, don't distort after any number of winds. / Flanges locked to the hub are parallel, stay parallel. / Hub and winding surface are machined concentric (±0.001 inch tolerance), faces machined flat and parallel (±0.001 inch tolerance). / Every tape supplier can provide Data Packaging reels and cases for the choosey ones. Be choosey.

Data Packaging Reels and Cases

205 Broadway, Cambridge, Massachusetts

U.S.A. patent numbers are 3229928 and D202831. Other U.S.A. and foreign patents issued or pending.

a total thickness of two mils, said to be equal in overall thickness to 1½-mil (base) tapes offered by others. The metal-plated Kapton film base, which is 1.9-mils thick, provides the recording tape with a working temperature range from −100° to +500° F. The firm also has tape on a half-mil-thick base. Recording densities are said to exceed 1600 bpi. LASH LABORATORIES, San Diego, Calif. For information:

CIRCLE 164 ON READER CARD

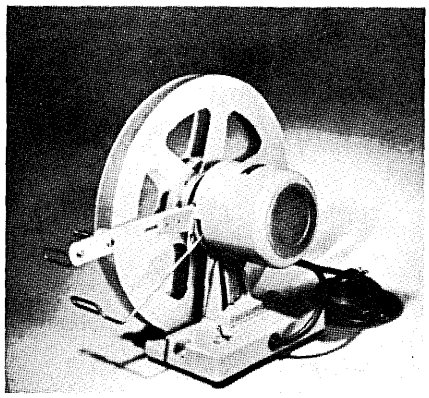
mag tape terminal

The D524 terminal consists of a mag tape handler, 1,024-character core memory, and a coupler for phone line interface. Reportedly compatible with most computing systems, it performs such functions as exchange, interpretation, formatting and translating data. Applications include data collection and distribution, auxiliary processing and load sharing, inquiry, message and data switching, and remote processing. Features include automatic vertical and longitudinal parity checks, detection of memory overflows or errors, and provision for interrupted operation until errors are corrected. The self-contained system can receive from or transmit to other mag tape terminals, paper tape terminals, printers, and operate on-line. DIGITRONICS CORP., Albertson, L.I., N.Y. For information:

CIRCLE 165 ON READER CARD

tape winder

A fully automatic unit, the 3-15 can be used with 10½ or 12-inch reels and with tape widths of 11/16, ⅜, or 1-inch. Wound tape can be pulled out for examination, and the motor can be stopped or started when tape is either loose or taut without tearing the tape. Available with collapsible and non-collapsible reels, units can also be supplied panel-mounted. Tension regulator is provided, J. H. BUNNEL & CO., Brooklyn N.Y. For information:



CIRCLE 166 ON READER CARD

data terminal

The System 200 data communications receiver operates at asynchronous speeds up to 60 cps with a Bell 402-D or equivalent data set. The paper tape unit is desk-top sized. TALLY CORP., Seattle, Wash. For information:

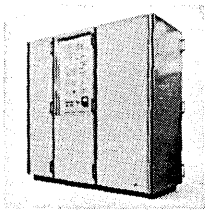
CIRCLE 167 ON READER CARD

matrix software

Software package for performing matrix operations on the PDS 1020 is entered with paper tape. It enables operator to add, subtract, multiply, invert, transpose, create identity or move matrices in toto. Input can be in fixed point or floating point format, and matrices as large as 20 x 20 can be inverted. Numbers up to eight significant digits and up to $0.99999999 \times 10^{99}$ in size may be used. PACIFIC DATA SYSTEMS INC., Santa Ana, Calif. For information:

CIRCLE 168 ON READER CARD

←FOR DATA PACKAGING CIRCLE 53 ON READER CARD



Want to integrate your scattered, multicomputer system?

Require more work from your present system?

Need to simplify your random-access programming?

Librascope's LIBRAFILE mass memories are your answer. They are large-capacity, high-speed, random-access information storage systems. These disc-file mass memories are easily adaptable to any large data-base application presently being performed by a mix of computers. LIBRAFILE mass memories are finding wide application for document retrieval, communications, intelligence, simulation, management information, command and control, process control, and time-sharing. We invite you to investigate the throughput increases to be gained from the addition of computer-controlled, high-speed disc files. For complete details, write for our technical bulletin.

Here's a mass-memory diagram you should keep in mind...

SYSTEMS DIVISION

GENERAL PRECISION INC.

LIBRASCOPE GROUP

□ □ □ 808 Western Avenue □ □ □
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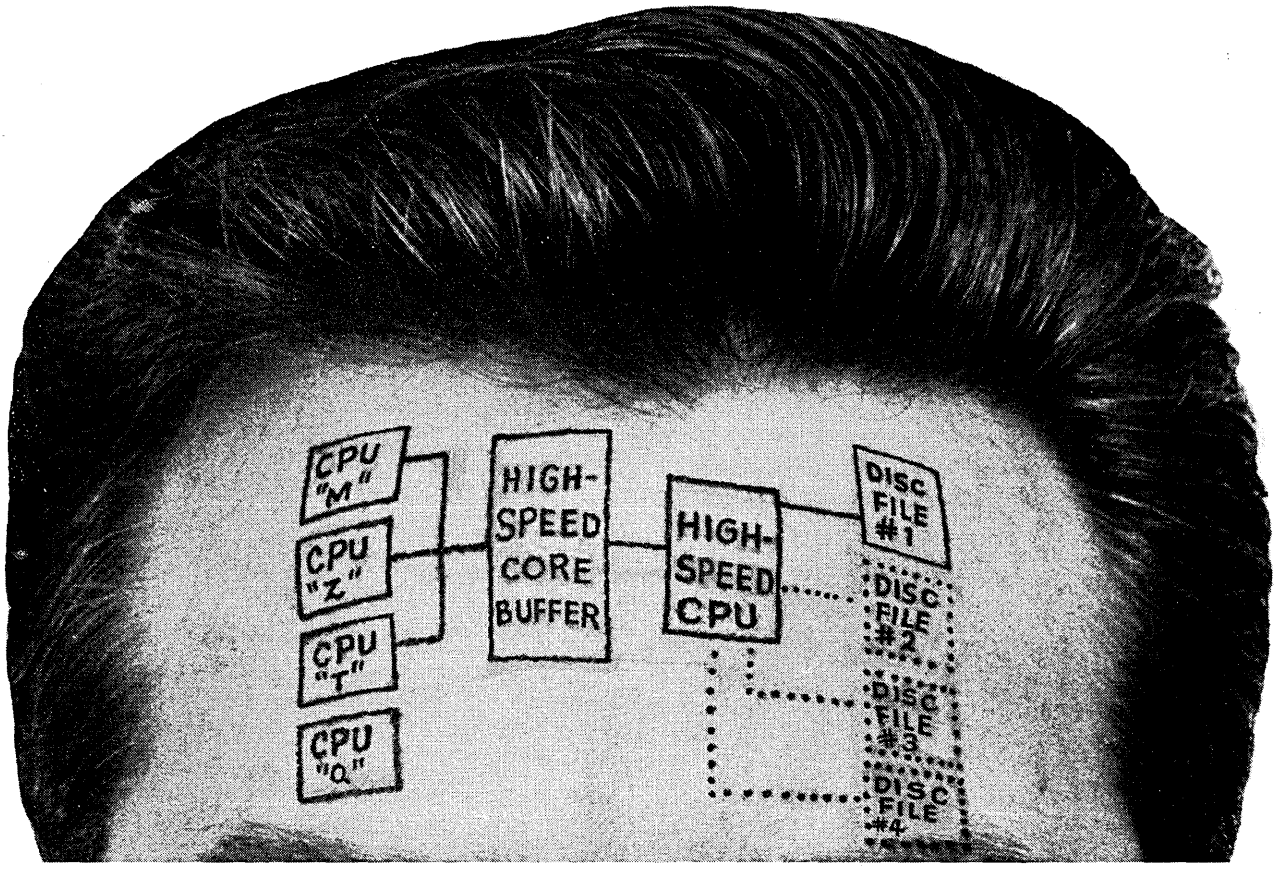

CIRCLE 55 ON READER CARD

new literature

O.R. IN BANKING: 17-page booklet lists current uses of OR techniques and classifies them according to their present state of development: successful and in-use, experimental and theoretical. Sections included are planning, investments, loans and credit, trust department, operations and bibliography for each of the these categories. BONNER & MOORE ASSOC. INC., Houston, Tex. For copy:

CIRCLE 130 ON READER CARD

DESK-TOP COMPUTER: Designed for scientific use, the WS-02 can be augmented with up to 24 keyboard controlled storage registers of 24-decimal digits each. Pushbutton call-out for up to 16 programs or subroutines also may be added. Eight-page booklet explains applications, capabilities, display and keyboard, input system and peripheral equipment. WYLE PRODUCTS DIV., El Segundo, Calif. For copy:

CIRCLE 131 ON READER CARD

ELECTRONIC SOURCE PROCUREMENT: 1966 edition lists over 12,000 firms engaged in manufacture, sales and distribution of electronic components and equipment. Data directs users to local outlets where off-shelf delivery is available. Directory is divided into four sections: manufacturers alphabetical section, purchasing index, representative roster and distributors. Directory is on controlled request and paid basis. Cost per copy: $20.50. ELECTRONIC PERIODICALS, INC., 33140 Aurora Road, Cleveland, Ohio 44139.

CORE MEMORIES: Description, applications, specifications and options are described in six-page brochure. Diagrams are given for memory mode/read-restore, memory mode/clear-write, buffer mode/read and write only. AMPEX CORP., Redwood City, Calif. For copy:

CIRCLE 132 ON READER CARD

MEDIUM-PRICED COMPUTER: Sigma 7 is a real-time computer developed for time-sharing, multiprocessing and multiprogramming. 24-page booklet includes general characteristics, programming systems, hardware features and instruction list. SCIENTIFIC DATA SYSTEMS, Santa Monica, Calif. For copy:

CIRCLE 133 ON READER CARD

PNEUMATIC CONTROLLERS: Eight-page brochure and 18 single-sheet bulletins describe components used to produce control systems for process applications. Bulletins illustrate control configurations that may be applied to any process: single-loop, feedforward, cascade, cascaded feedforward and ratio. Each control action is explained through illustrations that include a logic diagram describing the function; pneumatic schematic showing a remote-mounted controller. Ordering information is presented in tabular form. BAILEY METER CO., Wickliffe, Ohio. For copy:

CIRCLE 134 ON READER CARD

PARALLEL MAG DRUM STORAGE SYSTEM: Engineering specifications explain and illustrate the 700-kc 8-bit parallel drum system characteristics, basic system requirements, available options, system packaging criteria and product assurance provisions. Major elements that make up the basic drum system and advantages of various options offered are discussed and illustrated. BRYANT COMPUTER PRODUCTS, DIV. OF EX-CELL-O-CORP., Walled Lake, Mich. For copy:

CIRCLE 135 ON READER CARD

TRENDS IN COMPUTER HARWARE: 37-page book describes capabilities of elements of dp systems which might be expected to be economically available about 1971, based on an extrapolation of present developments. Pointed out is the importance of software designers to recognize the greater potential of hardware-plus-software systems, rather than maximizing the complexity of software alone. AD-632 477. Cost: $2; microfiche, $.50. CLEARINGHOUSE, U.S.

21-301

The SDC programmer now has an ever-widening range of significant new projects to challenge his enthusiasm and capabilities. Large-scale defense systems incorporating advanced real-time command and control techniques continue to be of major import to us, as do all aspects of national defense and space work that benefit significantly from a systems approach. At the same time, the scope of our work in the public interest continues to broaden day by day. Now SDC is contributing its experience to such national concerns as education, law enforcement, social problems, health, urban and regional planning, and numerous other public-serving applications. The SDC environment is inter-disciplinary. Programmers work in close concert with engineers, systems analysts, and human factors scientists... to create, develop, evaluate, and install major systems in the public interest...and to adapt these systems to the users' changing needs. □ If you are a programmer in the mood for new career challenges—and if you plan to be in Los Angeles for business or pleasure —we'd enjoy meeting you and talking about your future at SDC. Please call John Mitchell at EX 3-9411. Or we invite you to mail your resume to Mr. Mitchell at System Development Corporation, 2401 Colorado Avenue, Santa Monica, California 90406.

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SYSTEM DEVELOPMENT CORPORATION

Other major facilities in Paramus, New Jersey; Colorado Springs, Colorado; Falls Church, Virginia; Lexington, Massachusetts; Dayton, Ohio.

CIRCLE 57 ON READER CARD

new literature

DEPT. OF COMMERCE, Springfield, VA. 22151.

SUPERVISORY CONTROL SYSTEMS: Eight-page brochure includes discussion of Paricode solid-state systems employed in control, indication, telemetering, data logging, and status reporting. Locotrol which provides synchronous control of slave locomotives in long freight trains is also described. RADIATION INC., Melbourne, Fla. For copy:

CIRCLE 136 ON READER CARD

HYBRID SOFTWARE: Eight-page booklet defines software and describes methods by which programming takes place, along with specific software packages. These packages are divided into hybrid compilers and assemblers and self-contained utility. Schematic shows the interrupt structure. BECKMAN INSTRUMENTS INC., Fullerton, Calif. For copy:

CIRCLE 137 ON READER CARD

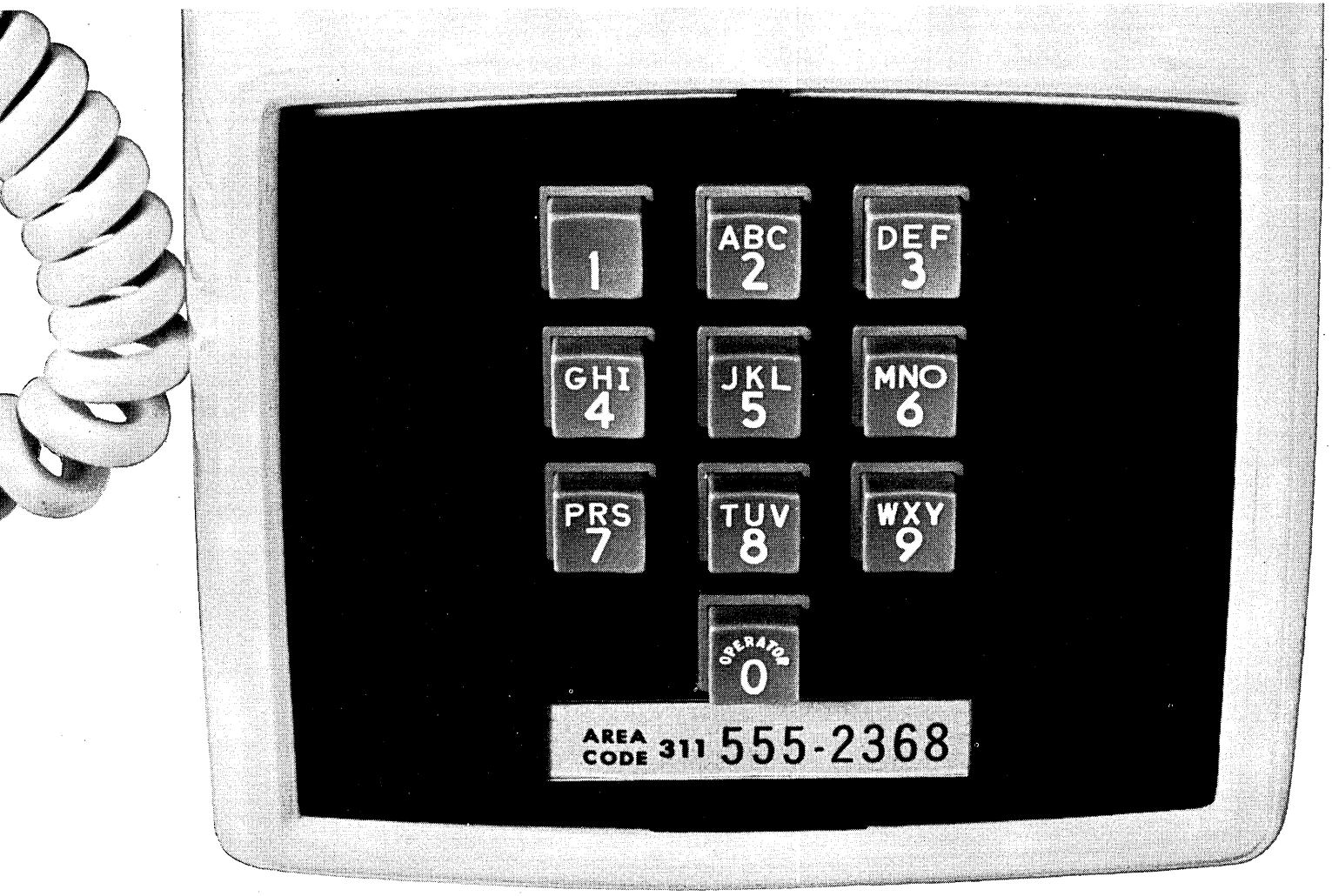
EDGE PUNCHED CARDS: Four-page folder provides specifications of standard cards used with Friden, SCM and Dura equipment. Illustrated also are dp folders which combine filing of tapes or EP cards with letter-size documents. VUE-FAX SYSTEM CONTROLS CORP., Westbury, N.Y. For copy:

CIRCLE 138 ON READER CARD

MAGNETIC MEMORIES: Four-page brochure describes design concept with either ferrite core or magnetic film elements. Systems are in the 1 usec to 150 nsec full cycle range. Core memory systems operate from 1 usec to 375 nsec and magnetic film memories in the 500 to 150 nsec range. Operational summary lists specific features. FABRI-TEK INC., Minneapolis, Minn. For copy:

CIRCLE 139 ON READER CARD

LIST PROCESSING LANGUAGE: 85-page book describes the Bolt, Beranek & Newman language being used in their artificial intelligence research program. Features are that it uses a small core memory and a drum for storage of list structure. Special paging technique allows use of PDP-1 which has 8,392 18-bit words of 5 usec core memory and 92,312 words on a drum with an average access time of 16.5 msec. AD-632 669. Cost: $3; microfiche, $.75. CLEARINGHOUSE, U.S. DEPT. OF COMMERCE, Springfield, Va. 22151.



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Ohio Bell handles 2200 of them every day in the Greater Cleveland area.

And overnight they have to be distributed to intercept operators.

Now, Multigraph isn't the only way to handle this job. Ohio Bell just chose us because our system could do it at lower cost.

Working with Ohio Bell systems engineers, we recommended and installed the Photo Direct Master system. It records the changed numbers as they come off the computer. Copies are duplicated and distributed to intercept operators before the next day breaks.

The savings from this system over the previous one are substantial. And as a bonus, the Multigraph equipment is used on other projects during the day.

Ohio Bell wins coming and going. We bet you can, too. Just call your Multigraph man. Or write Addressograph Multigraph Corporation, Department T-6626, 1200 Babbitt Road, Cleveland, Ohio 44117. No matter what your game is.

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CIRCLE 58 ON READER CARD

world report

CERN MOVES TOWARD 6400/6600 T-S SYSTEM

The Geneva-based international nuclear research centre, CERN, has reviewed its computing requirements up to the 1970's, and concludes that "big science" projects (such as in high-energy physics experiments) are making demands that are pushing computing technology to its limits. It also states that CERN predictions in 1963, estimating a loading equivalent of 15 7090's by the end of '68, were on the low side. In practice, demand from the various laboratories is exceeding this rate of growth. The general plan is to establish a computing service with much better fail-safe characteristics in supplying regular user service.

CERN's hardware consists of a 7090, CDC 6600 and 3400, plus several units, such as an SDS 920 and analogue devices dealing with experimental apparatus control, and data handling and display. A 65K 3800 is being installed. Next month, a decision will be made on whether to replace the 3800 with a 6400. This would be linked up with the 6600 to provide a big time-sharing system, and to guarantee large batch processing facilities should either system break down. A CDC 512K memory would provide necessary additional storage. The scientific policy committee states that the performance of the 6600 was restricted during its run-in period in '65 by poor software, and indicates that scientists will have to learn to live with the problems in systems programming arising from the demand on technology made by "big science."

ICT WRAPS UP GERMAN UNIVERSITIES

ICT has made inroads into German scientific computing with a block order of $2.75 million for four 1900's for the Technical Univ. of Berlin, the Fritz-Haber Institute, Berlin, the Technical College of Brunswick, and the German Research Assn. Brunswick will have the largest installation with a 65K 1907, disc store and remote terminals.

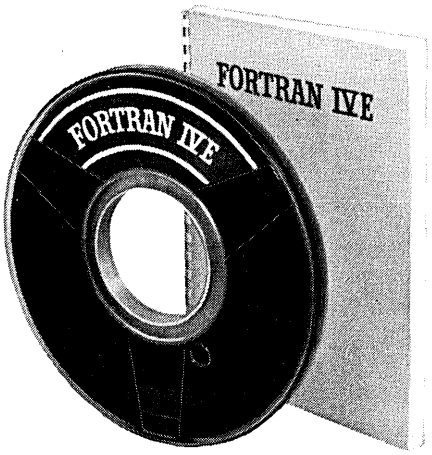
AUSTRALIAN EDP NET COMPLETED, BETS SPEEDED

Installation of a CDC 3200, which arrived early last month in Perth, Western Australia, will complete the nationwide dp network of the Commonwealth Bureau of Census and Statistics. Other node points — Melbourne, Sydney, Brisbane and Adelaide — have a 3200, and the Canberra center has a 3600/3200 complex. (For full story, see March '65 issue, p. 26.)

Received with more acclamation among the citizenry, however, was a CDC 3100, installation of which will reduce the closing time of betting in the state of Victoria from 40 to 20 minutes. To facilitate off-track betting, the government has more than 200 agencies where on-line Teletypes will replace current telephones. It's a $2-million system.

A recent survey shows the majority of computers in Australia are being used merely as fast calculators. Only a handful of companies has anything like a "total" system...The Dept. of the Army is making news by offering salaries ranging from $4,568 to $7,570 for programmers and analysts — high by local standards.

(Continued on page 95)



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Digitek's FORTRAN IV E Level for IBM System 360
is now operating under TOS and DOS. The stress is on small size and high reliability.
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in four phases / diagnostics integrated with source listing / no reserved words / compiles directly to standard
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CIRCLE 59 ON READER CARD

(Continued from page 93)

FOR BOAC, A 90 MEGABUCK SYSTEM

British Overseas Airways Corp. has updated its seat reservation and integrated management information ideas into a $90-million-plus bonanza — with IBM on the receiving end. Updating has occurred before original schemes got under way. First proposals for a $17-million system were made last year, based on two 360/50's. These go up to twin 65's. An order for displays worth $5 million is being contested between IBM, Elliott Automation, Ferranti and Raytheon's U.K. subsidiary, Cossor.

BOAC is planning an "all corners of the world" hook-up. As this will demand higher capacity communications, ITT's British subsidiary, Standard Telephone and Cables, has been awarded a $20-million job to plan and install high-speed lines for real-time operations among 100 international offices. BOAC's chief of information handling, Peter Hermon, estimates a corporate "profit" of $40 million by 1980 by using computers in almost every management department, or a return of 16% of capital investment.

BITS & PIECES

The New Zealand Post Office has ordered an English Electric-Leo-Marconi System 4 model 30, and Edinburgh Univ. a $1.5-million model 75 multi-accessing system for the Scottish regional centre...Britain's Motor Agents Assn. (the trade group for 20,000 gas stations and auto spares distributors) is providing a central bureau facility. A stock control package has been prepared in conjunction with ICT and is said to be an economic proposition for any local distributor handling spares worth more than $150,000 a year...GEC Computers and Automation has a £400,000 order from British Aircraft and Sud Aviation for two series 90 model 30 machines (made under license from SDS) for data analysis connected with the Anglo-French supersonic airplane Concord project. GEC also hopes to clinch a $5-million deal for series 90's for an integrated process control and data handling system for one industrial customer...Brandon Computer Services, London, has entered contract programming...Hughes Aircraft has won the $300-million Nadge contract in collaboration with Marconi, U.K.; CFTH, France; Selenia, Italy; Telefunken, Germany, and Signaal Apparaten, the Netherlands...Univac has collected a $7.25 million win from Shell International for twin 1108's and multiple 9000's for the U.K....Unofficial reports are that Univac is well over the 100 mark in Europe for 9000 series orders...Computer Resale Brokers Ltd. has formed a subsidiary in New York City to obtain used U.S. computers for offer by CRB in Europe, and to act as a buying agent for customers outside the U.S....CDC has purchased controlling interest in Camarughi & Cie SpA, an Italian firm that operates dp centres in Milan, Genoa and Rome...Recognition Equipment International has been opened in Frankfurt, Germany, to market their optical scanner. REI will function through subsidiaries to be formed in France, U.K., Italy and Sweden...The Swedish Statistical Central Bureau is installing a 360/50H.

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2201	IBM 1401/1410 Programming	10/03/66	10 Days
2203	IBM System/360 Computing System and Assembler	10/03/66	10 Days
2204	General Programming IBM System/360	9/19/66*	15 Weeks
2301	FORTRAN	10/24/66	5 Days
2303	PL/I	9/19/66*	5 Weeks
		10/03/66	5 Days
2401	IBM 1410 Operating System	10/17/66	5 Days
2402	IBM 7094 Operating System, IBSYS, IBJOB	10/24/66	5 Days
2404	IBM Disk Operating System/360	10/17/66	5 Days
2405	IBM Operating System/360	10/17/66	5 Days
2501	General Purpose Systems Simulator III	11/07/66	5 Days
2601	Computer Concepts for Market Research	11/07/66*	3 Weeks
2701	IBM System/360 for Operators	9/30/66	2 Days
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CIRCLE 61 ON READER CARD

The next time somebody asks you why the talent is moving to the Independent Software Houses, quote him Bauer's Second Law.

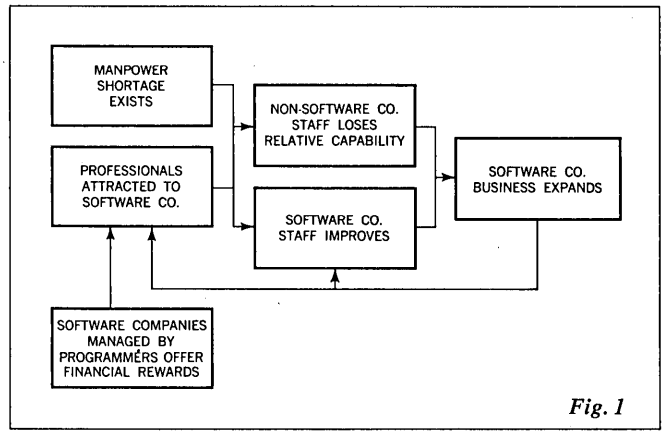

Fig. 1

Fig. 2: Dr. Bauer

Bauer's Second Law: Talent migrates from areas of well defined and stratified responsibility to areas of expanding activity at a rate proportional to the rate of expansion. Or, stated more simply: *talent goes where the action is.*

COROLLARY

Independent software companies, those not associated with a manufacturer or user group, are attracting an increasing percentage of available programming talent.

MANPOWER SHORTAGE EXISTS

Our basic premise is that talent, especially top talent, is in limited supply in any field. In the software industry the demand for top-rated specialists exceeds the supply. Consequently, software experts have a choice as to where they work. At present, and with increasing frequency, they choose to work for independent software companies. This is not to say that you can't find very talented people employed by computer manufacturers or user organizations. You certainly can. But more and more of them concentrate in independent companies.

SOFTWARE COMPANIES, MANAGED BY PROGRAMMERS, OFFER FINANCIAL REWARDS

It is true that part of the attraction is financial. Independent software companies depend on talent for their livelihood and consequently are willing to pay for it in several ways. Empiricists please call.

PROFESSIONALS ATTRACTED TO SOFTWARE COMPANY

But specialists are attracted to the independent company by more than money. A professional, given his choice, would rather work among his fellows. It is always best to work where your contribution is essential to the success of the enterprise, a place where you feel yourself in the mainstream of the business. Furthermore, when a man and his management are of the same discipline his needs are understood, his accomplishments rewarded, and his individual worth appreciated. Finally, working among top talent, a man can improve his own skills. This is especially true where people who have relatively narrow specialties within the basic discipline have a chance to exchange ideas and to learn from one another.

SOFTWARE COMPANY STAFF IMPROVES

For these reasons the staff of the independent software company improves, both in quality and in quantity. Since the talent pool is limited, it follows that the increased capability of the independents results in a decrease in the relative capability of non-independent software groups.

SOFTWARE COMPANY BUSINESS EXPANDS

This increase in capability brings more business to the independents. This in turn, makes it possible for the software company to offer more challenging work, more responsibility and more rewards. All this attracts still more talent. Thus the whole process repeats itself and becomes self-propagating.

IS THE INDEPENDENTS' GROWTH GOOD FOR YOU?

In five short years the independent software industry has grown from a meager $5,000,000 annual business, to $70,000,000 last year. And this year the figure is expected to double. Such growth must have sound economic reasons. There must be something the independents have to offer. There is. Stated in the simplest terms, the independent software firm can offer a pool of specialized talent which few users could afford to maintain for themselves. You can buy all this expert know-how, and use it for just as long as you need it to solve a given problem. And you will pay less than if you tried to solve the problem yourself. Furthermore, you will get the results on time.

HOW DOES INFORMATICS FIT IN?

Within our own organization (you knew the commercial was coming, didn't you?) we can call upon systems specialists, language specialists, experts in artificial intelligence, in data retrieval, in PERT, and many more. Without even leaving the building. Now, this kind of talent doesn't come cheap. (Look at our payroll and at our salary incentive plan, unique in the software industry.) We're always busy working on the latest problems. Right now, about 80% of our work is in the new field of on-line computing systems. We sponsored the first national symposium on the subject together with U.C.L.A. (We'll be happy to send you some of the papers presented in return for the coupon, below.)

THE MORAL:

If you have read this far, you might be interested in talking to us further about our services, capabilities, and opportunities. Simply call (213) 872-1220 and ask for me, for Frank Wagner, for Bob Rector or for anyone else on our staff. If more convenient call Werner Frank at our Washington office (301) 654-9190.

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in Los Angeles August 30 through September 1, please visit our suite at the Chapman Park Hotel to learn more about our company.

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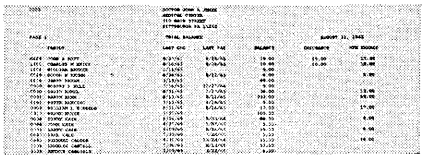
STATEMENT DATE 9/30/65 PHONE 333-8800 AMOUNT ENCLOSED $_____
PLEASE DETACH AND RETURN THIS PORTION WITH YOUR PAYMENT IN THE ENCLOSED SELF-ADDRESSED ENVELOPE

DATE		DESCRIPTION	CHARGES & CREDITS (CR)	BALANCE
8/31/65		PREVIOUS BALANCE		62.00
9/07/65	KAREN	X-RAY	5.00	67.00
9/14/65		MAIL REMITTANCE	50.00CR	17.00
9/21/65	TED	SCALING	3.00	20.00
9/30/65		BALANCE DUE		20.00

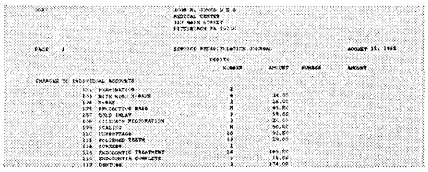
CHARGES OR CREDITS PROCESSED AFTER THE STATEMENT DATE SHOWN ABOVE WILL APPEAR ON THE NEXT STATEMENT

What started out to give doctors relief from bookkeeping chores has turned into a remedy for many another small business in Pittsburgh.



For now the Mellon National Bank & Trust Company of Pittsburgh is doing it for restaurants, auto parts stores, florists, drugstores, country clubs and others, as well as for dentists and doctors.

Prepunched account cards are inserted into a card reader connected to a Data-Phone* data set. And the information is transmitted over regular telephone lines. At the bank, the cards are automatically duplicated

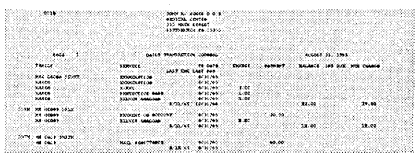


and then processed to provide the bills and forms shown here.

Businesses using the service need no longer be concerned with accounting equipment, maintenance agreements, printed forms, envelopes and stamps.

Overtime and billing-time confusion are eliminated. Remittances come in regularly, because statements are mailed on time regardless of personnel turnover, vacations, peak loads and emergencies.

The bank's data system provides businesses with these daily reports and forms: Transaction Journal; Trial Balance Journal; summary of all daily charges, payments, adjustments, month-to-date and year-to-date receipts; deposit tickets for all money



automatically deposited in the business's account; prepunched cards for new accounts.

Monthly reports include: Statements for all due accounts; Aged Accounts Receivable Report; Service Recapitulation Journal; New Account Report; Closed Account Report.

Now even small businesses get big-business billing service.

Our Communications Consultant can give you more details.

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If the first 20 features of this new incremental recorder don't turn you on, the 21st will

Whatever your data processing needs, you'll spot a number of features just for you in the new PI-1200 incremental recorder. And they're all standard—no optional extras needed!

1. Reads and writes asynchronously at 0–300 steps per second.
2. Reads and writes synchronously from 600 to 20,850 characters per second.
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15. All control electronics included.
16. Operates on 48-62 Hz power inputs.
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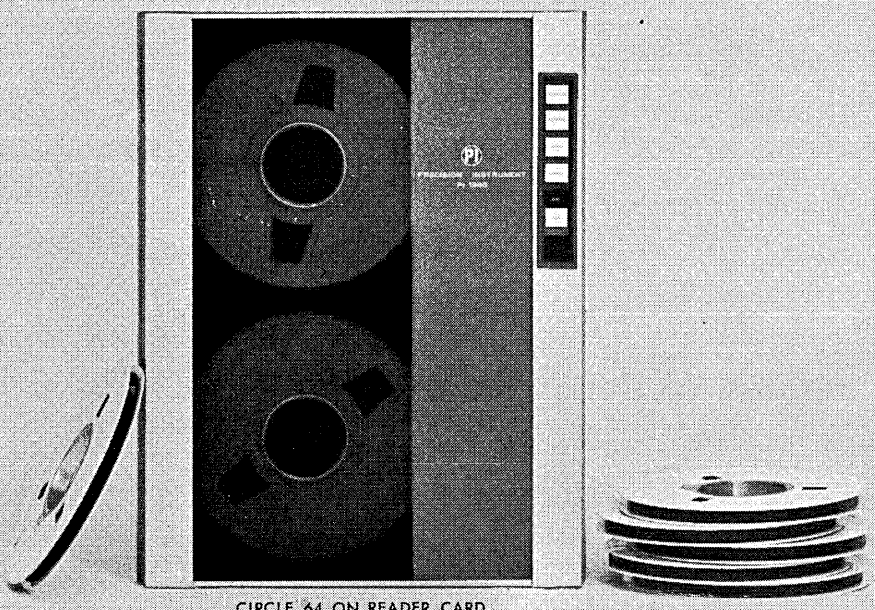

CIRCLE 64 ON READER CARD

washington report

THE COMMUNICATIONS FIGHT: COMSAT VS. COMMON CARRIERS

A substantial reduction in domestic telecommunications rates is the likely outcome of a complex struggle between Communications Satellite Corp. and the common carriers — now unfolding before the Federal Communications Commission. Initial reductions will be in international rates — ranging from 2-40% for voice circuits and 14-50% for Teletype circuits — scheduled to take effect in October. Further cuts are likely.

Pressure for lower local rates comes from a Comsat proposal to the FCC for a domestic satellite system. Scheduled for operation as early as 1969, this new network would reportedly have a rate schedule below existing domestic tariffs.

Nub of the fight right now is control of the ground stations. Comsat argues that if it controlled the stations, it could use some of them for both domestic and international service, spread its rate base further, and thereby reduce rates accordingly.

BROOKS BILL'S EFFECTS BECOMING EVIDENT

Steps are being taken to get the provisions of the Brooks Bill implemented. Ed Dwyer, GSA's chief dp coordinator, now reports directly to the office of the deputy director, instead of to the assistant administrator for finance. This follows issuance of LBJ's June 28 directive, telling agencies to "cooperate fully" with the BOB, GSA, and NBS.

The Budget Bureau, promoting support for the bill, seems to be gaining the upper hand. Case in point: the Navy, which recently decided to purchase nine H-200's for use at public works offices here and abroad, has been "persuaded" by the BOB to fill at least part of the gap by using available time on existing equipment.

BURROUGHS FIGHTS CONTRACT TO IBM

Last May, the U.S. Geological Survey decided to buy a 360/65, a mod 30, and four 20's (plus more later) to implement a nationwide on-line network. IBM won the contract, apparently after a last-minute change in specs. Burroughs, one of the unsuccessful bidders, says it wasn't told of the change. In letters to Geological Survey director W.E. Pecora and to Interior Secretary Udall, the company has questioned this and several other aspects of the award. The case is now under review, reports Pecora.

INFORMATION, PRIVACY, AND THE NATIONAL DATA CENTER

Last year, Rep. Arnold Olsen introduced legislation giving the Census Bureau authority to set up a National Data Center. That bill, HR 11779, is still pending. Another bill, however, to control the uses and users of the proposed center is being drafted by Rep. Robert N.C. Nix.

The center, brainchild of the American Economics Assn., is to fill an information gap that allegedly hampers scholarly research. Some, however, see it as an Orwellian big brother.

CAPITOL BRIEFS

Ivan Sutherland is leaving ARPA at the end of August, becomes associate professor of electrical engineering at Harvard in October. Sutherland's replacement is his present assistant, Robert W. Taylor...Dr. Sam Alexander, Norm Ream's assistant at the NBS Center for Computer Sciences & Technology, has been named a senior research fellow — an NBS first.

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APOLLO/GEMINI:

How do you verify a flight program into the unknown?

Mr. R. S. Woodruff, Manager,
Scientific and Engineering Programming Department
Houston Aerospace Systems Division
Lockheed Electronics Company

The challenge we face down here in Houston is, "How do you find out if Apollo and LEM are going to work *before* they lift off for manned exploration of the moon?"

The theoretical answer is, "With total simulation to achieve, ideally, one hundred percent reliability." If this total simulation is itself correct, then the ideal can be achieved. But how do you simulate with complete accuracy a flight into the unknown? This is the heart, and therefore the fascination, of our work.

Essentially, our work here in this department is the analysis of spacecraft missions, which includes the verification and validation of softwear used in the guidance and control of the spacecraft. Right now, as I have said, we are carrying out a detailed analysis of the Apollo mission by means of digital simulations. This involves the simulation and programming of Apollo's on-board computer, and then worrying it with the environment and other vagaries of the flight conditions. And the fascination lies in the fact that our work has a real, vital place in determining the success or failure of manned spaceflight missions.

To help us in this fascinating work, we have here in Houston what is almost certainly the largest and most up-to-date information processing complex, with seven computer systems, including real time computers, data conversion equipment controlled by computers, and priority interrupt systems.

To work with these systems on the Apollo program, we need senior computer programmers and analysts, both of the highest caliber. We are looking for men who relish tough problems, who are looking for professional growth, and who enjoy working with others of like ability and ambition. The program will not end when we set a man on the moon; as a matter of fact, some of us are beginning work on the application of Apollo technology to the exploration of the solar system.

Your work in Houston will permit you to undertake evening graduate courses through the doctorate level if you desire. And family living is unsurpassed. A magnificent community with fine schools, sailing, fishing, golf and attractive homes has grown up around the Manned Spacecraft Center. Theaters, museums and all the other cultural and entertainment advantages of a large metropolitan area are a few minutes drive away in Houston.

If you are a programmer or an analyst, drop me a note today outlining your experience and qualifications, or, if you prefer, telephone collect to my associate, Mr. R. K. Glasgow, at (713) HU 8-0080. We will be glad to supply you with any further information you may desire.

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Computing Engineers

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Salary range: $8,000-$30,000. All expenses paid by client companies (fees, interviewing and relocation). Submit your resume in strict confidence, including salary requirements and geographic preference, directly to Mr. R. L. Keilholtz or Mr. Donald Wayne, or write for our composite resume form.

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The kind of EDP hardware we can offer you is the kind you might enjoy. For example, we have had three IBM 7010's sharing over one and one half billion characters of random access storage supported by 360's and 1460's. Scientific applications are supported by an IBM 7044, 360/40 and two SDS 930's. More important, perhaps, is the way we're using this equipment—pushing it for all it's worth, and more—to develop the techniques we will need for next generation equipment. We are already using mass random access, message switching and remote computing in varying degrees.

Most important are our plans for the latest in computer capability—a large-scale, remote-access, time-sharing system. We believe this tool can be an integral part of a business organization—and we intend to prove it!

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Develop programs required for computer solution and processing; prepare detailed flow charts. Write required and associated documentation and write appropriate machine language or symbolic language instructions; receive instructions and explanations of the over-all programming objectives of the project and his assignment from his supervisor. Will be responsible for implementing programs, making octal and symbolic corrections to the operational and/or applicable programs; analyze and describe problems so that other personnel may locate and correct faults. He will work with well-defined problems and concepts under the guidance of Program Analyst and/or as directed by section supervisor.

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(Two or more years' of directly applicable experience in programming or computer operation.)

Write and/or participate in the preparation and debugging of machine language or symbolic language instructions and work from detailed flow charts and/or detailed mathematical equations under the guidance of Sr. Programmers and Program Analysts.

For more information, forward your resume in strictest confidence to Mr. J. J. McMahon, Room 30H, ITT Federal Laboratories, 500 Washington Avenue, Nutley, N.J.

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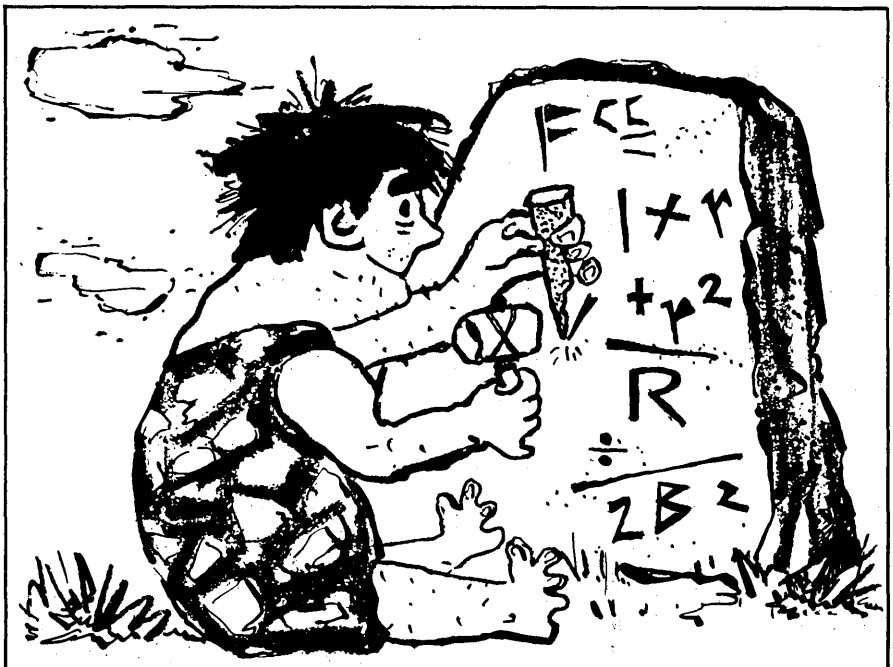

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people

■ Dr. Robert R. Coon has been appointed vp and director of technical planning for Sperry Rand's Univac Div., Philadelphia, Pa. George H. Geick was named vp and general manager of Univac's International Div. succeeding David H. Baker who has been chosen vp, international operations, for the Sperry Rand Corp.

■ Richard C. Lemons has been elected vp, Washington D.C., for Informatics Inc. He was formerly manager, Washington Information Processing Region, for G.E.

■ Salvatore Parisi, president of Tabulating & Data Processing Corp., New York City, has been elected president of the Assn. of Data Processing Service Organizations (ADAPSO). Vice president is F. R. Lautenberg, vp, Automatic Data Processing Inc.; treasurer, Bernard Goldstein, Computech Data Center, Control Data Corp.

■ Lauron Lindstrom, formerly with IBM, and Ernest Butts, Bjorn Heglie, and Lance Clifford, all previously with Pacific Power & Light, have established COMTEK Inc. to provide programming and consulting services in Portland, Ore.

■ Irvin Vincent Voltin is chief of the computer services division, NBS Institute for Applied Technology. He was previously director of the Univ. of Alabama Computer Center. Robert E. Rountree Jr. has joined the staff as a systems analyst.

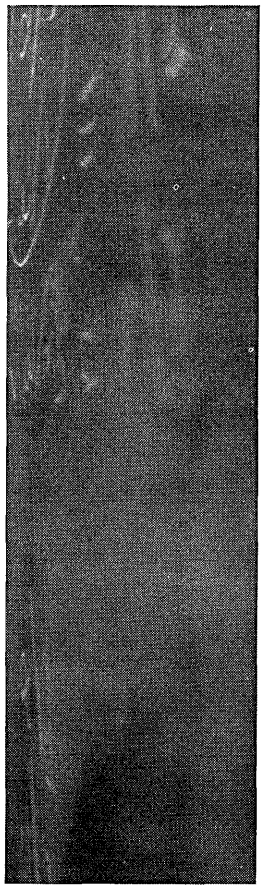
■ Dr. Richard I. Tanaka has been elected vp of California Computer Products, Anaheim, Calif. Before joining CalComp, he was the senior member for computer research, Electronic Sciences Laboratory, Lockheed Missile & Space Co., Palo Alto, Calif.

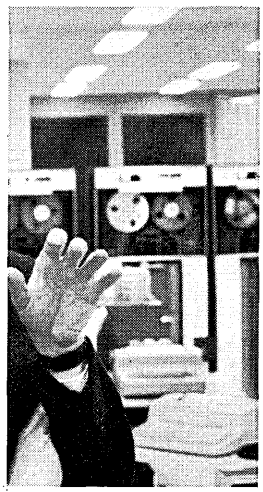
■ Vincent Swoyer has been named director of the Univ. of Rochester Computing Center. He succeeds Thomas A. Kennan who was recently named information systems planning director for the university.

■ Philip R. Vance has been chosen to head the new department, command and management systems planning and engineering, the MITRE Corp., Bedford, Mass.

Top: Kenneth Iverson (*A Programming Language:* Wiley, 1962; *Automatic Data Processing:* Wiley, 1963, co-author F. P. Brooks, Jr.; *Elementary Functions:* Science Research Associates, Inc., in press) has used his language in a formal description of IBM System/360. It is now being used to write a formal description of advanced software.

Left: David Sayre, left, and Robert Nelson (members of the original FORTRAN team) use a remote console of a time-sharing computer now in operation at IBM. The machine was designed specifically for programming research, with a wide variety of timing and measuring features to permit evaluation of programming performance.





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Center: Herbert Gelernter ("Empirical Explorations of the Geometry-Proving Machine": *Proceedings of the Symposium on Mathematical Theory of Automata*, Vol. XII: Polytechnic Institute of Brooklyn, 1966), left, and Heinrich Ernst ("MH-1 A Computer Controlled Mechanical Hand," *Proceedings of the Spring Joint Computer Conference:* National Press, 1962), right, discuss the adaptive checker-playing program with Arthur L. Samuel, center, editor of *IBM Journal of Research and Development.*

Right: William S. Dorn (*Numerical Methods and FORTRAN Programming:* Wiley, 1964; *Mathematics and Computing:* Wiley, 1966) oversees the IBM Research Computing Center, which will install a System/360 Model 67 this fall.

books

Technology and the American Economy: Report of the National Commission on Technology, Automation, and Economic Progress, Volume 1; Government Printing Office, 1966.

The thin volume under this title (which the public has already shortened to "the Automation Commission Report," and which will be followed by further volumes of supporting materials) has, within less than a year, altered the context and terms of the national debate about the effects of automation on employment. It is not long ago that many people in industry, labor, the government—and the country generally—were concerned that the mechanization and automation of production would put many people out of work permanently. There was much talk that something would have to be done about computers and other machines if the level of employment in the country was to remain high.

Today, such talk has largely died down, mainly for two reasons. First, unemployment is now lower than it has been for years. Second, the Automation Commission Report—backed by such authorities among its members as Edwin Land, Walter Reuther, Thomas J. Watson, Jr., and MIT Professor Robert Solow, with the advice of much of the President's Cabinet—has convinced most knowledgeable and reflective people that the link between automation and employment is not nearly so direct as was once thought.

The two major conclusions of the report are: 1) there is no automatic guarantee of full employment, irrespective of the rate of technological advance; 2) nothing foreseeable over the next 10-15 years suggests that an active conventional economic policy cannot steer the economy in a way that will keep employment full and rising.

There is an important qualification. There will certainly be serious transition problems for particular individuals, industries, and occupations as technological advances change the mix of capital equipment and labor skills that the economy requires, and the most specialized occupations and industries will in general be the most vulnerable to change. Social welfare measures will therefore be necessary to cushion these shocks of transition.

But there is no evidence of a *worsening* mismatch between needed skills and available skills. There is, in other words, no evidence of a growing group of unemployables. There is unquestionably an upgrading of the skills needed by the economy, but the level of skills is also rising as a result of better training.

The commission found it very unlikely, finally, that workers will need increasingly to accept low wages in order to compete with presumed more efficient machines. Real wages generally keep pace with increases in productivity, and there is no evidence of a progressive impoverishment of the labor force.

These findings facilitate distinction of two related but basically different questions. The first is a question of economic analysis about which a great deal is known, which is susceptible to well-developed and rigorous methods of inquiry, and on the dimensions and implications of which there is a high degree of consensus among the professionally competent. The consensus is that there is not much that is significantly new in the probable consequences of automation for employment. Automation is but the latest form of mechanization, which has been recognized as an important factor in economic change at least since the Industrial Revolution.

What *is* new is a heightened social awareness of the implications of machines for men, which derives from the unprecedented scale, prevalence, and visibility of modern technological innovation. The second question, therefore—which is not dealt with in the report—while one of work, to be sure, is not mainly one of employment in the economic connotation of the term. It is a distinct question that is often confused with the economic one because of the accident that brought it to the public consciousness in the context of the effects of automation on employment. It is less a question of whether people will be employed than of what they can most usefully do given the broader choices that technology makes available. It is less a technical economic question than a question of the values and quality of work. It is not primarily a question of what to do with increasing leisure, but of how to define new occupations that combine social utility and personal satisfaction.

In contributing to the distinction between these two kinds of questions, the Automation Commission Report has raised the level of public discourse about both.

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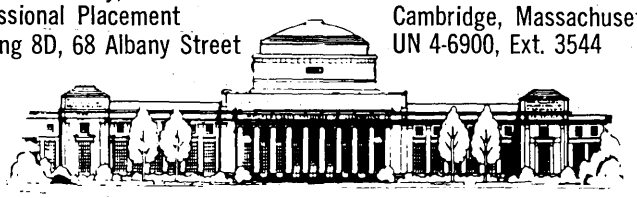

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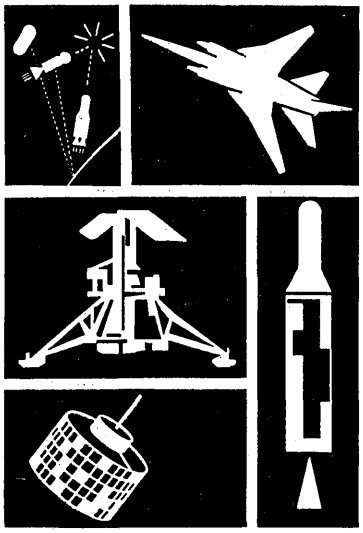

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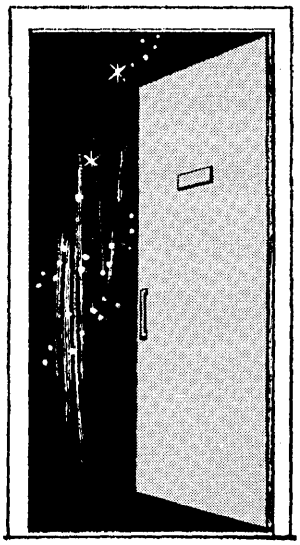

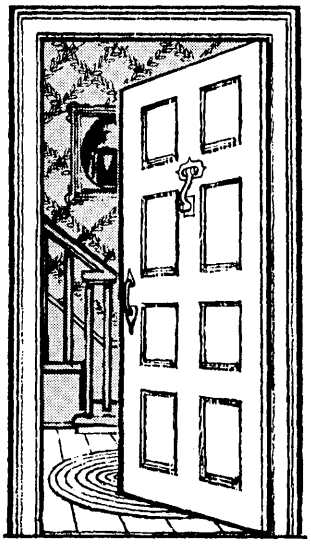

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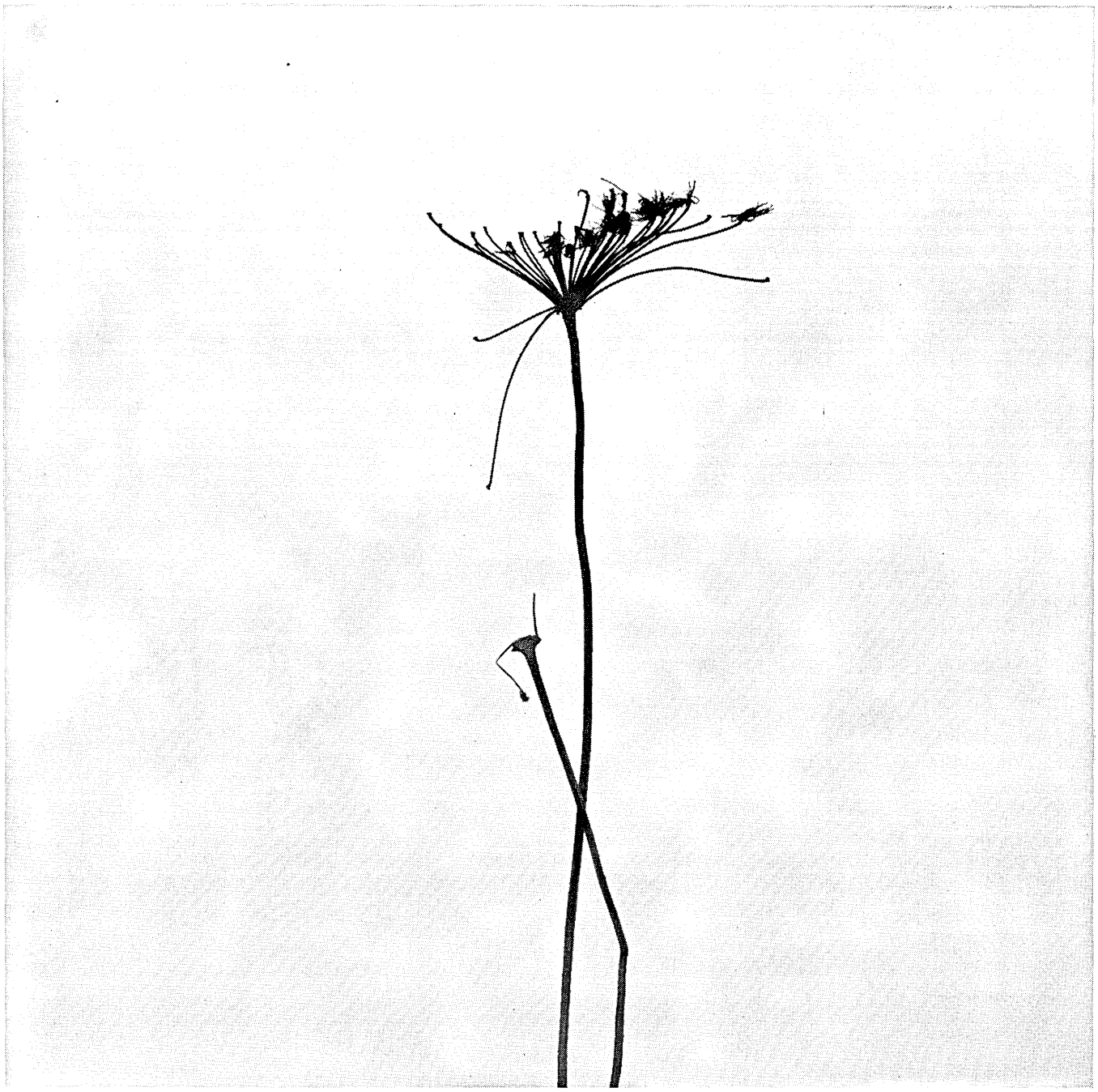

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the forum

The Forum is offered for readers who want to express their opinion on any aspect of information processing. Your contributions are invited.

REAL-TIME MANAGEMENT INFORMATION? LET'S NOT BE SILLY

Inevitably, as real-time systems assume an increasingly important role in many industries, the general business publications must come to venture into the real-time world. Last year, for instance, there was Fortune's excellent series on "The Computer Age." And now we find the Harvard Business Review, the prestigious elder statesman of these journals, providing commentary on the subject in its pages. The May-June issue of HBR harbors not the genteel and judicious overview that one might have expected, but rather a crude frontal assault by John Dearden on the "Myth of Real-time Management Information."

Professor Dearden, who is a sort of house oracle on information systems at the B School, thinks that real-time management information systems are silly. He says so plainly at the beginning of his polemic and at the end. He even says so in the middle.

Things get off to an interesting start with an assertion that "allegedly, a real-time management information system enables the manager to obtain complete and up-to-the-minute information about everything that is happening within the company." The reader is left to puzzle out for himself who, besides Mr. Dearden, would make such a sweeping allegation. Certainly no responsible real-time system designer, who has learned to be wary of words like "complete" and "everything." Up-to-the-minute information about *everything*?

With this for openers, the author proceeds to identify three characteristics of a real-time system, all irrelevant to an evaluation of management's need for timely information. He says first that "data will be maintained 'on-line.' In other words, all data used in the system will be directly available to the computer—that is, they will be stored in the computer memory or in random access files attached to the computer." This statement, of course, blithely ignores the fact that one can provide real-time management information without maintaining all data on line. To the contrary, most system designers contemplate a hierarchy of storage, with only the most critical data stored in main memory or direct access storage and the less critical and more voluminous files maintained on magnetic tape and other less expensive media.

Next, Mr. Dearden asserts that, according to his view of a real-time system, "data will be updated as events occur." He does not perceive that one can do a splendid job of providing real-time management information from a data base which is maintained by off-line techniques. This is, in fact, exactly the method by which the central information files of several real-time commercial banking systems are updated.

Thirdly, Professor Dearden says that real-time systems are characterized by computer-stored information which "can be obtained on request from a number of locations at a distance from the place where the data are processed and stored". He thus singles out one of the most expensive features of certain real-time systems, such as SABRE, but neglects to note that a real-time management information system need not necessarily have remote terminals at all. There are perfectly respectable systems housed entirely under one roof and possessing no more than one or two terminals to provide real-time management information.

The body of Mr. Dearden's paper is devoted to a discussion of several basic managerial functions and to a consideration of the appropriateness of real-time systems in supporting these functions. The first is Management Control. Here, Mr. Dearden somewhat grumpily concedes that "it may be useful to have a computer available at the time of the budget review to calculate the effects of various alternatives suggested by management" but his previously defined view of real-time systems leads him to conclude that usage of the computer in this fashion "is not a real-time system, since a computer console need be installed only for the review sessions." Seemingly, Mr. Dearden feels that a system cannot qualify as real-time unless it makes information available when it is *not needed*. Actually, the hallmark of a real-time information system is its responsiveness to managerial needs, not how many consoles it drives or how frequently these consoles are connected on line.

Another management function which Mr. Dearden analyzes is that of Early Warning about potentially troublesome managerial problems. Here he expresses the somewhat startling opinion that "early warning has not been a problem in any top management control system with which I have been acquainted." One wonders how many of Mr. Dearden's executive readers would concur in this curious judgment.

In considering the management function of Strategic Planning, the author concedes "that past data are required to forecast future events," but goes on to complain that "these need hardly be continuously updated and immediately available." Absolutely correct, but the information is nonetheless needed in real-time *during* the planning session.

Personnel Planning is another management function identified by Mr. Dearden. In solving problems of personnel planning, "about the only advantage" that he can see to a real-time system "is that information becomes available somewhat more quickly." Perhaps the professor is making progress after all, for one must agree that,

while this may not be the *only* advantage to any real-time system, it is an advantage which is oftentimes of critical importance in personnel or any other kind of planning.

Mr. Dearden concludes his survey of top management functions by discussing the applicability of real-time systems to Operational Control. He says that "it is very difficult to generalize about this situation" before going on to generalize later in the same paragraph that "I cannot believe that there would be many instances where a manager would be concerned with operating problems to the extent that a real-time information system operating from his office would be justified."

Are you beginning to get the idea? Set up some straw men in the form of assertions that no self-respecting system designer would utter, then proceed to demolish them. The notion of the console in the office is perhaps the author's favorite straw man. Either that or he is genuinely unaware that it is a matter of the utmost indifference whether a manager prefers to obtain his real-time information directly or through staff assistants who operate the consoles.

If you stay with him to the end, Professor Dearden offers some fascinating conclusions. He believes that "there is little danger of a company president waking up some morning to find his chief competitor has installed a computer-based, decision-making system so effective that it will run him out of business." There are many systems professionals who hold the opinion that this is a clear and present danger, particularly in the case of company presidents who heed the type of counsel provided by Mr. Dearden.

The author winds things up with what could very well go down as one of the most inappropriately chosen analogies in contemporary business literature when he compares the development of real-time systems to that of the automobile. He says "It would have been foolish for a businessman to get rid of his horse-drawn vehicles just because some visionaries said that trucks would take over completely in 20 years."

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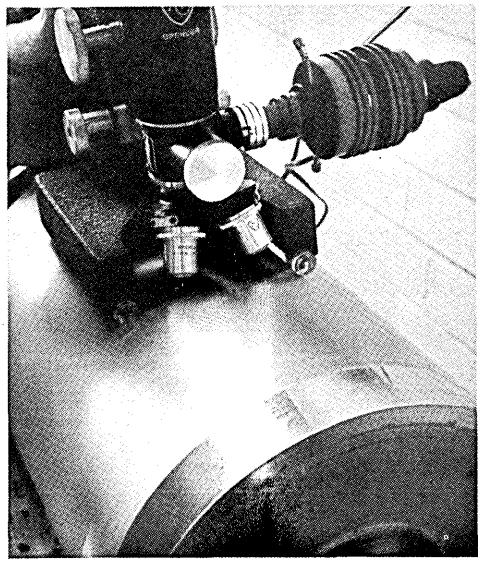

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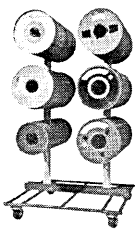

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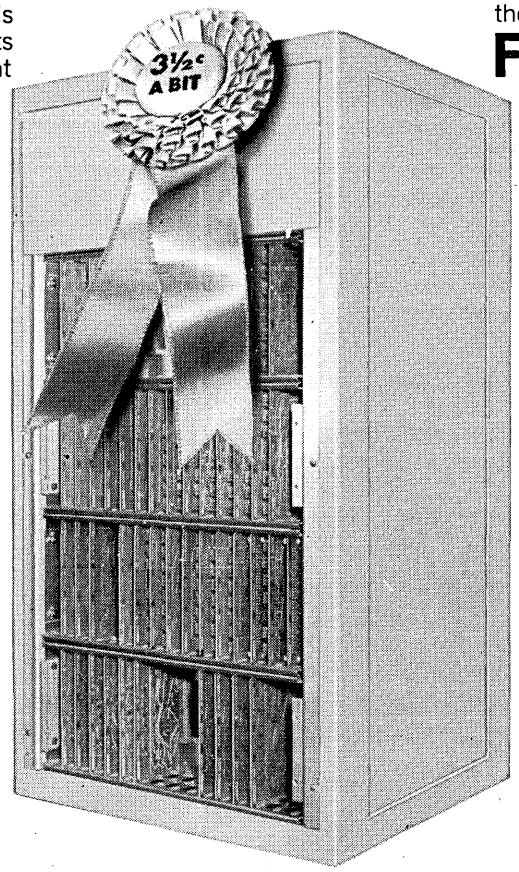

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