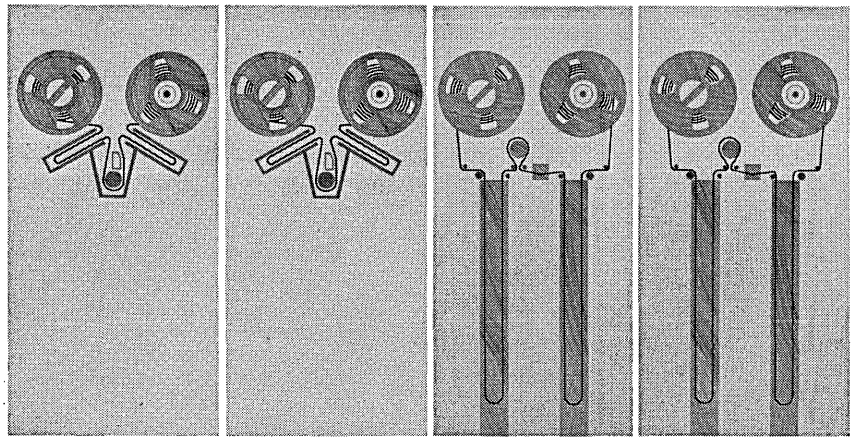
DATAMATION®

66

January

Only Ampex gives you a complete family of interface interchangeable single-capstan tape transports.



What are your EDP system needs?

TM-7 for up to 45 ips, 36 KC
TM-9 up to 75 ips, 60 KC
TM-11 up to 120 ips, 96 KC
TM-12 up to 150 ips, 120 KC.

All with servo-driven single-capstan drives.

All generating tapes up to 800 cpi, fully IBM/ASCII compatible.

Now one source meets all your data transfer requirements: Ampex. Only Ampex gives you a family of servo-driven single-capstan digital transports with a complete range of drive speeds and data transfer rates—from 0 to 120 KC. *All units are interface interchangeable.* This allows you to easily pick the drive to match the requirements, and change the drive if requirements change. Also, you can select exactly what you need: just a transport, or the transport with electronics and control, or a system comprising several transports with time-shared data electronics and control.

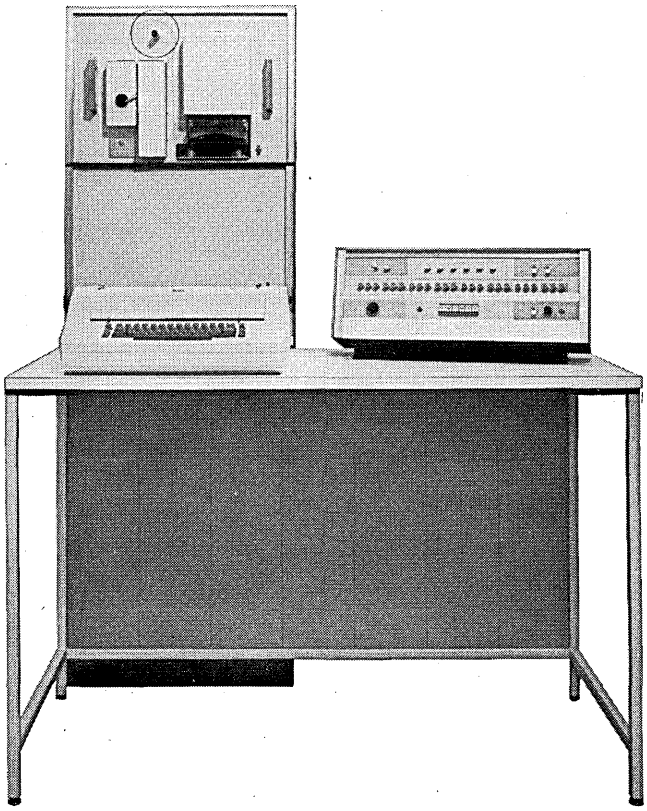
Ampex transports meet or exceed the reliability of the equipment they serve. You get at least 2,000 hours mean-time-between-failure and at least one billion start/stop operations before start/stop mechanism replacement parts may be needed. Also, the single-capstan design eliminates problem parts and tape path adjustments. Result: more uptime, greater accuracy, performance to specification, all at lower cost.
Write for complete details.
Ampex Corporation,
Redwood City, California.

AMPEX

CIRCLE 1 ON READER CARD

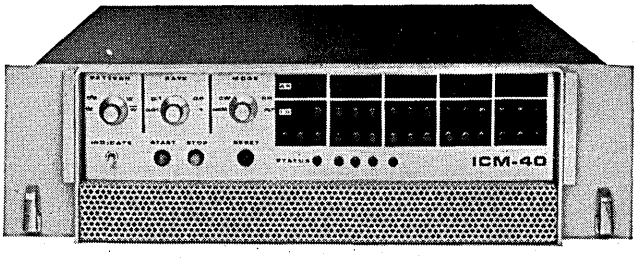
ONLY 3C OFFERS

TOTAL INTEGRATED CIRCUIT CAPABILITY: μ-PACS, MEMORIES, AND COMPUTERS



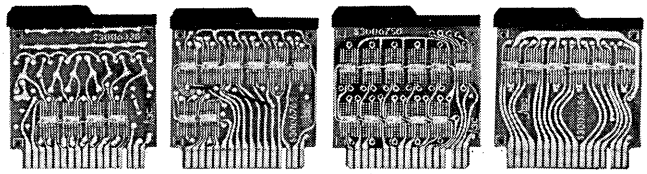
MICROCIRCUIT DDP-124

24-bit word DDP-124 features monolithic integrated circuit μ-PAC^{tm} construction; fast, reliable, and flexible logic configuration — binary, parallel, sign/magnitude, single address with indexing, powerful command structure. Over 285,000 computations per second. MEMORY: 8192 words (expandable to 32,768) directly addressable; cycle time 1.75 μsecs. INPUT-OUTPUT: Typewriter, paper tape reader and punch. (Strong optional I/O capability and broad range of peripheral equipment.) SOFTWARE: FORTRAN II and IV, assembler, executive, utility and service routines. Fully program compatible with DDP-24 and DDP-224 general purpose computers.



INTEGRATED CIRCUIT 1 μSEC CORE MEMORY

New ICM-40 microcircuit, coincident current, random access core memories feature full cycle operation in 1 μSEC (less than 500 nsec access time). ICM-40's feature price, size and reliability advantages of integrated circuit μ-PAC^{tm} logic. Word capacities to 16,384 in a 5¼″ high unit for mounting in a standard relay rack. Design permits pull out front rack access. Operating temperatures from 0°C to +50°C, with broad margins. Clear/Write, Read/Restore and Read/Modify/Write are standard modes of operation. ICM-40 interfaces comfortably with both discrete component and integrated circuit systems. Low power dissipation.



μ-PAC LOGIC MODULES

3C is the world's largest supplier of digital logic modules. With several years of in-house funded research and design, 3C has developed a broad line of standard, fully integrated, monolithic, 5mc circuit modules with the flexibility of 3C's long established discrete package lines. This has been achieved while retaining advantages inherent in the integrated circuit — price, size, reliability.

3C SALES OFFICES: NEEDHAM, MASS.; FOREST HILLS, N.Y.; LEVITTOWN, PA.; SYRACUSE, N.Y.; SILVER SPRING, MD.; HOUSTON, TEXAS; HUNTSVILLE, ALA.; COCOA BEACH, FLA.; DES PLAINES, ILL.; DETROIT, MICH.; WEST CARROLLTON, OHIO; LOS ANGELES, CALIF.; KENT, WASH.; ALBUQUERQUE, N.M.

COMPUTER CONTROL COMPANY, INC.
OLD CONNECTICUT PATH, FRAMINGHAM, MASSACHUSETTS 01702

CIRCLE 4 ON READER CARD

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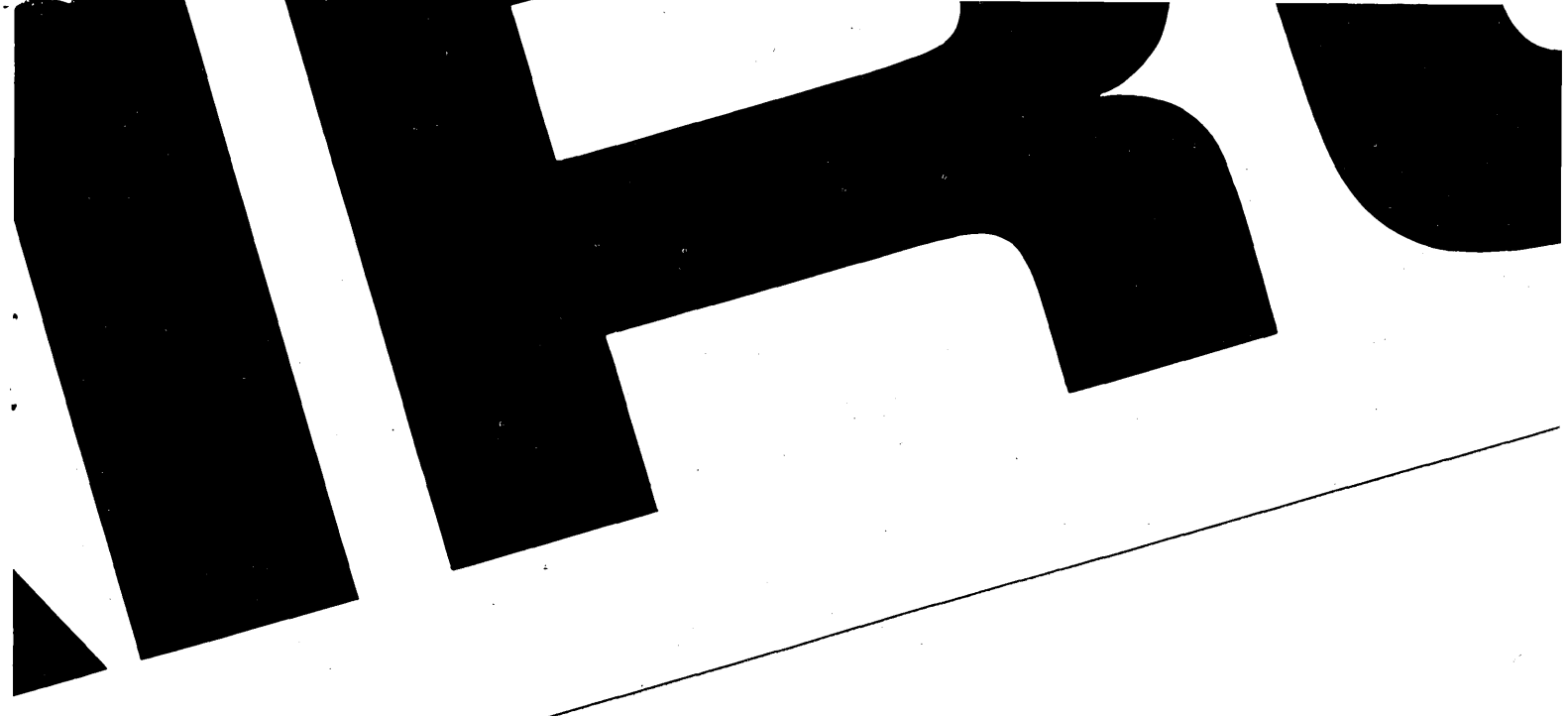


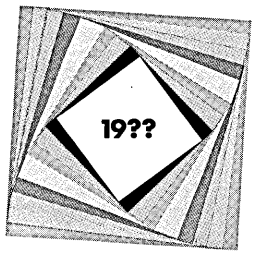
Some people still design third generation computers without Micrologic* integrated circuits.

Some people still make crystal sets, too.

CIRCLE 5 ON READER CARD

*Micrologic is Fairchild Camera and Instrument Corporation's Trademark for its Analog and Digital Monolithic Circuits

DATAMATION



january
1966

volume 12 number 1

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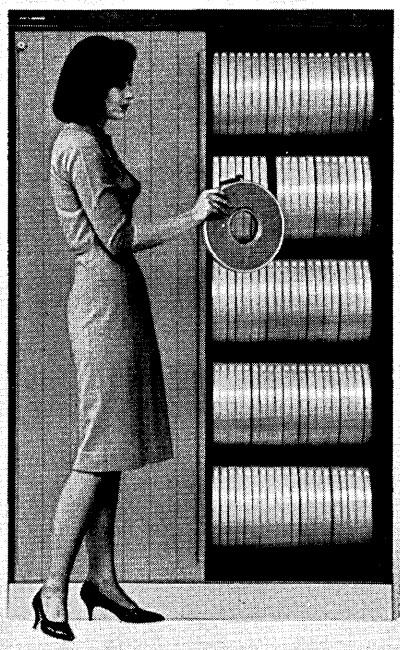
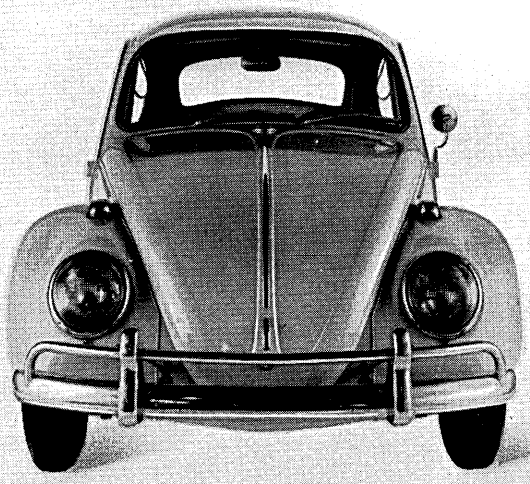
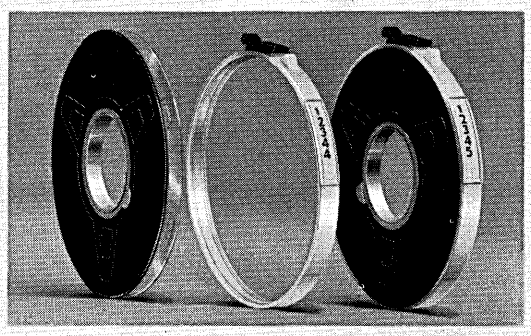




There are all kinds of space-savers.

The one on the left is called the TAPE-SEAL™ System.

It takes the bugs out of tape storage and handling.



You get a lot more mileage out of a tape library with the Tape-Seal System*. This new system for storing and handling computer tape features a unique belt that is 45% narrower and 90% lighter than a canister. Because the belt hangs in storage, it doesn't need wire supports like a canister does. In the floor space you're now using to store 96 tapes in canisters, you can store 200 in Tape-Seal Belts. Handling? A breeze. Tape protection? Better than ever. Labelling? A real pleasure, for the first time. So write for complete details soon, won't you? Before tape storage problems drive you buggy.

(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

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

CIRCLE 62 ON READER CARD

Mayday!

Ever have days when you get this sinking feeling? Tape problems — transport problems — dropout problems?

Next time maybe we can help. Before you go down for the third time, call your nearest Computron Regional Office and shout "Mayday". Your Computron customer engineer will be on his way in a trice. He is fully qualified in all phases of EDP. He is not a salesman. He knows tapes — he knows computers — and he has had a great deal of experience in getting them to talk to each other.

Of course, many people have solved their data recording problems simply by switching to Computape.

In any case, we are at your service. For advice, application assistance, problem solving, or just a reel of tape, call your nearest Computron office.

A PRODUCT OF COMPUTRON, INC.
MEMBER OF THE BASF GROUP
122 CALVARY ST., WALTHAM, MASS. 02154

CIRCLE 8 ON READER CARD

DATAMATION 66®

january
1966

volume 12 number 1

Momentarily abandoning its usual short-sighted concern with today's problems, Datamation this month takes a far-out look at how today's technology will affect various disciplines in 19??.

automatic
information
processing
for business
industry & science

datamation departments

More on large-scale hybrid computation and the EAI® 8900 from Walter Brunner

Walter Brunner continues his observations on hybrid computation. The comments here put particular emphasis on the software requirements for hybrid simulation.

Mr. Brunner has been with Electronic Associates' Princeton Computation Center for the past eleven years and has been director of the Center since 1961. During this period, he has helped solve hundreds of customer problems covering the complete spectrum of simulation applications. Walter was among the first laboratory managers responsible for tying an analog and digital computer together, as the Princeton Computation Center began operating its first hybrid computer in the fall of 1961. Walter and his staff have continually worked with hybrid problems from many areas of application. Throughout this period, he has made this experience available to the design team working on the newest EAI hybrid computer, the EAI 8900 Scientific Computing System. A few of the more important criteria he recommended to the design team are presented on these pages.

BRUNNER. *"Just as important as efficient equipment utilization is efficient programming, so that programs can be written simply and rapidly."*

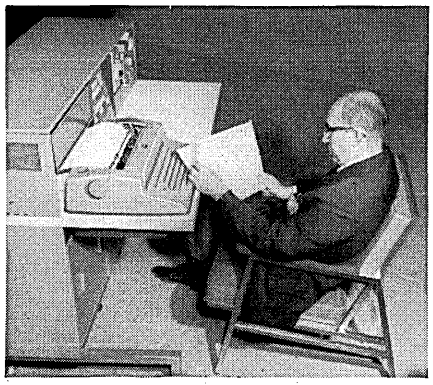
EAI 8900 Hybrid Computing System:

The EAI 8900 is a large-scale hybrid computer designed as a fully-integrated, standard system of hardware and software. It consists of an EAI 8800 Analog Computing System, an EAI 8400 Digital Computing System and an EAI Control and Data Interface System. This equipment and each of its major elements has been designed for efficient, practical, and productive hybrid computing.

8900 DESIGN. The 8900 incorporates many programming features that simplify and reduce the effort required by the hybrid programmer. The capability of using FORTRAN for the majority of digital computer operations results in significant time savings. Within the FORTRAN source coding the programmer can use the analog and conversion control commands, assembly language sub-routines, and for the most critical speed requirements, in-line assembly language coding, all interspersed within the FORTRAN as required.

Another programming aid is the execution time information produced as part of the FORTRAN compiling process. Accurate statements of execution time for any program section will be produced, thus providing the data for working in a real-time computing environment. Also valuable to real-time computing are pseudo-clocks and their pseudo-interrupts that can be used conveniently to call for specific program routines at periodic intervals under program control.

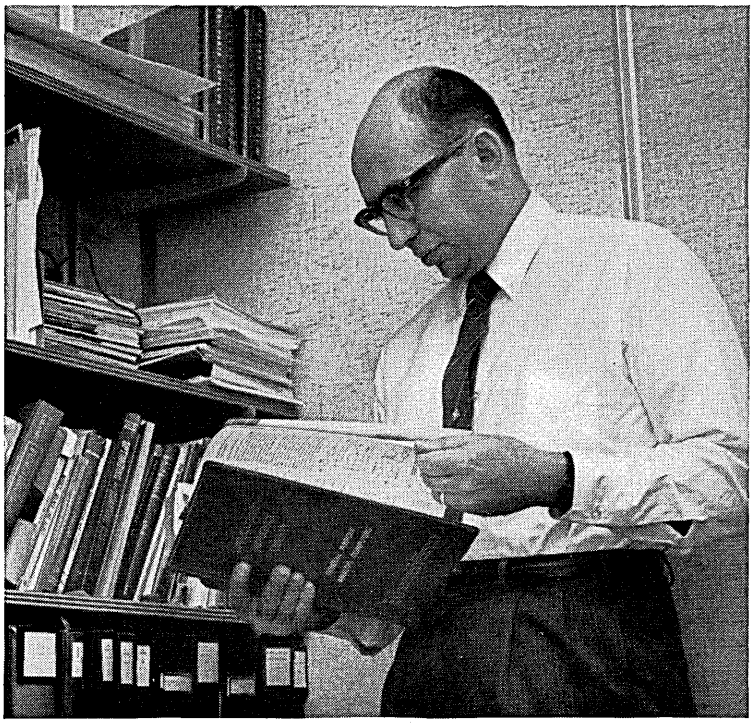
Further simplicity in hybrid programming is achieved through a library of hybrid-oriented subroutines. A family of integration algorithms is provided, including appropriate initialization and the ability for change of time base. Generation of functions of one and several variables, and transport delay routines are also provided.



BRUNNER. *"Good debugging tools are extremely useful to the simulation laboratory manager in achieving the most efficient utilization of his large-scale hybrid computer. As the problems we simulate become more complicated, it is important to free the design engineer from the details of the programming to devote his attention to the problem."*

8900 DESIGN. The EAI 8900 is equipped with powerful debugging tools to minimize unproductive computer time.

Digital program debugging is accomplished by the SPECTRE debug software. SPECTRE is a conversational, keyboard-entry program used by the operator to "talk" to the computer. It permits the user to look at any memory location, which he can address by symbolic name. The contents of the memory cell will be disassembled from machine language and typed out in assembly mnemonics and programmer-specified symbols. Modifications to the program can be made by inserting or deleting instructions. The memory storage space is automatically adjusted by the 8400's unique capability of dynamic storage re-allocation so that the corrected program remains as one continuous block of instructions.



Analog program debugging is simplified by the HYTRAN Operations Interpreter with its static check and diagnostic capability. Additionally, preventative maintenance panels for the 8800, used in conjunction with the 8400, may perform a rapid and complete hardware checkout.

As one of many other hardware features contributing to easier debugging, the 8900 System Fault Interrupt is used to report faults and indicate which one of a variety of conditions or malfunctions has occurred—amplifier overload, invalid address, servo-set attenuator null failure, power supply failure, etc. This alone can save considerable trouble-shooting effort by immediately identifying a possible source of error in the problem solution.

BRUNNER. *"Finally, the importance of good software in a hybrid computing system has been demonstrated clearly in many hybrid labs, and certainly it is important to my people here at Princeton. The full potential of hybrid software will be realized with the growth of commonly used software packages. The demonstrated capabilities of various programs such as APACHE, MIDAS, MIMIC, etc., should be merged and integrated into a common system of software which incorporates the ideas of the simulation language being formulated by Simulation Councils, Inc."*

8900 DESIGN. The EAI 8900 is a standard hybrid computing system supported by an extensive software system and a significant program of follow-on software development. The HYTRAN simulation language, which is based on the Simulation Councils' simulation language, is a system that encompasses the capabilities of earlier digital simulation programs such as MIDAS and MIMIC for dynamic check solutions, and also includes many additional hybrid-oriented features. In addition, it is the vehicle for EAI research into implementing an automatic analog programmer and other more comprehensive hybrid capabilities. Such a program is only possible because of the substantial number of 8900 systems that will be in use. This also makes possible the benefits of a user's group. Such a group is now being established to afford its members the opportunity to learn from each other's experience and share the results of each other's programming efforts.

A complete text of Mr. Brunner's remarks on hybrid computation and the successful development of necessary hardware and software is available on request. We will be pleased to furnish detailed data on the EAI 8900 Scientific Computing System as well.

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
5.5-7.0 μsec floating point multiply
64K memory capacity
7 hardware index registers

The EAI 8900 Software
FORTRAN IV
Macro Assembler
SPECTRE Debug 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.

EAI®
ELECTRONIC ASSOCIATES, INC., *West Long Branch, New Jersey*

CIRCLE 10 ON READER CARD

calendar

● Symposium on simulation languages will be held in March, Univ. of Pennsylvania, Philadelphia. Application deadline is Feb. 1.

● Business show and midwest management seminar is scheduled for Feb. 8-11, Conrad Hilton Hotel, Chicago. Co-sponsors are the Administrative Management Society, Chicago Chapter, and Northwestern Univ.

● Computer Usage Education Inc., New York, has scheduled two seminars: "IBM System/360 Software: Plans and Prospects," Feb. 8-10, Hotel Somerset, Boston, and "Information Retrieval: Today and Tomorrow," Feb. 23-25, Marriott Twin Bridges Motor Hotel, Wash., D. C.

● American Univ. is sponsoring courses: "Eighth Annual Institute on Information Storage and Retrieval," Twin Bridges Marriott Motor Hotel, Washington, D.C., Feb. 14-17; "Short Course on Electronic Information Displays," Twin Bridges Marriott, March 7-10. Fees: $175 and 200.

● Calif. Analysis Center, Inc. will give a course on SIMSCRIPT programming language Feb. 14-18, Santa Ynez Inn, Pacific Palisades, Calif. Fee: $250.

● Institute of Management Sciences will meet Feb. 16-19, Hotel Statler Hilton, Dallas, Texas.

● SHARE XXVI will meet Feb. 28-Mar. 4, El Cortez Hotel, San Diego, Calif.

● Course in theory and techniques of linear programming will be given by Univ. of California Extension, March 15-25, San Francisco, Calif.

● Lomond Systems Inc. and Chevy Chase Travel Inc., Bethesda, Md. will sponsor a group seminar tour for edp executives in eight European countries, March 21-April 7.

● The Div. of Continuing Education, Univ. of Texas Graduate School of Biomedical Science, is sponsoring a symposium "Biomathematics and Computers in Life Sciences," Mar. 24-26, Shamrock Hilton Hotel, Houston, Texas.

How to succeed while you're still young

"Take the initiative. You won't always be right. But knowing business fundamentals will cut your margin of error to the minimum . . . . .

"Actively seek all of the responsibility you can possibly handle. You'll never get anywhere by avoiding the tough assignments . . . . .

"Develop the instinctive ability to make quick, accurate decisions. Business has always reserved its greatest rewards for men of action and courage . . . . .

"Broaden your knowledge of business in a systematic, organized way; learn the problems and viewpoints of all major departments of business . . . . ."

An interview with James M. Jenks, President Alexander Hamilton Institute

THE famed management consultants—Booz, Allen & Hamilton—contend that *"The return of rigorous competition is forcing the improved use of executives. In many cases the margin of competitive success or failure is locked up in the quality of management talent."**

It is in times such as these that seniority is often thrown out the window; and that knowledgeable, ambitious young people are permitted to rise as fast and as far as their ability enables them to go. For business has too much at stake to discriminate on the basis of age.

The man who can do the job, gets the job . . . whether he's 28 or 58.

And today—as in critical eras in the past—top managerial talent is emerging from big and small organizations throughout the country. From engineers, chemists and other technical men. Among salesmen. Accountants. Lawyers. Marketingmen.

Their backgrounds are diverse; but all of these men *share* a compelling force to succeed, and the intelligence to realize that only people with a well-rounded grasp of business functions can direct the activities of subordinates.

A Fascinating "How to Succeed" Plan

Most people are surprised to learn that the average age of our subscribers is closer to 40 than to 20.

And we, in turn, are equally surprised that this mistaken notion has persisted for so long.

After all, rarely does a man mature sufficiently until he is in his thirties to give any serious thought to his future, or to the security of his family.

But the day comes inevitably when he asks himself: "Where am I going to be in five or ten years? Will I be able to put my children through college? Will my estate support my family, for a reasonable period, without the need for additional funds?"

If he's fortunate, acts while time is still on his side and if the program he follows is valid, he frequently becomes successful while he's still young.

All of this, necessarily, is an oversimplification of the problem.

For that reason, we have analyzed the Institute's approach to executive-training problems in written form. The program is outlined fully in a 32-page book titled "Forging Ahead in Business."

This little book is not for children or even the 20-year-old. Rather, it was designed to show the mature, ambitious man how to build his career on a solid foundation—how to cope realistically with the problems everybody must meet and solve before he can hope to aspire to the top managerial level.

A copy is yours for the asking

After having devoted more than fifty years to helping ambitious men help themselves, we're naturally aware of the reasons why some men reach the heights at an early age . . . why others don't hit their peak until years later . . . and why some never do make the grade as major executives.

Surprisingly, native ability and intelligence are not nearly as dominant influences as one might expect (the $50,000 a year man is not five times as intelligent as the $10,000 man.)

Few men work at more than a fraction of their capacity . . . and most are willing to settle for mastery of a single department of business.

Somehow they fail to realize management's need to understand, relate and communicate on an overall administrative level . . . to master the basics of marketing, accounting, finance and production.

While helping thousands to accomplish more in months than they would, ordinarily, in years, the Institute has compiled, analyzed and refined authentic case-history material . . . made depth studies of real and complex business situations. Thus the training is immediately applicable to average everyday business problems.

Many executives have called the Institute's descriptive booklet "One of the most valuable contributions ever made to business literature."

It explains the modern method of attaining success while you're young—while you can still enjoy it to the fullest. Tells you what you must do, what you must know, to make upwards of $15,000 a year reasonably early in your career.

The program it describes is not meant for everybody; but if you happen to fit the pattern of the success-minded man, it's entirely possible that you, too, will find that the Institute's program will bring you a little closer each day to your chosen goal.

There's no charge for "Forging Ahead in Business" because—depending on the individual—it can be worth *nothing* . . . or a *fortune*.

To obtain your complimentary copy, simply fill out and return the coupon below.

**Quoted from June, 1962, issue of "News Front"*

ALEXANDER HAMILTON INSTITUTE
235 East 42nd Street, New York, New York 10017

ALEXANDER HAMILTON INSTITUTE
Dept. 669, 235 E. 42nd St., N. Y., N. Y. 10017
In Canada: 57 Bloor St., W., Toronto, Ont.

Please mail me, without cost, a copy of the book—"FORGING AHEAD IN BUSINESS."

Name_____

Firm Name_____

Business Address_____

Position_____

Home Address_____

CIRCLE 7 ON READER CARD

letters

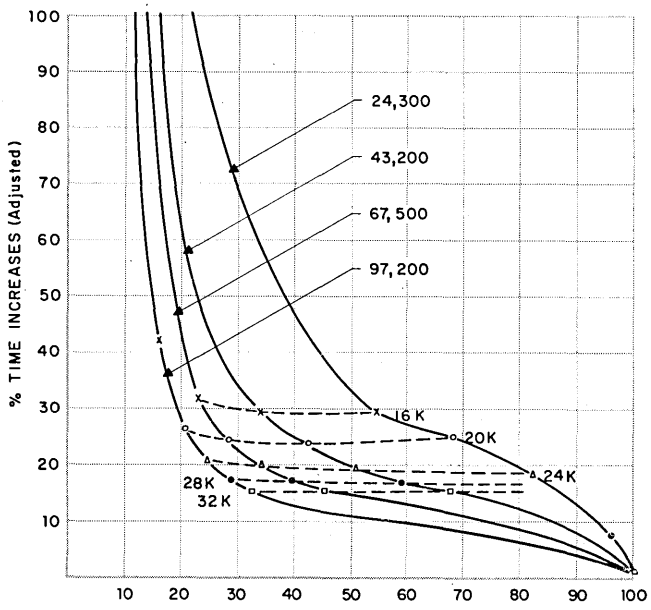
secondary storage

Sir:

In my article, "Automated Secondary Storage Management" (Nov., p. 24), the legend was deleted from Fig. 4. Assuming a philosophical posture, I have concluded this mistake will afford me an opportunity to see if anybody reads my article closely enough to note the omission.

F. B. MacKenzie
Burroughs ElectroData Division
Pasadena, California

Please see corrected version below.



software deliveries

Sir:

Mr. Weisberg's statements regarding the availability of operating systems for multiprogramming ("Computer Characteristics & the Role of Software," Oct., p. 42), fail to do justice to the pioneer in this field. As far back as 1961, Univac has delivered with its U-III, 1107 and 490 the software for these computers, which include operating systems with "extensive" multiprogramming capabilities . . .

I agree with Mr. Weisberg that computers must be delivered with the necessary software, which has to include operating systems (for multiprogramming or, rather, multi-program execution) . . . Such complicated software packages as operating systems . . . will have to be operationally field-tested for a long time, perhaps for years, before such systems can be considered to be "clean."

P. R. D'Anaud-Gerkens
South Pasadena, California

on-line banks

Sir:

I'd like to correct an impression made by a News Brief item (Oct., p. 107) about Bankers Data Processing Inc., which provides on-line dp services for a group of Massachusetts banks. The article made everything sound like "futures."

In August, seven banks were placed on-line during a three-week period. All told, almost 300,000 accounts were converted with no parallel runs, and every one balanced to the penny the first day. Over the Armistice-Day weekend, we added an eighth bank (450,000 accounts), converting it live from ledger cards via on-line terminals from Worcester—a distance of 40 miles . . . By the end of the year (1965), we'll have 12 banks with close to a half-million accounts on-line.

A. F. Montgomery
Burroughs Corp.
Equipment & Systems Marketing Division
Lexington, Massachusetts

casino blackjack

Sir:

In my article in the November issue, entitled "Casinos, Cards and Computers," I suggested that the new

automatic blackjack machines in the Nevada casinos might actually give the smart player an edge. My remark was qualified by the phrase "provided that the deal is truly random." Regrettably, the experiences of a number of persons who tried the machines during the FJCC provided substantial statistical evidence that this assumption may not be true. The electronic dealer seemed to draw winning hands more than his due share of the time! My apologies to any conference attendees who were led astray.

Your readers may be interested to know that after the conference I finally managed to squeeze in two hours of play on the blackjack tables, before having to catch a plane. Betting over a range of $5 to $20, and using my simple Wilson point count system, I came away with a $100 win. In view of the short sample, "luck" played a greater role than skill; my "expected win" was more like $20. Nonetheless, my bets were always higher when the deck was "rich," and I could *feel* the system working for me!

ALLAN N. WILSON
San Diego, California

divisive fortran

Sir:

I have extracted two interesting conclusions from Dan McCracken's article, "How to Tell if It's FORTRAN IV" (Oct., p. 38).

1. If one masks the ASA features shown across the table, eliminating those compilers which do not have all the features, or which are not currently operational (Oct. 1965), only four of the 27 compilers remain: SDS 9300, NCR 315, GE 600 series, DDP 24, 124, 224.
2. Applying the two tests at the beginning of the article shows that SDS 900 series FORTRAN II (circa April 1963) is a FORTRAN IV.

My only comment is, "No, Virginia, there isn't a FORTRAN IV."

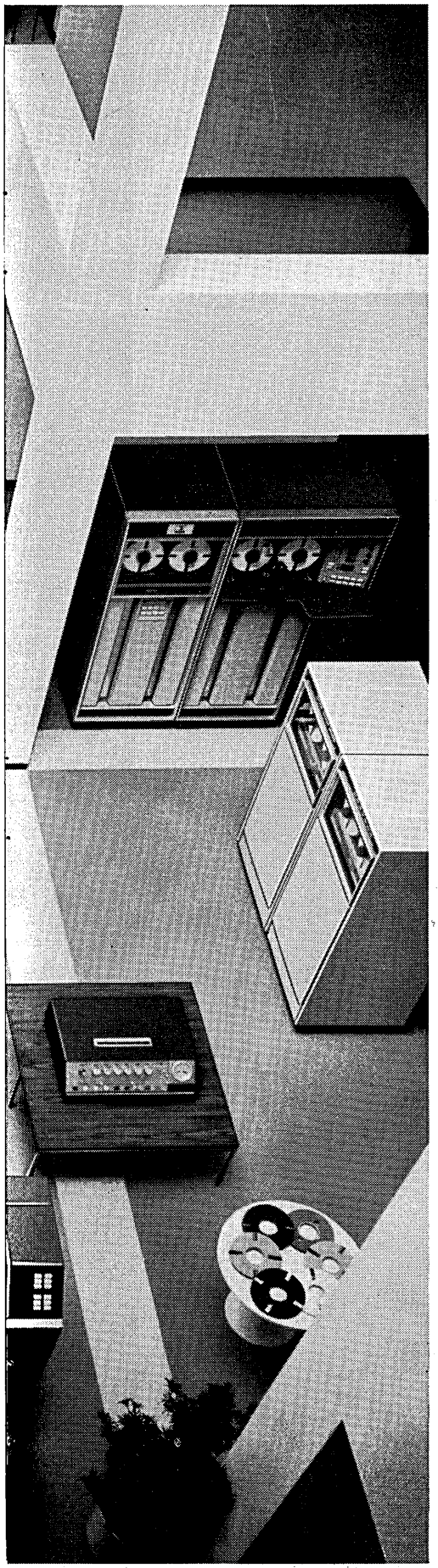
DAVID H. OWENS
Scientific Data Systems
Santa Monica, California

10 usec here & there

Sir:

You have done us wrong! In your October new product announcement of the SDS 940 computer (p. 113), the memory cycle time is erroneously listed as 11.75 microseconds. The correct speed is *1.75* usec.

HAROLD J. BERGSTEIN
Scientific Data Systems
Santa Monica, California



To computer users who are looking ahead:

Sharpen your peripheral vision

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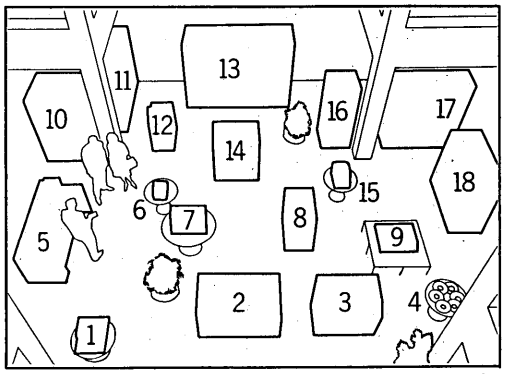

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CIRCLE 15 ON READER CARD

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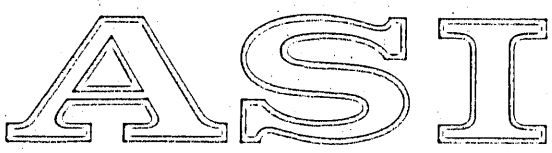
PHYLIS*—PHYsics On Line Information Station is a system designed to process data received from on-line low energy nuclear physics experiments at Argonne National Laboratory.

Argonne required a computer to process data from an on-line nuclear experimental system. In addition the computer had to have the speed to apply the results of the processed data, back into the experiment before completion, thereby saving the time and efforts of setting up a second experiment to obtain proper results. To help solve this problem, ANL called on the system specialists from Advanced Scientific Instruments.

The PHYLIS system processes data acquired from a 12 MeV Tandem generator and a 4.5 MeV Van de Graaff generator. The system, in addition to the ASI Central Processor, includes a number of standard, and special purpose devices. The following special units were designed and supplied by ASI as a part of our total systems support program: a data link to the Tandem generator incorporating a pulse height analyzer, a remote station link to the Van de Graaff accelerator, and a communications link to a larger computer.

Whether your processing problems deal with nuclear physics, hybrid simulation, optical systems, or whatever, ASI's "special" approach to complete systems design is ready to help you. Call or write ASI today.



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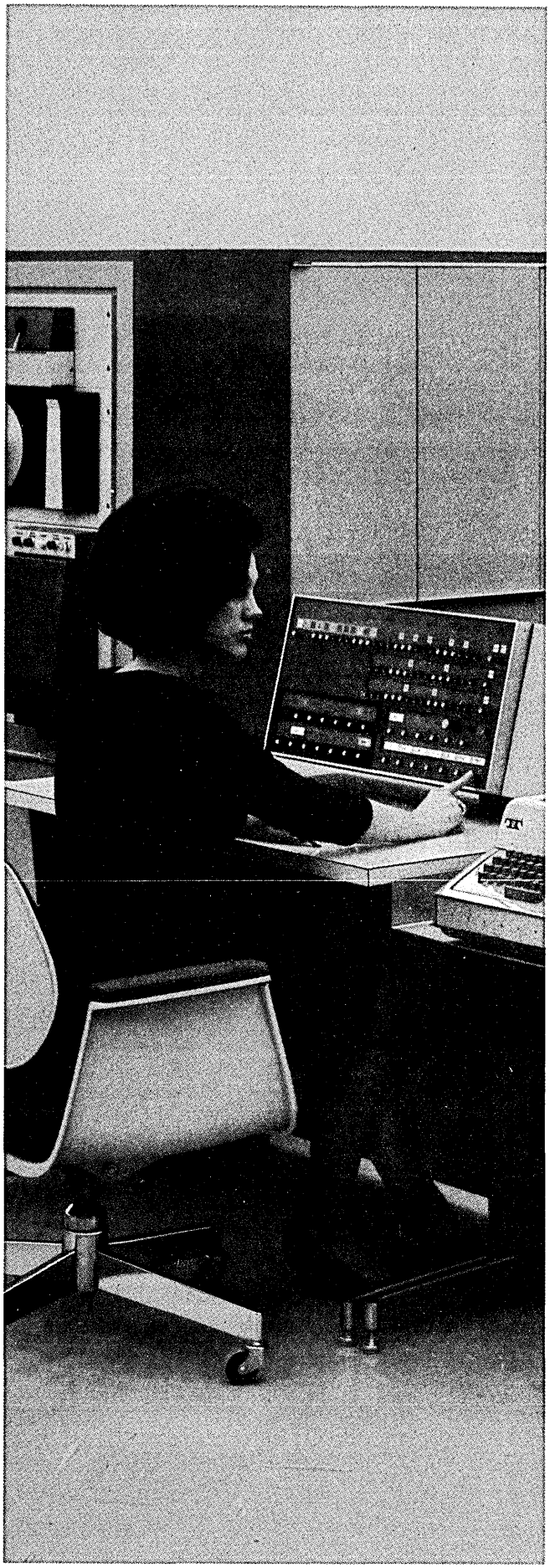


CIRCLE 16 ON READER CARD

look ahead

PROGRAM-OF-THE-MONTH CLUB

University Computing Corp. will enter the mail order business soon, offering software to users in search of instant programs. The Dallas firm is establishing a Program Trading Center under Tom Lyons, is soliciting descriptions of programs to be considered for entry into a "catalog." The programs will be made available at a fixed price, for unlimited use (but limited distribution), to other users. UCC may buy some programs outright, but generally will offer the program developer a royalty -- anywhere from 10% to 50% of the program's revenue, depending on how much documentation and maintenance UCC has to do. The company has already signed to offer Opcon -- the Datatrol-developed 1401 operating system -- in four southwestern states. If successful, the operation could be a foot in the door for eventual separate pricing of hardware and support services, a dream of many mainframe and software houses.

BEKINS BRINGS
THE SPECS

A forthcoming request for proposals for a monstrous new Army edp system is giving Washington computer salesmen king-size headaches, although all the specs aren't out yet. First phase of the new logistics supply system -- called Project Napalm -- will call for some 11 systems costing maybe $35-50 million, with up to 40 computers eventually. At this writing, only 24 volumes of specs -- over three feet high -- were out, with another four volumes due. Initial target dates have been withdrawn, but proposals will probably be due 150 days after specs are out, and benchmark solutions due 60 days after that. Delivery of the first pilot installations is supposed to be set for the end of '66.

One manufacturer is said to have estimated it will cost over $1 million just to bid. Another guesses it will cost at least $250K. It looks as if Project Napalm will burn some manufacturers badly.

SLIPPAGE SEISMOGRAPH
STILL SENSING SHIVERS

Tremors from the IBM hardware and software slippages are still being felt. One customer was told that a version of the 1800 would be delayed from mid-'66 to late '67, that basic software for the 360/67 would slip six months, to expect one year delay in teleprocessing software, and that bulk core would be one year behind (defense priority orders are a possible cause here). One bright spot: the 44K PL/I compiler is on time.

The delays are hurting, causing previous estimates of next year's dp savings to dip sharply. Some customers are grumbling about taking another look at other manufacturers, who may not be much better off. Others have gone to short-term leases, or gotten lucky with quick deliveries from competitors. Some are using 360's to the extent possible without software, but paying no rent.

Douglas, however, has signed a letter of intent

for four Spectra 70/35's to replace two 360/30's installed and two yet to come. The alleged cause: inability of IBM to deliver on time the big cores required on these particular configurations.

3M SHARPENS ITS GRAPHICS IMAGE

It looks as if Minnesota Mining & Manufacturing is tippy-toeing into the information processing business. We hear the company is beginning to test market a new electron beam recorder which will record directly and at high speeds on microfilm. Also in the works, units for transmission of drawings to remote microfilm printers. Prices? We're guessing the EBR will compare with the SC 4400, may compete with multiple 1403 printers.

THE TAXMAN THINKETH

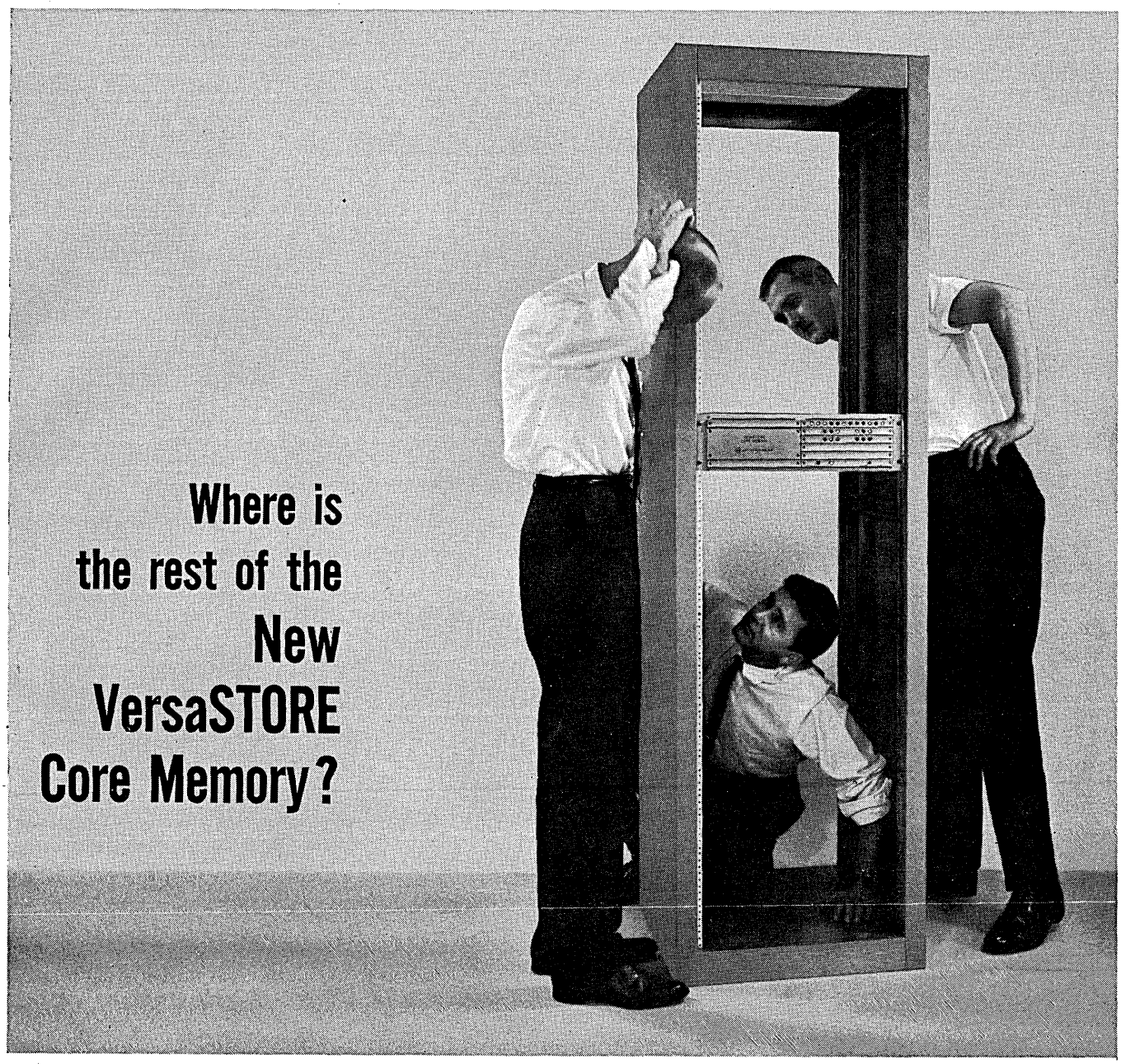
The new IBM purchase option plan (Nov. News Briefs) may have interesting tax implications. Under the old setup, one computer-rich county taxes IBM for leased systems on 40% of the original purchase price over six years. What now? Says the assessor, "If the equipment doesn't reduce in value, it certainly gives us something to think about."

GE BLOWS WHISTLE ON 200-SERIES T-S CUSTOMERS

People thinking about installing the Dartmouth time-sharing system on GE hardware (265) have had to take another look. GE says time-sharers have to buy the gear or lease it over a four-year period. Why? Probably because they realize the lease life of their 200 series is short...and perhaps because they plan to enter the T-S service bureau biz themselves. A possible tip-off: GE is adapting the 200 T-S software for its 600 line. One former GE prospect, Tymshare, has switched to the SDS 940 and the Berkeley software.

RUMORS AND RAW RANDOM DATA

One interpretation of the mysterious cross-licensing agreement signed last month by IBM and Univac: Perhaps the new Univac line will be so compatible it will be just like the 360. In return, Univac drops its pushes on ENIAC patents (awarded in 1964)... Data Systems, Inc., which folded suddenly after being acquired by Union Carbide, lives on in the form of its product, which will be updated and marketed by Hewlett-Packard...Look for Three C's to announce a couple of small i.c. computers in the CDC 1700 class next summer...Latest translator is TRANSIM, out of Comress, Inc., Wash., D.C. The firm says it will start with 100% program translation from 1400 series and 7080 to 360 and Spectra 70...Honeywell has won a $70K/month order for 16 120's to tie into the B 5500 ordered recently by Chrysler Corp... Great Britain's Ministry of Education and Science has approved expenditures of $85 million over six years for a computer utility at Manchester, Edinburgh and London...Latest entry into the mag tape manufacturing game is Magnetics, Inc. Originally formed as Datatape Corp., the new company is building a plant in Graham, Texas, plans to get into production within six months...Although disturbed over the fact that some employers are asking applicants for computer positions if they have the DPMA certificate, the ACM voted down a resolution to condemn the certificate program as "subprofessional." It now looks as if the two organizations will get together to investigate the possibility of cooperating on the exam. Earlier, DPMA shot down a plan to offer a certificate in scientific data processing.



That's all there is!

Just 5¼ inches of rack space for a full 4096 word, 24 bit VersaSTORE Core Memory. And it's all accessible from the front panel, including the core stack. VersaSTORE comes in capacities from 256 to 4096 words of up to 24 bits. Any VersaSTORE may be field expanded to the maximum size.

If you like our compact package, look inside, VersaSTORE is loaded with features! Like the continuous lamp display of all the registers for immediate data identification. Integrated circuits for maximum reliability. 2μsec. cycle time with half cycle operation. A flexible interface, either PNP or NPN for easy integration with your system. VersaSTORE requires only $\pm$12V. $\pm$5% to operate. Buffered input from 3V. to 24V. and output from 1V. to 12V. Plenty of output drive for system requirements. Random access. A servoed current drive that maintains good operating margins at temperature, without stack heaters. The exclusive "Dataguard" that protects the memory content during system checkout. Options include sequential and sequential interlace addressing and self-test.

If you like our compact package and our features, you'll really like VersaSTORE's compact price.

For a VersaSTORE brochure, full of facts and figures, write to:

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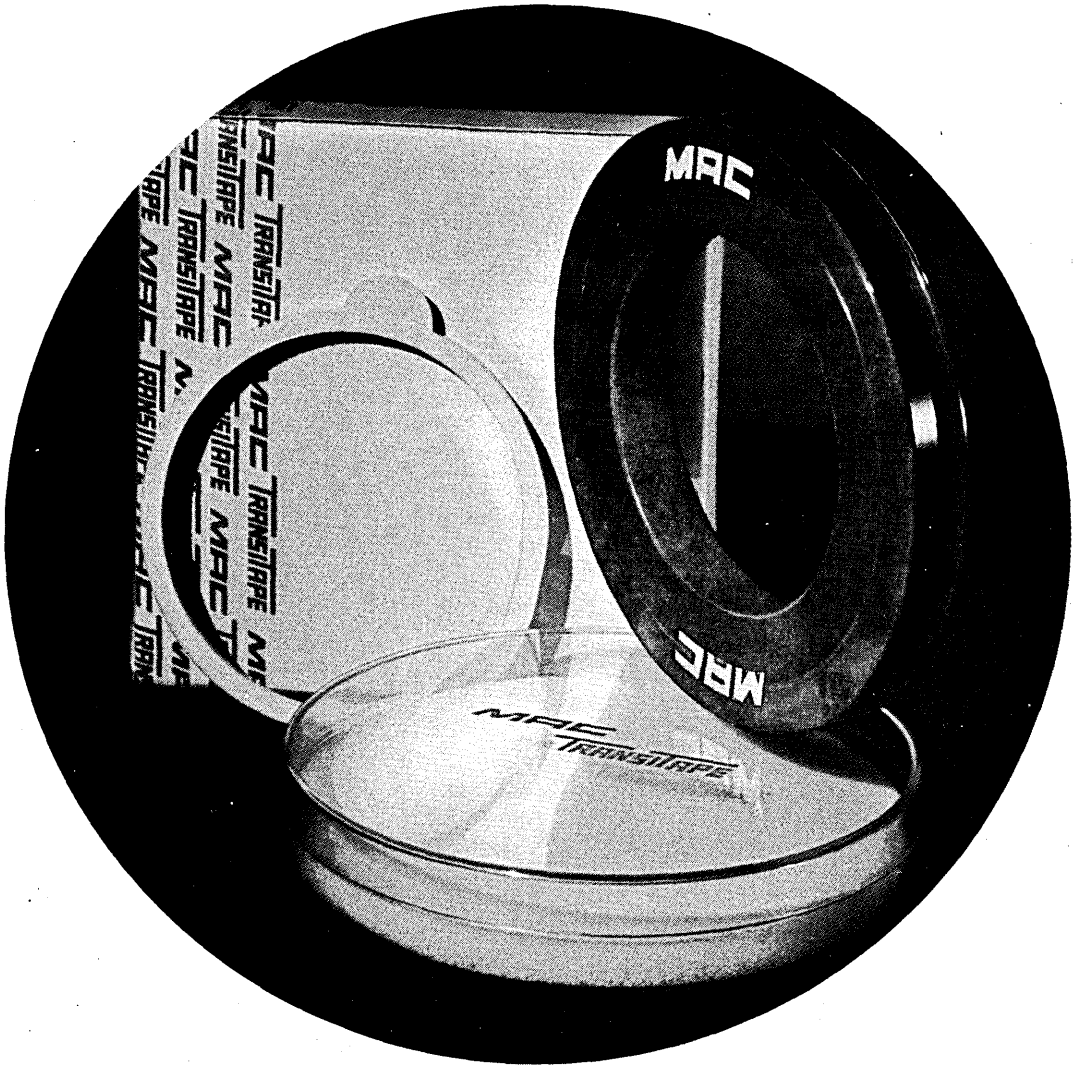
CIRCLE 12 ON READER CARD

the demand for MAC TRANSITAPE has been overwhelming



. . . and now we've made TRANSITAPE even better.

New solid flange reel and plastic container make MAC TransiTape easier to handle, even more versatile than before. MAC TransiTape's new reel design is the result of extensive field research and the overwhelming demand for a 200-foot, 6-inch reel with all the features of a larger reel. □ Now, MAC TransiTape has them all—a specially designed, solid flange reel; top quality, heavy-duty computer tape tested at 800 BPI; photo sensing markers; file protection ring. And, MAC TransiTape is also available either in the new, easy-to-store plastic container or packed in a reusable poly bag and mailing box. □ MAC TransiTape—even better now for any short job calling for less than 200 feet of computer tape. Ask your MAC representative for complete information.

MAC

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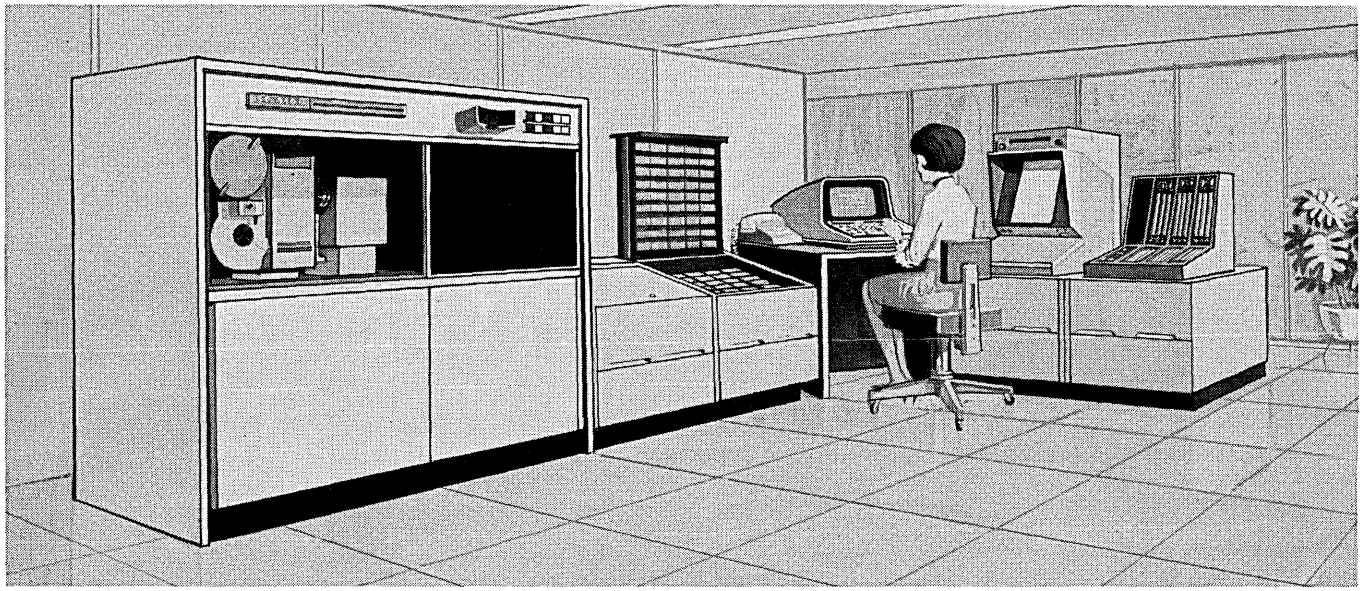
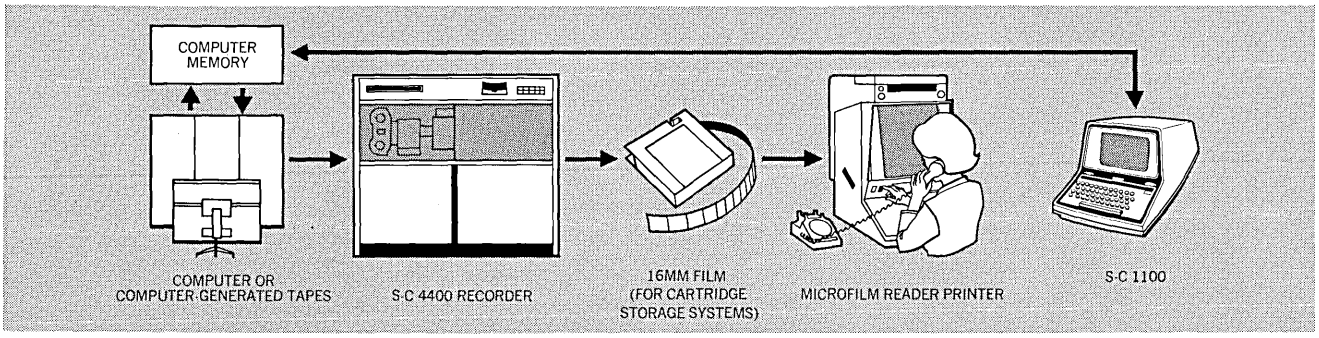
Representatives throughout the World

CIRCLE 19 ON READER CARD



Be the first to install the most practical high speed data storage and retrieval system!



Study the diagram above for a moment—the system it represents can save you thousands of dollars a month by eliminating costly steps in retrieving and adding to stored data.

The elements all exist today. Each piece of hardware has been *proven* in actual operation. Actually, this is a *triple data storage system.*

PART I. For storage of semi-permanent and permanent records, the S-C 4400 Document Recorder converts computer output into ordinary language and records it directly on 16mm or 35mm microfilm.

PART II. Modern microfilm storage and retrieval systems, such as Recordak's MIRACODE system, can retrieve one film record out of a million in 15 seconds and display it on a reader/printer.

PART III. New data entries which have not yet been recorded on microfilm can be stored in the computer memory. The S-C 1100 Inquiry Display System makes possible instantaneous retrieval and display of data from the computer memory. Operators can also *add* data to the stored record automatically, thus assuring up-to-the-minute accuracy of information. Over 400 of these desk-top units may be used to work with a centralized data system.

Stromberg-Carlson believes this *triple data storage system* is the fastest, most practical in the world for high-speed data handling.

Insurance companies, banks, utilities, airlines or other organizations which must store a large volume of computer-generated data (or add to it) can achieve multiple benefits from this system. These include: increase of computer efficiency, elimination of costly business forms inventory, paper copies, and magnetic tape (when S-C 4400 is operated on-line with the computer), better budget and inventory control, reduction in external and internal telephoning, manpower savings, greater personnel efficiency and better morale because of faster availability of stored information.

You can have these benefits by adding a triple data storage system to an existing EDP installation. When you install a third generation computer, the system will work equally well with your new equipment.

For details write: Stromberg-Carlson Corporation, Data Products Division, Dept. G-10, Post Office Box 2449, San Diego, California 92112.

STROMBERG-CARLSON
CORPORATION
DATA PRODUCTS-SAN DIEGO

CIRCLE 25 ON READER CARD

editor's read*ut

IT'S THAT TIME AGAIN

Every year about this time, most of us feel a strong desire to stagger, however briefly, off the treadmill, in an attempt to figure out where we've been going, and where we're headed. It's an ancient urge, as old and as regular as the calendar, and usually fairly harmless. Most often it takes the form of making New Year's Resolutions, staring out the window, sighing, and asking, "What Does It All Mean?"

Editors, like people, succumb to this annual madness, usually in the form of an issue designed to tell All about What to Expect Next Year. *This* year, we thought we'd be a bit bolder. We decided to look several years ahead. In an attempt to assess the future impact of current work, we asked several articulate computer experts to think, then write about, how they thought the computer would affect different technologies and disciplines in 19??. The results — some amusing, some frightening, and some both — appear on the following pages.

Such exercises, it seems to us, can be quite useful. They can act as imagination stretchers, helping us to put into the perspective of its implications for tomorrow the work we're doing today. And if the implications appear to be unhealthy, perhaps such futuristic impressions can serve as a stimulus to timely corrective action, as a sort of *pre facto* feedback.

If history can serve as a teacher, then perhaps an imaginative preview of history can educate also, helping us anticipate problems and to think more creatively and wisely about solutions.

It's not easy, of course, to get off a treadmill. Today's problems — the new chain printer that won't make a mark on the third part of the form, the missed benchmark deadline on a critical software system, the hangnail or hangover or whatever it is that keeps your key project leader home for a week — see to that.

But it's important, nevertheless, to try. Especially for an industry which is revolutionizing the ways we think, educate, and plan is it vital that we wonder about what we're doing and how it will affect us and those to follow us in the days to come. We hope this issue will give you an excuse to sidestep today's pressures momentarily, and to think a little bit about where we're all heading. Tomorrow it will be too late.

BON VOYAGE—1984 STYLE

by ASCHER OPLER

Machine: This is the Universal Time Sharing System. Today is June 21, 1984. It is now 20:37 Standard Time. May we serve you?

MAN: YES. MY NAME IS LESTER P. JONAS, U.S. SOCIAL SECURITY 483-05-2700. I WANT MY UTSS COUNSELOR.

Machine: Greetings, Mr. Jonas! This is your UTSS Counseling Program. What is your problem today?

MAN: I AM BORED BY MY WORK AND I AM FREQUENTLY FATIGUED. WHAT DO YOU RECOMMEND?

Machine: Your UTSS Physical Health Record was just checked. No special problem.
Your UTSS Mental Health Record was just checked. No special problem.
It is logical that you need either a job change or a vacation.
Your Job Experience Record and your UTSS Skills Record are being checked against 216 available jobs for which you are eligible.
Sorry, only three are suitable and these jobs are identical to your present one.
Therefore, UTSS recommends a vacation.

MAN: BUT . . . . .

Machine: You were probably going to say that you had one recently.
Yes, your record shows vacations starting:
December 18, 1983
July 12, 1983
August 22, 1982
Nov. . . .

MAN: O.K., O.K.

Machine: Checking your UTSS Employment Record.
You are eligible for 23 days of vacation. When can you leave?

MAN: IT WOULD BE BETTER IF I COULD START QUITE SOON, BUT I HAVE NO IDEA OF WHERE TO GO.

Machine: Your UTSS Counseling Program will help you.
An analysis of your last 9 vacations follows:

Summer	6 ;	Winter	3.
Domestic	5 ;	Foreign	4.
Sedentary	2 ;	Touring	7.

What about a trip to a part of the world you have not visited?

MAN: LIKE WHERE?

Machine: Asia, Africa, South America.

MAN: I PREFER ASIA.
INCIDENTALLY, CAN I AFFORD THE TRIP?

Machine: Your UTSS Personal Account Record has just been consulted.
Yes, you can afford it.
Your UTSS Cultural Interest Record has just been consulted.
UTSS recommends Japan for you, Mr. Jonas.

MAN: BUT I ALWAYS WANTED TO SEE CH. . . . .

Machine: Japan has been selected.
One day for SST travel each way leaves 21 days in Japan.
Your time there will be divided:
Two restful weekends in mountain inns
Four busy days in Tokyo
Four-day trip on the inland sea
One day each in Nagoya, Osaka, and Hiroshima
Two days in Kyoto

MAN: IT LOOKS INTERESTING. WHEN CAN I START? . . . . . NEXT FRIDAY?

Machine: The Universal Air Travel Reservation System is being consulted. Sorry. Accommodations are available only starting the following Monday. Is that O.K.?

MAN: O.K.

Machine: The Universal Hotel Reservation System is being consulted.
Your itinerary will feature accommodations in first-class hotels except for Kyoto. There you will stay in a Ryokan (Japanese inn).
Please indicate your acceptance of the itinerary.

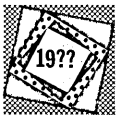
MAN: I ACCEPT. WHAT ARE THE CHARGES AND WHEN WILL YOU SEND MY TICKETS?

Machine: You have forgotten the UTSS way. Your account was debited thirty milliseconds ago. You are now $2,748.21 poorer.
You receive no tickets under our new 1984 UTSS system of paperwork elimination. All verified arrangements have already been transmitted directly to the airline passenger file and to the hotel's guest list.
Be at the International Airport on Monday, July 7th at 7:30 a.m.
Please request weather prediction and clothing recommendation system 48 hours before departure.
Your passport is in order.
Your Japanese visa has just been approved.
Bon Voyage! Compliments of Universal Time Sharing System! ■

Mr. Opler is now executive director of Computer Usage Education, Inc., and was most recently director of programming systems for Computer Usage Co., Inc., until the founding of the new firm. His experience in the computing field began with the Dow Chemical Co. in 1947.

THE STUDENT OF TOMORROW

by DANIEL D. McCRACKEN



It is 8 p.m. in the dorm at State Tech. George, a sophomore in electrical engineering, walks down the hall to the console pool, picks a likely-looking one, wheels it back to his room, and plugs it in to power and the phone jack. He dials the computer, identifies himself, and proceeds with the following dialog.

Computer: If you wish the system for a particular course, name the course.
George: E 176.
Computer: Do you wish to name a section in the computerized course guide?
George: Start section 27.
Computer: Section 27—complex simultaneous equations in simple ac networks. Do you wish to review the mathematics, the program for solving a system of equations, or the electrical engineering principles?
George: Electrical engineering.
Computer: Very well. Let's review. What does Kirchhoff's voltage law say?
George: The algebraic sum of the voltage drops around any loop of a network is zero.
Computer: Your answer probably OK, although not identical with stored answer, which is "Sum of all voltages around a closed loop is zero." Do you understand, or shall we go back?
George: Understand.
Computer: What is the major difference between the application of Kirchhoff's laws to dc and ac networks?
George: Must use complex numbers and complex arithmetic for ac.
Computer: Right. What is the . . .
George: (Interrupting) Skip ahead 10 questions.

Author/co-author of nine books on programming, Mr. McCracken is a New York-based consultant and technical consultant to Datamation. His latest book is "Numerical Methods and FORTRAN Programming" with W. S. Dorn of IBM. Mr. McCracken holds degrees in mathematics and chemistry from Central Washington State College.

Computer: See Fig. 144 in computerized course guide, and state the voltage drop equations.
George:

$$(-20 - J*10)*I(1) + 20*I(2) = -60$$
$$20*I(1) + (-20 + J*15)*I(2) = 0$$

Computer: Your answer evidently not in standard form. See form 8 on page 150 of guide, and try again.
George:

(−20, −10) (20, 0) (−60, 0)
(20, 0) (−20, 15) (0, 0)

Computer: Your system gives the correct answer, but it differs from the stored form of the system. If you think you know what the difference is, you may re-enter or order "continue," otherwise ask for "review."
George:

(20, 10) (−20, 0) (60, 0)
(−20, 0) (20, −15) (0, 0)

Computer: Right. What is the meaning . . .
George: (Interrupting again; he thinks he's ready to do his homework assignment). Call complex simultaneous equations solver, E 176 version.
Computer: State N.
George: 3.
Computer: Enter coefficients in row order, with constant terms having signs as if written on right.
George: (Enters a system of three simultaneous complex equations that he thinks describes a bridge circuit assigned for homework).
Computer: (Gives solution).

There is a knock on the door. George opens it to his buddy Sam.

Sam: You working on the E 176 homework?
George: Yeah, and this crazy computer just gave me a stupid answer. I put in the equations for this bridge here, and the dumb computer tells me that the ac impedance is 2000 ohms. How can that be, when the largest reactance is so much less than that? It's not a series circuit, either.
Sam: I dunno. How much time you got left?
George: Half an hour on the sheet, but there were 10 consoles still in the pool, so I probably can keep it.
Sam: Let's fool around. What would happen if we doubled that resistor?
George: Can't hurt to try. (Enters values; computer returns solution). Now *that's* funny. The impedance didn't change more'n about . . . 2%. I wonder what happens if we change the capacitance? (Enters values; computer returns solution).
Sam: Hey! Now the impedance drops by a factor of three. Is this computer nuts? Let's change the capacitance just a little and see what happens. (Does so).
George: Well! One percent in the capacitance changes the impedance by 20%. Is that possible?
Sam: Ah . . . you know, we've been looking only at the impedance across the bridge, in terms of the current forced through it by a voltage from the outside, so to speak. I wonder what kind of currents might be circulating inside it? Let's ask for a full solution. (Does so, for last three systems). What gives here? Much more current is circulating inside than is flowing through.
George: I think maybe I see what is happening. The arms of this bridge contain capacitance and inductance, so that you get a kind of resonance: lots of current flowing back and forth, sort of, with not very much outside current required to supply the losses in the resistors.
Sam: (Pause) Yeah, that makes sense. Let's ask about it in class in the morning.
George: If I know Old Stoneface, that's what he was trying to get us to figure out for ourselves.

* * * * * *

Just what is the value of the computer in such a situation? And what are the implications for the future? I suggest a two-part answer.

First, the computer has value precisely as the "giant slide rule" that is so frequently maligned. George and Sam want to learn network theory; ac network theory involves solution of complex simultaneous equations; even a small system of this type is agony, and doing the arithmetic teaches absolutely nothing after the first time or two. With the ability to solve 20 systems of equations in an evening, instead of suffering to do two or three, George and Sam are able to learn their electrical engineering more effectively.

And that is the really important point of all this: the principal value of the computer in education is rapidly becoming that of an educational tool in non-computer courses. With the computer to help them test their tentative concepts, and with gentle pushes from teaching programs, George and Sam are learning electrical engineering better. They are not going to forget reactive current soon—after all, they discovered it themselves!

This is no prophecy. It is being done today, almost routinely, at many schools. (Although not always with the conversational mode feature and not usually in the dorms). And schools are not doing this sort of thing as an afterthought. A surprising number of institutions have progressed far beyond teaching programming as something with value *in itself* for all students. They do teach programming as a subject in its own right for the relatively few students who want and need it. For the remaining majority, however, programming is taught only to the extent needed to make the computer available as a tool for education in subjects far removed from computing.

The possibilities are suggested by the diversity of experiments that have been tried. Considerable publicity has been given to an experiment in teaching economics to elementary school pupils with a computer game. More than a few high school physics students have programmed a rocket sled problem, in the process gaining a good intuitive idea of what a differential equation is without the fright of hearing the words. Many a calculus student has programmed the rectangular rule for numerical integration, in order to see a "demonstration" of the idea of the limit of a sum.

In all of these, and the many others that could be cited, we see the computer being used as an educational tool in subject areas where the emphasis is not all on computing as such.

The ferment proceeds on diverse fronts. Some dozens of schools, maybe more, are pursuing the explicit educational goals. More will realize the potential soon. In the computing fraternity, numbers of people are at work on software and hardware tools to facilitate the drive, although there is the danger that some workers are more concerned with the techniques than the purpose. Some are looking for programming languages that may be better suited to these purposes than existing ones. The textbook people are beginning to suffer the pangs of a realization that yet another revolution is upon them.

At the present pace, it is not at all impossible that within a very few years most computing at educational institutions will be directed toward non-computing courses, with the presently more familiar computer sciences becoming an important but secondary factor. ■

THE FUTURE OF PRIVATE TRANSPORTATION

by R. L. PATRICK

Urban sprawl and traffic glut blight the American Dream. As our society gets more complex, trivial happenings assume catastrophic proportions. An oversight can dim a great city. A slight miscalculation can close a freeway.

California has 9.5 million registered vehicles, over 3.5 million of them housed in L.A. county. Some of our freeways carry 300,000 autos in a single day. Our growth is legend; our troubles are too. For those of us who look into the future, the freeway appears as a long, twisty, smog-producing snake. During one of our monumental jams, a wag observed, "Let's just pave over the tops and start the process anew."

The following scheme is slightly less drastic. In addition, it provides the maximum possible personal latitude in an increasingly complex modern society.

As our commuter of the future starts for his car, he will check to see if he has his wallet, his keys, and his driver's license. He will be able to easily locate his driver's license: it will resemble the embossed oil company credit card of today, with his name, address, and license number in bumped-up letters on its face. The other information will be visible under the transparent plastic coating.

To start the car, the license must be properly inserted in its slot before the key-start is engaged. The edge of the license will contain a series of metal slugs which encode the driver's identity number and the class of his license. The car ignition circuitry will be conditioned by a compare circuit. If the class of the vehicle doesn't match the class of the license, the auto won't start.

Once the vehicle is underway, our driver will pass the normal profusion of stop signs, school children, and traffic: for less congested routes present traffic control methods will be sufficient. On these routes, the worker (or the housewife on her local rounds) will be unaffected by the freeway control system. The driver's license in the slot will be a slight inconvenience, but then so are the keys and the baby.

If Mrs. Commuter is stopped, her tamper-proof license is a solid identification. It will simplify many recording chores and, if she's unlucky enough to receive a ticket, the officer may imprint directly on a machine readable form. Machinable tickets will speed the judicial administrative mill and also allow the officer to return to his enforcement duties sooner.

on the ramp

Meanwhile, our downtown worker has encountered the Automated Freeway, Automay for short. As the driver approaches the entrance ramp to the Automay, he observes an indicator beside the ramp which indicates if conditions are "congested." If so, a rampside advisory sign will remind him to flip his dash switch to automatic and to dial his exit code.

A series of poles along the in-ramp will transmit commands to the vehicle by radio link, accelerating and decelerating it in a test exercise. As these slight perturbations in speed occur, a series of load cells will measure the car's weight. Another command will cause the fuel sensor to read out the gallons on board. A scanner on a pole will read the vehicle identification number. A final command will acquire the exit code, the driver's identification, and the classifications of both driver and vehicle.

A special-purpose rampside computer will determine whether the car, load, and mechanical condition place it within the allowable bounds for acceleration and deceleration, check if the fuel level is appropriate to the exit, and that the classes of driver and vehicle are commensurate with the road conditions. All of these items will be checked in a fraction of a second. If they are not all satisfactory, a divider will raise to shunt the incoming auto back to the surface streets. A display mounted over the

Mr. Patrick is a computer consultant based in Northridge, Calif. Interested in traffic and its control, he was recently appointed by the mayor to the Board of Traffic Commissioners of Los Angeles. His latest research encompasses personnel classifications and career planning. Holder of a CDP from the DPMA, he is also the editorial adviser and a frequent contributor to Datamation.

road will advise the frustrated driver of his deficiencies. On the other hand, if all the conditions are GO, the control of the vehicle will be passed to a computer which controls merging at the head of the ramp.

en route

During periods of congestion, all vehicles on the Automay will be under computer control. A series of addressable transmitters and receivers will communicate with each vehicle under the control of the area computer. Each vehicle will contain a radio receiver and a small instruction unit. The instruction unit, in turn, will control a pacer, to keep the commanded speed constant; a speed programmer, to control changes in speed; and a steering servo to allow the vehicle to automatically change lanes or round corners under the control of a wayside device. The receiving antenna on each car will be so oriented that it will respond only to commands intended for its lane.

Each vehicle will also contain a series of sensing elements. One such device will measure horizontal acceleration along the lane in the direction of travel. Another device will measure acceleration across the lane. A logic circuit will match these readouts with the input command so that lane changing or closing maneuvers can take place as commanded and independent of slight irregularities of the roadway or vehicle condition. Accelerations will be broadcast to adjacent vehicles. If the neighboring auto receives an unexpected signal, an emergency sequence—a series of controlled brakings which slow traffic to a halt—will be initiated. Every transmission to a vehicle will be checked and acknowledged. Any command which involves relative movement will be relayed to adjacent vehicles so that the surprise circuitry will be disarmed. Any acceleration will be transmitted to those likely to be affected. If the surprise circuitry is not disarmed, any acceleration from an adjacent vehicle will be interpreted as a true emergency and the emergency sequence initiated. Thus, the system is fail-safe. An emergency—triggered by a circuit or vehicle component failure, or by a wayside command during unstable conditions—will cause all vehicles to come to a programmed stop. A visual indicator on the roof of the offending auto will identify it for emergency crews. The driver will be able to over-ride the servo controls on the vehicle, but sufficient force would be required so that this was not an accidental happening. The auto-manual switch on the dash will be ineffectual except in emergencies, and when the vehicle is off the Automay. Normal manual control could be regained only after a stop or on an out-ramp. The control receiver would also have an audio path so that traffic advisories could be given to the driver after an emergency stop. A series of checks would be built in so that the system was fail-safe and (damn) foolproof.

pluggable engines

One essence of the scheme is routine vehicle maintenance and care. To ease the maintenance chore, while simultaneously raising the quality to a level appropriate to the electronics involved, power-control unit leasing should be considered. Personal vehicles will contain an easily replaceable, rail-mounted power-control unit, including sealed engine, automatic trans-axle with inboard brakes, electronic controls and related servos for speed, brakes, and steering. In service, the passenger compartment would probably be driver owned. A range of interchangeable power units would be available. A low-power unit could be purchased (or leased) for local driving; it would have no electronics or servos. A higher-power unit could be purchased (or leased) for cross-country touring or operation on the Automay during uncongested periods. It would have electronics for the static readouts and a receiver for the receipt of automatic messages and traffic advisories.

A high-power unit with full control electronics would probably be leased. Whenever the unit was due for regular attention (or whenever electronic service was necessary), the driver need only stop by any service facility for a simple five-minute exchange. New components would replace the old, the revitalized car would hesitate in a test cell, a computer-controlled exercise would take place (similar to the ramp test sequence, only diagnostic in nature), and upon satisfactory results, the vehicle would be ready for the road again.

alternatives are bleak

All this may sound frightening, but the alternatives are even more frightening. Unless something is done to smooth the movement of people and goods during periods of peak activity, our cities will be fractured into a series of separate but related geographical units. Due to difficulties in commuting, something akin to the company owned town—with all its disadvantages—may be recreated. Our big cities are already seeing dislocations in families, individuals' education and land prices as whole industries pack up and move to the suburbs. Companies in eastern cities reluctantly pay full salaries for only a 30-hour work week. We who consult raise our rates to cover the time lost commuting and thereby increase the costs of the products we support. Except in areas of very high population density (usually related to some natural deformity of the landscape), public transportation is not the sole answer.

related progress

Some authors talk about a rapid transportation system as if there is none in being. The city of Los Angeles does, today, have a transportation system. The system consists of the licensed motorists; their vehicles; the surface streets and freeways; and the relevant laws and ordinances of the city, county, and state. Long-term developments as noted above will require a true partnership between big government, big industry, and we consumers.

Without a doubt, auto manufacturers could devise the vehicles required. Experiments to date show no profound unsolved technical problems. The computer field could draw from developments now under way in air traffic control, railroad car numbering and dynamic scanning, automated missile checkout, and real-time command-guidance systems for our contributions to the partnership.

Big government is also nearly ready. New York has statutes which prohibit trucks and other low performance vehicles on its parkways. Washington, D.C., and surrounding territory establish emergency conditions (due to snow), control the use of the public way, and stipulate the equipment required for legal access. California is requiring mandatory smog-control devices and frequent inspection. Many states require mandatory vehicle mechanical inspections. Chicago and Seattle have some adaptive roadways which favor the rush-hour traffic with more lanes.

The "authority," be it port, airport, or transit, is an inter-municipal organ legally established to solve such problems. The way is clear for the megalopolis of the future. The prices of automated devices are dropping so rapidly that controls will be cheaper than concrete and condemned real estate. Cliff dwelling is the alternative to automated control. ■

THE COMPUTER IN LITERATURE

by NED KELLY

Computers, it is often asserted, will transform our world beyond recognition. It does seem that we are in the midst of an information processing revolution, potentially of greater import to our slowly-evolving social and political institutions than any other outgrowth of modern science, excepting only the new biology.

The prediction of future technology and social conditions is not ordinarily considered to be scientific activity. One may, however, extrapolate from current research to tomorrow's application, and scientists, engineers, and managers with suitable apologia will sometimes indulge in this form of speculation. The *New Scientist* last year published a collection of articles under the heading "The World of 1984," the projection 20 years into the future having surely been suggested by George Orwell's now classic novel *1984*. The distinguished contributors produced a fascinating collection of essays, some quite uninhibited and reading almost like technically good science fiction; computers and communications are interestingly treated by Wilkes and Pierce, respectively. Some of the articles presented sketches of likely social conditions two decades hence, putting one in mind of the sort of science fiction pioneered by H. G. Wells, in which typical human beings are depicted under alien conditions.

The merits of science fiction as a literary form have often been argued; but a more interesting question is whether the medium serves as a useful vehicle for serious examination of the impact of assumed change brought about by advances in science and technology, especially now that we are beginning to wonder whether change is coming too rapidly for human beings to adapt. Examples are H. G. Wells' *Food of the Gods* and Aldous Huxley's *Brave New World,* each exploring worlds transformed by biological discoveries. Whether either of these books can properly be called science fiction is irrelevant; Huxley's at least has helped warn us of impending problems.

computers in literature

What does one find of computers in literature? On the surface there seems to be very little. Did the technology outrace the writer's imagination? Is the subject matter present but disguised? Is one close to what is happening naturally near-sighted rather than far-sighted? Wells wrote in the *Food of the Gods*: "Change played in its new fashion with the world for 20 years. To most men the new things came little by little and day by day, remarkably enough, but not so abundantly as to overwhelm. . ." Those in their 40's today may remember youthful enthusiasm for Buck Rogers and Flash Gordon in the 1930's but how many imagined that they would see jets, inter-continental missiles, atomic and nuclear weaponry, satellites, and space-ships during their lifetimes?

By contrast, in the late 30's Aiken and Stibitz were beginning, independently, to conceive of computing machines unheralded except perhaps for isolated instances by fictional predictions even though Charles Babbage had, in one of the most remarkable and hopelessly premature inventions in the history of science, conceived his analytical engine. Gernsback's *Ralph 124 C 41+* envisioned a possible future where people were dependent upon "logics" for all sorts of business and clerical tasks. Gerns-

back's vision, it now seems, will arrive within the next 10 to 20 years if the predictions of the "computer utility" enthusiasts are realized. The computer as such had little appeal as a subsitute hero or even a stage prop until well after it had come into use, and then fiction tended to lag behind rather than foreshadow reality. Some tales, titles now forgotten, described machines of monstrous size and power consumption but absurd performance as compared with existing equipment.

Isaac Asimov's robots equipped with "positronic" brains (adaptive digital devices?) starred in *I, Robot* and other stories in which the interaction of robots and people provided subject matter. The laws of robotics provided a "moral" code which was embodied in circuitry to protect human beings from defective robots—a kind of "fail-safe" mechanism. Of the genre, Karel Capek's often-referenced but seldom-read play *R.U.R.* featured conflict between humans and robots (Capek coined the word *robot* from a Slavic root meaning worker). Robots are eminently better suited for roles in literature than computers, especially if realized in humanoid form. The computer scientist seems not to take the idea of robots seriously, arguing that the humanoid form is hardly efficient and that the economics are unappealing in an overpopulated world. Do we just possibly have a feeling of unease about mobile, self-controlled artifacts (after all, computers just sit there, lights flash uninterestingly and mechanical appendages whirr, click and buzz with so little variety that even a small child would soon be bored)?

There are instances of super communication networks dominating an environment: E. M. Forster's *The Machine Stops* is a fine example. The play *Desk Set* is in a class with the cartoons so common in the press in which the machine, tier upon tier of lights and meters (!), delivers a pink slip to its attendant. One wonders whether man will ever deliver himself and his destiny so completely to a machine as he does in Forster's short story. Still, this is a long way from the idea that mankind may even disappear, leaving behind robots as his only descendents. We ask what this could mean—the mind boggles at the thought—but does the reader recall the weird dialogue between Margaret Mead and Warren McCulloch in the film *The Living Machine*?

automated society

Kurt Vonnegut Jr.'s first novel *Player Piano* is a thoughtful examination of a possible future easily reached from the present. Published in 1952, it is set in a time following a war of such magnitude and duration that the U.S. had been forced to develop a totally automated industrial organization dominated by an elite class of managers and engineers. The personnel people have finally had their way and each person is tested, classified and pigeonholed with his various ratings duly recorded for use by the impersonal personnel machines. Even the elite class is slowly whittled away as occasional new inventions eliminate a job. Those masses unfit for managerial or technical contributions are relegated either to the large standing army or work battalions. Since a fairly high scale of living prevails and the oppressive atmosphere of a totalitarian regime is lacking, the worth of the novel as a study of idle man in an automated society is accentuated.

Player Piano also includes several vignettes of a computerized society: Checker Charley, a checker-playing computer, takes on the works manager but develops a short circuit and bursts into flames (Samuel's checker playing program came several years after the book was written and while the machine used was rather larger than Checker Charley, modern micro-miniaturization could fix that); automatic trains require insertion of a perforated card to allow the passenger to get off so that old, sometimes forgetful, ladies occasionally had to ride the trains for hours before liberation (compare with the recently announced Westinghouse computer-controlled train).

Central planning is managed by EPICAC XIV, a computer occupying 31 chambers in the Carlsbad Caverns. Started during the great war, the computer has passed through 14 stages of evolution, the older portions having been retained (in our experience improvements have come so rapidly that the oldest machines have little value and are seldom kept, an exception being Bill Wolf's sentimental preservation of Whirlwind). EPICAC XIV is threatened by sabotage from bottles of nitroglycerin introduced into Coke machines provided for the machine's attendants. A player piano figures as a symbolic forerunner of automation, hence the title. The book is recommended reading for those interested in long-range effects of automation though it is not as skillfully written as Vonnegut's recent and remarkable *Cat's Cradle*.

according to hoyle

The distinguished astrophysicist Fred Hoyle has written some technically excellent science fiction that shows an increasingly imaginative view of computers. *Ossian's Ride* referred to a machine working on a problem of celestial dynamics, a task inadequately suggested by the description of the workings of a paper tape reader and punch and is not to be compared with the ingenious episode featuring a differential equation in *The Black Cloud*. Hoyle was at CalTech when these books were written and probably had only an early drum computer as his model, and perhaps too was just getting acquainted with computers.

Later, the novel *A for Andromeda*, on which an extremely successful BBC television serial was based, had quite a different order of machine very much in the foreground. A radiotelescope receives from the Andromeda galaxy a coded transmission which is found to consist of three parts: the logic design for a computer, a program, and initial data. The novelty comes in the eventual choice of input-output "devices." Hoyle implies that the machine is cryogenic, which either puts it well into the future or into the land of might-have-been. Biophysical computations are the prime activity of this computer designed by extraterrestial intelligences. Hoyle's interest in computers led to considerable newspaper publicity last year when he objected to the "Buy British" policy, which he claimed prevented him from obtaining a sufficiently powerful machine for his researches were he to remain in England.

What about the serious and accomplished writer that one wishes had chosen computerized societies for literary material? Ray Bradbury, John Wyndham and Arthur Clarke might each have done well; consider Bradbury's *Fahrenheit 451*, Wyndham's *The Day of the Triffids*, and Clarke's *Tales from the White Hart*. Clarke inexplicably neglected to consider computers in his *Profiles of the Future*, a book containing many interesting extrapolations beyond present science and technology.

Perhaps some computer scientists concerned with the possible social ramifications of the ever-growing use might turn to science fiction as a medium for thoughtful speculation. Certainly, serious essays on the social implications of information processing seem rather dull and repetitious. ■

an exclusive interview

WAR OF THE COMPUTERS

by JACKSON W. GRANHOLM

I felt it a great honour when my editor assigned me to an interview in the field. I was to interview the noted author, Mr. H. G. Wells.

Wells was spending the summer in Wales, down at Great Ormes Head. I took the evening train out of London, planning to spend the night at the inn at Great Ormes Head, and to meet the famous man at his summer house on the following morning.

On the way down I sat in the train and reflected on the mighty accomplishments of H. G. Wells. His versatility was fully as outstanding as his success at the book counter. For many years he had outsold every other contemporary author in Britain. His works ran the gamut from all-out science fiction to most serious works of history, biology, and similar endeavors. His output was prodigious. He walked through time as a normal person walks through a garden, going all the way from the Jurassic age in "Lost World" to the far distant future in "The Time Machine".

Purportedly Wells was working on a new book, a work of science fiction. Actually, he was always working on a new book. Rumor had it that he sometimes worked on three at a time. I was to discuss this forthcoming work with him, and seek him out for the controversial comment for which he was famous.

I felt misgivings about approaching the great man. After all, I was a mere journalist, and he was one of the greatest authors of our time and a genius by his own admission. Would he consider my visit an annoyance not worth bothering with?

I arrived at Wells' house at the appointed hour on the following morning, and was shown to the terrace overlooking the sea. It was almost an hour before the noted author himself came out. He blinked in the sunlight and gazed long at the sea towards Ireland before he spoke.

"You are welcome to my humble abode, sir," he said. "Shall we get on with it then?"

"Yes, my dear sir," I said with some embarrassment. "My publishers and I are wondering as to what approach your next fictional descriptive effort might take."

"Fictional?" he said, suddenly bristling, "Do you, along with the rest of cloddish humanity, actually believe that my works are fiction? Admittedly, such works as "The Time Machine" have an element of farsightedness in them, but fiction? I think not. And surely, who can claim that "Outline of History" and "Science of Life" are fiction?"

"Yes, I see your point, sir."

"If men would listen to me," he said, "If they would but listen, I could show them the way to be supermen. What a world we would have, lad. What a world, indeed!"

"But don't let me frighten you, lad, with my ramblings; you haven't come here for that. Now, to be serious for a moment, consider, if you will, the work of the past masters. From them we can learn, you see. It is my great study of history that enables me to predict the future not with cloudy vision but with certainty. I presume you have never heard of Charles Babbage? No, I thought not."

The noted author passed a hand slowly over his forehead.

"It was from reading the trials and tribulations of Babbage that I first gained inspiration for the work with which I now wrestle. I had only skimmed Babbage when I received from him in part the inspiration for my work entitled 'The Time Machine'. Since that time I have come to a fuller understanding of where Babbage went, or rather, whither he sought."

"I foresee, in this present work, that mankind will have its very being altered drastically by the kind of machine Babbage envisioned: a giant calculating machine. These machines will, in their way, have power greater than that I ascribed to the gigantic mobile tripod platforms used by the Martian invaders in 'War of the Worlds'. These great computing machines I envision as tools of competition among mankind."

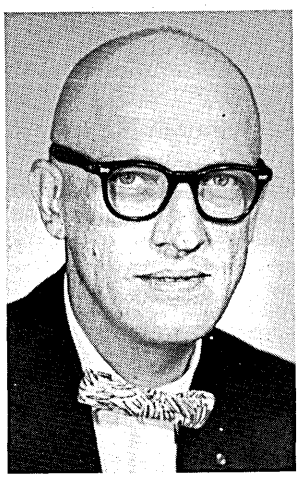
"How so, sir?" I asked.

"Kindly do not interrupt my train of thought when I am in the midst of a lucid description of the plot of my new book." he said.

"Now, to resume, I envision these machines as electrically powered. In fact, I depict them as having no internal moving parts at all, in the mechanical sense. Rather, I foresee that surges or impulses of electricity itself, continually recirculating within the machine, will permit it to keep track of and work with vast amounts of information at speeds far beyond the power of the human brain. And, the unassailable thesis of my book is that, whoever controls the world's information controls the world."

The noted author halted to stare intently for some moments at a peculiar dark spot upon the water, some distance out to sea.

"Men will vie with one another," he resumed, "to



Jackson W. Granholm, noted author, lecturer and philanthropist, is now senior vice president and general manager of Wolf Research and Development Corporation's Western Division, Encino, California.

possess and control these machines, but, in the end, it is the machine who will control men."

"I set my story sometime before this final event. My protagonist, or 'hero' as you would call him, is the chief calculating machine planner of Europe. He controls the interconnected network of machines, one in each capital. The Prime Ministers of the various entities called 'countries' for tradition's sake report to our protagonist who bears the simple title of 'Coder' of all Europe, or, as it is abbreviated, 'Eucode'."

"Because of the power of the machinery network which he controls, Eucode is able to translate all of his directives simultaneously into every language, so that instant communication is a part of his power. Instant and monitored news and education is piped into every residence with the utility services, so there is no need for institutions of 'education' as such. Every man is instantaneously and continually educated with all he may need to know."

"As we might suspect, however, Eucode has a rival. This man is a former Canadian professor of mathematics who controls all of North America because of his position as Chief of Programs for Computing, as they call it there. He is known as 'Programmer' for short."

"I see," I noted lamely while making notes.

"Kindly do not scratch away so loudly while I am speaking!" the noted author said abruptly. "My book is concerned with the rivalries between Eucode and Programmer. Naturally, each will try to tap the other's information sources. The large industrial combines which produce ever-widening machine speed and capability for Eucode and Programmer provide ample support for their respective leaders, and further, carry on a most ingenious espionage against each other, coupled with subversion based on mis-coding of the other's information."

"Now, naturally, to please the cloddish public, we have got to put some so-called 'romance' into our plot, have we not? Therefore, in a thinly disguised effort to wrest more royalties from my publisher, I cause Eucode to get in a damned interesting situation. While monitoring some secret receptions from Programmer's network, Eucode stumbles upon some 'code' or 'programming', we might call it, which has been written by Programmer's lovely daughter. Eucode is most impressed by the feminine beauty and charm with which this nubile young woman, known by the code name of PL/I, writes code. Naturally, he falls in love with her, long distance."

The great man scratched his shock of white hair, absentmindedly.

"Under the guise of writing a vast and all-encompassing new procedure called an 'EXECUTIVE', Eucode begins to carry on a secret love correspondence with PL/I, addressing her as 'ERMA' in code and making use of the underground intertie line through Greenland between network and Programmer's."

"Of course, Programmer discovers this budding romance, and contrives to use it as a way to undermine Eucode. When Eucode and PL/I arrange a secret tryst in Fridjof Nansen Land, Programmer kidnaps his own daughter and substitutes an agent in her place in order to seize Eucode and bring him to North America for 'de-education'. At this point, PL/I escapes and, switching allegiance, endeavors to save Eucode before the damage can be done . . . Of course, we have a dramatic situation here comparable to the best I have written."

"To find out what happens, naturally, you will have to buy my book along with the rest of the cloddish readers. I believe my publisher is aiming for a price within reason. Now, sir, if you will excuse me, I have much work to do to meet my many deadlines. Actually, I've a bit of work to do to work out all the ramifications of this plot, but, as you can readily see, it will be up to my customary excellence. I presume, if you are so minded, that someone might find you a spot of tea around . . ."

And the great man wandered aimlessly back into the house, muttering to himself.

On the train back to London that evening I thought at length on my brief interview with the great author. Surely he was a man of many parts and diverse interests. I thought of his book, now in work, and even found myself wondering if PL/I would manage to save Eucode. As the train thundered over bridges and through the countryside, I tried to doze but could not. I found my mind full of thoughts about giant calculating machines.

My fellow passengers in the compartment were startled when, in spite of myself, wrapt in thought, I spoke out loud.

"Preposterous!", I said. ■

BALLOTS AND BITS

By RICHARD H. HILL

Congress should use modern automated information systems, like the Executive branch and the military—quote from a recent news story.

Even in the usually blase halls of the Congress, Representative Billy Ray Bates was widely regarded as a phenomenon. To the old pros, he was a comer, one marked for greatness. To the lobbyist, he was a new power figure and largely unknown. Newsmen sought him out for an earthy quote to liven a story from the Hill, and then remarked that the intellectual quality they found reminded them of Jack Kennedy. Billy Ray was, in short, one to be reckoned with. In ten years in the House, he had made more of an impact than men who had served twice as long.

To many, this was not entirely unexpected. Billy Ray was an unusual man in many ways, not the least being his education and occupational background. He was the first computer programmer to be elected to Congress. A 1960 graduate of the University of Texas, Billy Ray took

his degree in mathematics to System Development Corporation, where he was rewarded with an apprenticeship in programming. Three years later, he felt sufficiently confident to apply for a job in IBM's Research Laboratories. He was turned down, but was offered a job having to do with something called System 360. He took it, and disappeared for four years into the vast maw that ground exceeding fine and at last produced what was then regarded as the most massive of computer systems. In 1967, Billy Ray was paroled to a command and control systems project in Virginia, where he became a Congressional buff. In 1969, his foresighted choice of parents paid off when they were both swept to their death by a Swiss avalanche while on holiday.

Billy Ray inherited the family ranch, a piece of southeast Texas scrubland that rocked gently on a sea of oil, and in 1972 went back home to run for Congress. He made it on his first try, on the back of a pro-intellectual wave reacting to the folksy ways of the Johnson administration. He was, of course, careful not to be too intellectual, not to forget the proper blend of conservatism and Texas twang that served to conceal a truly burning desire to change the world.

After ten years in Congress, Billy Ray still managed to conceal the desire. Indeed, his wife sometimes wondered, not without relief, if he had lost most of it. It seemed so almost always now, as, in his mid-forties, Billy Ray asserted the full vigor of the prime of life. He impressed conservative and liberal, young and old, high and low with his knowledge and charms. He worked hard, played reasonably hard, and seemed headed for a modest form of greatness.

Congressmen come to Washington with varying degrees of idealism and ambition, but most come first with large quantities of both. The difficulty is that idealism and ambition without a plan or specific objectives die stillborn. Billy Ray lacked neither. His plan, born naturally enough of his experience, he made work. That was why, after only ten years, the party leader remembered Billy Ray with committee chairmanships, delegateships and other modest tokens of esteem, while some of his colleagues languished in obscurity. The Bates Plan, now known as the Congressional Information System, began to form during Billy Ray's first term, and now after ten years was in full operation.

The Bates Plan, or CIS (its advocates were, of course, called CISsies in the early days), drew upon the features of the command and control systems on which Billy Ray had cut his technical teeth. It was intended to provide the Congress with the most up-to-the-minute information possible regarding the state of the nation and the desires of its voters for various forms of legislation. Billy Ray had reasoned, logically enough, that if the military could use computer-based information systems stretching their tentacles throughout the world, then Congress could do likewise. Further, he saw that of all influential social mechanisms, legislative bodies, and particularly the Congress, did their work in a miasma of opinion, half-truth, rumor and conflicting interests. For example, even after 15 years of experience, the actual effect of withdrawing the braceros from California was a hotly debated point. Unions and management groups presented directly conflicting sets of statistics bearing on a proposed increase in the minimum wage. Recent pressures to allow limited combinations of enterprises for private control of competition had reopened old debates over the social and economic effects of cartels. These instances, and dozens of others, had led Billy Ray to the belief that a vast on-line information network was needed to serve the lawmakers.

Billy Ray, himself, contributed much to the systems design of the CIS. In particular, he became an expert on economic indicators, and built into the system an adept and sophisticated facility for interpreting economic trends and forecasting the effects of proposed economic controls. He even did some of the programming, which led to jocularity about old fire horses. Other parts of the system allowed the Congressmen to query an endless stream of facts having to do with education, medicine, military preparedness, our three moon stations, public transportation and hundreds of other subjects.

The CIS was a personal console system. Each Congressman, the President, and members of the Cabinet was provided with a specially-designed console that looked like a modern walnut desk when closed. The desk top lifted up to reveal on the underside a screen for display of data in graphic and textual form. Inside was a keyboard, capacitative function plates, and an electromagnetic tablet for constructing special inputs and manipulating graphic outputs. To use the system, one opened the desk, then signed on, using a special magnetically-encoded identification card and a secret sign-on code. The system responded with a countersign, which in turn required a special response from the user. Finally, the system watch officer was alerted that a user had signed on, and both he and the machine checked on the whereabouts of the signer as a double check against possible unauthorized use. These precautions were necessary, not only because of the military classified information in the system, but also because of the obvious commercial value of the non-military information.

Not every user could access all the information in the system, of course. Not even all Congressmen are cleared at the same security levels, and some information ultimately came to be private to the President or to Congress. The people who worked on the system had special classifications also, permitting them to make alterations in the permanent contents of the system memories. They were the programmers who maintained and extended CIS. Billy Ray was especially proud of the fact that he alone in Congress belonged to this category.

In the early spring of 1982, the country basked in the beginnings of its twentieth year of prosperity, dating from the stock market slump of May, 1962. Part of the credit, many in Congress felt, was due to CIS, whose warnings of economic difficulties ahead prompted corrective measures on both administrative and technical levels. In 1980, for example, the President used CIS to simulate the effect of a threatened steel strike. He was able thereby to persuade both sides to negotiate a settlement proposed by federal conciliators. On the strength of such performances, CIS became widely accepted and used.

After that early spring of promise, CIS inexplicably began to warn of danger ahead. From external appearances,

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the country prospered, with employment high, prices stable, goods freely available, no war in sight; and yet CIS began to show that in the months ahead economic crisis was a certainty. At first, the word was kept quietly within the confines of the authorized users, but inevitably it began to leak to the press. A public made apprehensive by almost too much of a good thing reacted nervously. The stock market slumped again, as it had almost twenty years to the day earlier. Many businesses turned cautious and curtailed investment in new facilities and products, and so it went. Before almost anyone knew it, the economy had turned from boom to near bust.

Billy Ray steadfastly preached calm in the face of adversity. In contrast, many businessmen and particularly financial people, their nerves tautened for the downward slide after so many years of prosperity, predicted gloomily that the economic Armageddon had arrived. The issue gripped the country as few issues had for ten years, and Billy Ray was in the thick of the great debate!

While the philosophical exchanges raged, the programmers of CIS began to subject their finely-turned system to an elaborate series of tests. The first presumption was that errors existed in the formulation of the economic models in the system, hearkening back to the famous incident of the misplaced minus sign 20 years earlier. An independent evaluation of the models revealed no such problem. The second avenue of investigation covered the input data. As in all well-constructed systems, complete logs had been maintained of all system inputs and outputs, and these were reviewed to compare the inputs with independent sources of the same data. The comparisons were sufficiently close that input error had to be ruled out.

One CIS staff member noted in the course of this investigation, though, that changes had been made by a system programmer in certain program parameters. It was a tedious job tracking down all of the changes made by that particular programmer, because they had taken place at seemingly random intervals and had been carefully planned so that external changes were made to economic indicator routines . . . a parameter here, to accelerate the downward effect of normal winter slowing in major construction; a parameter there, to increase the warning economic significance of steel, instead of reflecting the growing dominance of aluminickel as the basic metal.

Altogether about 45 parameter changes had been entered over a 15-month period. The times of entry had been relatively random, but viewed as a whole the pattern was clear. There was, also, never the slightest doubt as to the identity of the tamperer. The CIS had carefully recorded this along with the entries themselves. Billy Ray Bates had carefully planned to use CIS to create a mood of uncertainty and unrest in the country into which he could ride as a knight in shining armor. His systems programmer card and his intimate knowledge of the system made it possible.

The news of his discovery reached Billy Ray in Texas as he was preparing to accept the senatorial nomination from the state Publicrat convention. He left his home on schedule but never appeared at the convention. ■

IMPROVEMENTS IN HARDWARE PERFORMANCE

short-term view

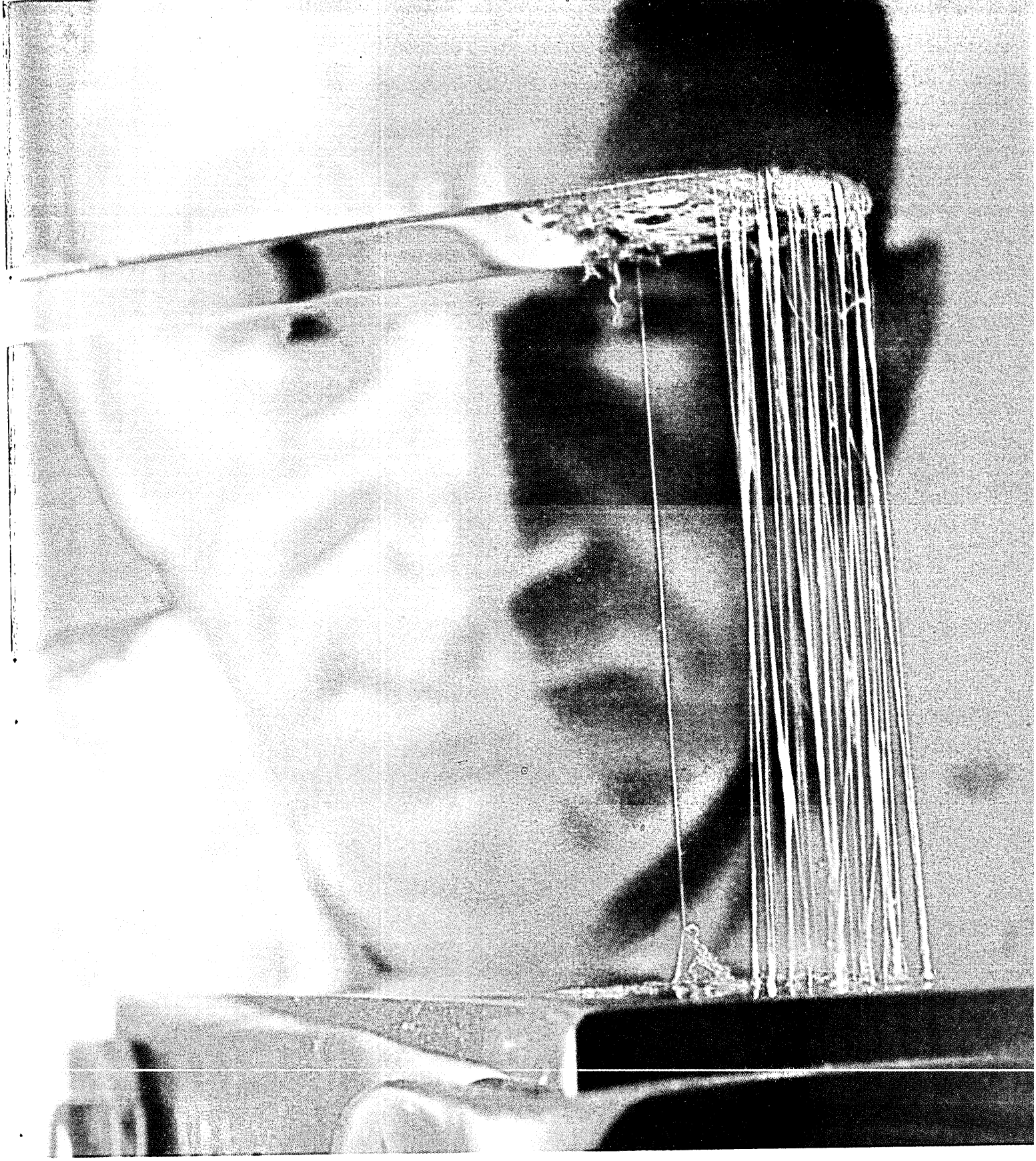
What can we expect in the way of hardware performance improvements in the next five years? Educated guesses on this, placed in the perspective of progress experienced during the last 15 years, were made recently by Dr. J. Presper Eckert, vp of Univac. As summarized in the chart below, Eckert foresees a factor improvement of 20 or more in the next five years in the performance-per-dollar of internal high-speed memories. Logic circuits, he said, can be expected to improve by 10 to 1. Tape units, specialized to provide fast loading and unloading of mass storage, will improve by 10 to 1, sacrificing their fast start/stop time to achieve this.

Speaking at the fall conference of the Data Processing Management Assn., Eckert went on to predict a 10-time improvement in the performance per dollar of mass storage devices, and a 3 to 1 improvement for mechanical printers. Most of the latter will be in speed, he said, and partly in cost. Non-mechanical printers will improve somewhat in speed and greatly in cost.

"The problem of programming, I believe, will continue to be a difficult one, and progress will continue to be less than we hope for—but probably at least as good as we have become accustomed to," he said. "The input problem, where character recognition is applicable, will improve by 2 to 1 or more in the larger, faster apparatus, mostly by cost reduction. I look forward to smaller, less expensive, slower character readers where performance per dollar will not be as good as the larger machines we have today but which will extend character recognition to smaller systems and to remote terminal inputs." ■

PERFORMANCE IMPROVEMENT FACTOR
(Speed Improvement Factor X Cost Improvement Factor)

AREA OF PROGRESS	PAST 15 YEARS (1950 to 1965)	PAST RATE Approx. Av. 5-Year Per.	NEXT 5 YEARS (1965 to 1970)
Internal High-Speed Memory	1000 to 2000	12	20
Logic Circuits	100 to 200	5	10
Magnetic Tapes (but in slow stop-start use)	50 to 100	4	10
Mass Storage	50 Mostly in last 10 years only	7	10
Printers Mechanical & Non-Mechanical	5 to 10	2	3 Higher for non-mechanical
Punched Card Machines	5 to 10	2	?
Programming (coding)	Perhaps 4	1½	?
Input—where character recognition is usable	100	5	2 in large systems —less when extended to smaller systems



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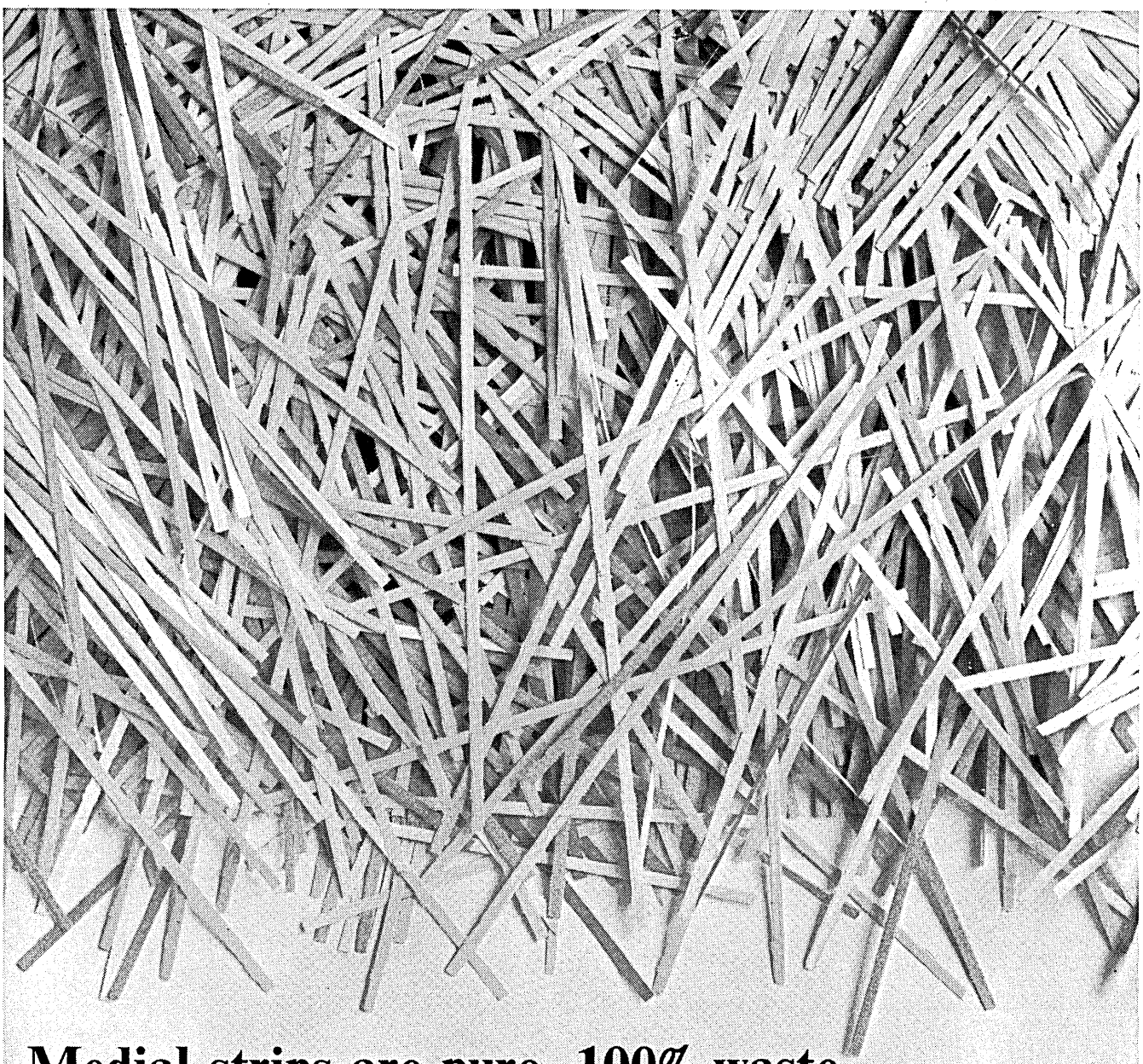

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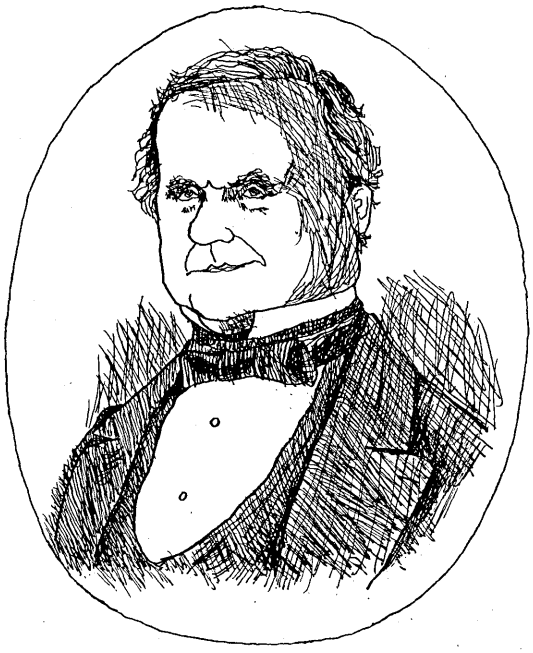


The Author of the ANALYTIC ENGINE

by

David W. Kean

with illustrations by Barbara Vada Benson

IT BEHOOVES A MATURING INDUSTRY to attend to its history. The information processing industry is particularly fortunate to have had as its principal progenitor the almost legendary figure, Charles Babbage. Not only was Babbage a hundred years ahead of his time (with respect to computation surely, but his publication *Economies of Manufacture* gives him standing in the eyes of some as the founder of operations research as well), he was also a colorful and provocative personality. No one who could dedicate a major portion of his time to tormenting organ grinders could have been dull and, consequently, I am for anything that adds to the Babbage lore.

The high points of his life and contributions to technology have in recent years been reasonably well disseminated: his sickly and secluded childhood; his years at Cambridge where he founded the Analytic Society and where, in 1812, the dream of the Difference Engine first came to him; the later construction of what we might today call a "data flow model" of it under a grant from the British government; his inspiration from the Jacquard loom for a calculating machine employing the punched card principle; the expansion of this notion to the design of the Analytic Engine, which was to receive both operations and variables from card documents; his appointment to the Lucasian Professorship at Cambridge though he never delivered a lecture there; and his bitter disappointment when the Chancellor of the Exchequer, Sir Robert Peel,[1] declined to support the construction of the Analytic Engine on grounds that Babbage had never really delivered on his commitment for the Difference Engine and therefore could not be entrusted with further funds.

These events, as I say, have been well documented in recent literature.[2] In addition, I have a

[1] Founder of the London police force, then and now affectionately termed "bobbies."

[2] See, for example, *Charles Babbage and his Calculating Engines*, edited by Philip and Emily Morrison, Dover Publications, N. Y., 1961; "Charles Babbage" by the same authors, in *Scientific American*, April 1952; "Charles Babbage, Scientific Gadfly," *Scientific Monthly*, November 1948; Profile, Jeremy Bernstein, New Yorker, October 19, 1963.

small contribution to make which I think sheds some more light on the Babbage personality as viewed by a contemporary.

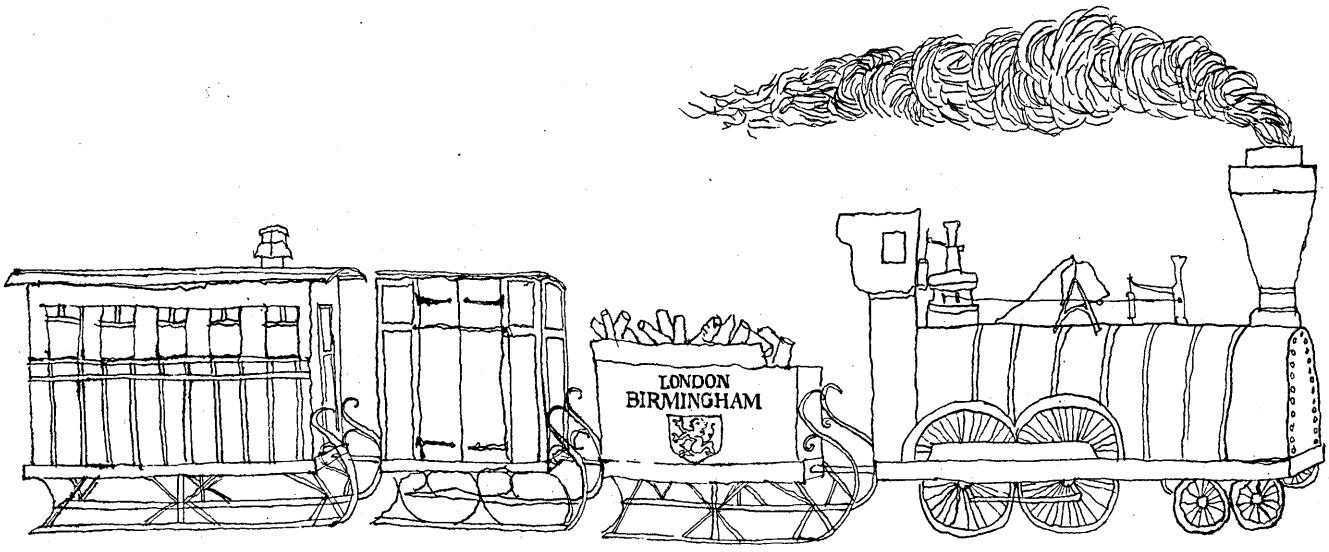
My offering comes as a result of a chance discovery made while browsing in the library of the University of California several years ago. Picking up a copy of Babbage's *Passages from the Life of a Philosopher* (Longman, Green, Longman, Roberts and Green, London, 1864), I happened to open it to page 336. There my eye was caught by a marginal inscription handwritten in fading sepia ink, "N B for futurity!" The passage referred to was underlined and turned out to be a proposal of the author that railways "give up wheels and put carriages upon sledges. This would lower the centre of gravity considerably and save the expense of wheels." Further exploration disclosed that page 336 was a minor example of abundant marginal notes, so I carried the volume home for more intense study.

I suppose that the practice of marginal commentary was more common a hundred years ago that it is now, but I would have thought that even then it would have been more often employed for emphasizing points of dissent rather than agreement. In the present instance, however, the notes preponderantly express enthusiastic acceptance of Babbage's frequently off-beat notions. Close examination of the caligraphy of the notations made it clear that at least three different persons had offered opinions, and it is apparent from the context, as we shall see, that at least two of them had some personal knowledge of the author's work.

The actual identity of the most prolific of the scribes in the university's copy of the autobiography (for that it essentially is) proved relatively easy to come by. An entry on the final page is dated "Hartwell, January, 1865" and a previous one in the same hand is signed "J. Lee." There is evidence in the notes that Lee was not entirely inconsequential himself; for example, at one point he claims (with an air of some superiority over Babbage, who had just lamented never having felt an earthquake), "I felt a considerable shock at Aleppo when a guest of the British Consul, Wm. Barker."[3]

Encouraged by this indication, I consulted the Dictionary of National Biography and found in Volume XI that a "John Lee (1783-1866), collector of antiquities and man of science, ... eldest son of John Fiott" occupied the estate of Hartwell House, Buckinghamshire, which he inherited in 1827 from the Reverend Sir George Lee. Twelve years earlier he had "assumed the name of Lee by royal license, under the will of William Lee Antonie of Colworth House, Bedfordshire, his maternal uncle." Although he was an advocate by training, the biographical note is devoted chiefly to his activities in the fields of archeology and astronomy.

He built a personal observatory at Hartwell and published a work entitled "Sidereal Chromatics, being a reprint, with Additions, from the Bedford Cycle of Celestial Objects and its Hartwell continuation, on the Colours of Multiple Stars." In 1831 he was admitted to the Royal Society. The sketch concludes, "His benevolence was unbounded. In politics he was an advanced liberal and made unsuccessful attempts in 1835, 1841, 1852, and 1863 to represent Aylesbury in the House of Commons



He favored a union of the church of England with dissenters and stoutly opposed Romanism. He was a rigid teetotaller and an enemy to the use of tobacco." He was 82 when he discovered "Passages."

The other two annotators left no clues to their

[3] William Barker, incidentally, was an Orientalist of some repute and later taught Turkish, Hindustani, Arabic and Persian at Eton. Although the Dictionary of National Biography devotes nearly a page to him, it says not a word of his having been consul at Aleppo. It *does*, however, note that "in the list of members of the Syro-Egyptian Society for 1847-8 he is designated, probably by mistake, as 'HBM Consul, Tarsus'." It would seem that Lee has cleared this misunderstanding for all time.

identity, and their contributions are far less numerous. One of these wrote in ink, as did Lee, while the other used pencil. These two engage chiefly in answering questions raised by Lee. For example, when in the text Babbage tells of receiving service beyond the call of duty from an employee named Minchin, and Lee asks, "What became of Minchin, was he promoted?" the penciller answers, "No—not even thanked." (Could this have been Minchin himself?) One would wish that the penciller, being apparently better informed on some matters, had projected more of his memories onto the pages of the book, but Lee remains the principal contributor. There is no clue as to whether Lee had actually met Babbage, but the entry on the last page, previously alluded to, suggests that he had. It reads:

I have been highly instructed and gratified with the contents of this work and am glad to have been permitted to complete the perusal of it. I wish that I had known of the contents of it twenty or thirty years ago, and to have been able to reflect on its contents. I hope the accomplished author may live to publish a second edition with additions. I understand a great deal of the work, but not the whole. Inter alia—I can not understand how an automation (sic) without a live man with him can play a game of chess or even a game of Tit Tat To. I hope to see the author on some day convenient to him bore a hole in a piece of glass.[4] *He has touched upon allmost all subjects except Freemason (sic) and Heraldry and conversing with the fingers.*

The range of subjects covered by the author is indeed catholic (although Lee might have added to his list of omissions his own specialty, archeology) for he discusses in addition to his life and principal works, which he considers "the greatest mechanical and intellectual triumphs of my country," economics, labor, volcanoes, earthquakes, diving bells, the theatre, music, electioneering and politics, experiences at courts, railways, glaciers, humor, religion, miracles, hints for travellers, Prince Albert, Sir Humphry Davy, the Duke of Wellington and other personages of the times, astronomy, flesh brushes, continental royalty, submarines, mines, crime detection, deciphering, and, of course, organ grinders.

Lee generally finds himself in complete accord with the author's comments on these subjects and is moved to exclaim on no less than 55 occasions, "true," "true!" "good," "certainly," or "of course." There also occurs an abundance of such notations as "an elegant idea," "beautiful reasoning," "an admirable definition," "a shameful job," or "a gratifying remark." But Lee is not so bedazzled as to be entirely uncritical, and in many instances takes pains to correct Babbage's grammar or punctuation (sometimes erroneously).

On one occasion the inventor's chief engineer in a pique "discontinued the construction of the (Difference) Engine, and dismissed the workmen employed on it." Babbage, at his leisure, "wrote . . . to the Treasury (which was funding the project) informing their Lordships of the fact;—adding that no advance had been made in its construction for above a year and a quarter; and requesting further instructions . . . . " Lee wonders, "How was this delay to be explained. Did he keep the government in ignorance of the Delay for a year. Did the government express its satisfaction at the Delay." At another juncture, when Babbage grumbles about the miserable support the Treasury provided his endeavors, Lee observes that "the Government liberally offered £3000 in addition to the £6000 already granted," although, he adds, "the expense is trifling compared to the hundreds of thousands now expending on useless fortifications and the millions wasted on iron and Turret ships for the amusement & occupation of the Navy."

But when Babbage expresses confidence in the infallibility of his Analytic Engine, Lee's ebullience goes out of control, "What does the Holy Father and his ministers say to this idea—will they admit that the powers of the A E are equal to the powers of His mind—If so—they must admit the superiority of the powers of mind of the author of the A E." In this case, incidentally, Lee has violated one of his own dictums, for elsewhere he states, in correction of the author's usage, that "God is not a man, but a spirit—It and not He is the term most applicable to God."

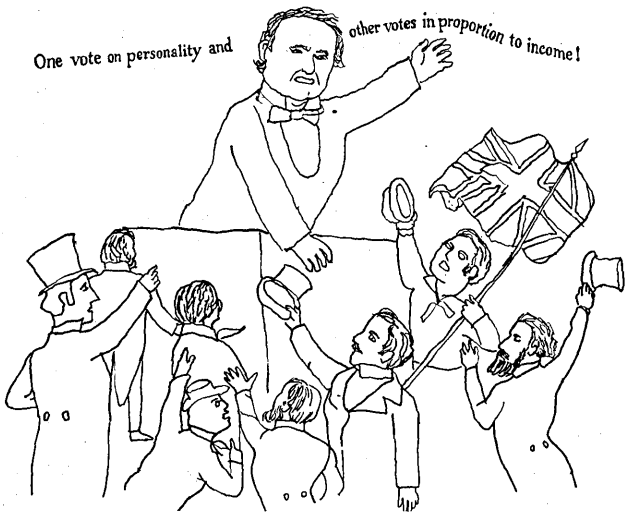
Babbage's bitterness against his own countrymen and government was intense and stemmed quite as much from his ill-advised adventures in the political arena as from the decision to scrap the Difference Engine. Once, having been soundly thrashed as a candidate for Parliament from Finsbury, he was asked to stand for the same body from another constituency, where, he was assured, "my opinions would be very favorably received." But Babbage writes that he would not again be "peculiarly desirous of wasting my time for the benefit of my country." In the course of his electioneering experience he noted some irregularities which he deplored and which, he felt, "if of frequent occurrence would have the tendency to introduce the vote by ballot; a mode of voting for representatives which, in my opinion, nothing short of the strongest necessity could justify."

Lee is moved to concur, in these terms: "Ballot is no check on the free and independent man and would be a (undecipherable word here) to the timid and conscientious and humble tradesman," and "Numbers of voters oscillate and waver, until they see which is likely to be the running tide and then vote with it. The case of the attorney at Windsor. A man ought to have but one motive—to vote for the most worthy." Babbage believed that each person should have "one vote on the ground

[4] This is in reference to a lengthy passage on the art of perforating glass without cracking it.

of his personality, and other votes in proportion to his income. Such a course would have a powerful tendency to good, by supporting the national credit and by preventing the destructive waste of capital by war, and it might even make us a highly conservative people."

In a chapter entitled "Hints for the Traveller,"



Babbage recommends taking along money, a stomach pump, "a dozen large and a dozen small gold buttons" (to be used to dazzle the natives), and the ability "to punch a hole in a sheet of glass without making a crack in it." Although the major portion of the chapter is concerned with the latter art, it is not made abundantly clear, to me at least, that a traveller, even in Babbage's time, would be lost without it, but Lee feels at this point that "Nothing of importance escapes his attention."

Two chapters are devoted to Religion and Miracles, the latter of which Babbage describes as naught but statistically infrequent manifestations of the laws of nature. Lee augments this with the observation that "Anderson the Conjuror nightly performs Acts which hundreds of his audience may believe to be miracles—because they have little knowledge of the Laws of Nature & they may think him inspired," and later, "Anderson the Wizard of the North performed miracles at St. James Hall in December—before Mrs. Lee and me and Mr. and Mrs. ———— and Mrs. Senior and hundreds of others, when he took one of his daughters and two moving rabbits and a goose out of his travelling portmanteau and when he turned the two (so called) live rabbits into one."

Although Babbage once told a friend that he had not had a happy day in his life, he hobnobbed with some of the greatest minds of his, or any, day, and in his memoirs recalls with delight and enthusiasm frequent soirees with these gentlemen which did not adjourn until three in the morning ("the hour of baseness," says Lee). He speaks of thus meeting with Bessel, Poisson, Fourier, Malthus, La Place, Humboldt, Davy, and others.

Once when Babbage was being considered for a secretaryship of the Royal Society, Sir Humphry Davy, then president, incurred his wrath by selecting another ("The President as president has no such right" and besides "he had promised . . . that I should be his colleague"). The snub led him to delve into the financing of a printing of copies of Davy's discourses and to conclude that the latter "contrived to transfer between three and four hundred pounds from the funds of the Royal Society into his own pocket."

In a chapter titled "Recollections of LaPlace, Biot, and Humboldt," the author gets woefully sidetracked on a long-winded discussion of a meeting with Lucien Bonaparte, brother of Napoleon, who "fled to England to avoid the necessity of accepting a kingdom." ("Was that the real object of his visit" asks Lee, and with reason, since Lucien was a prisoner of the British at the time.) Lee objects that "This is a most provoking chapter—

instead of the author describing the proceedings of the meetings at full or giving an abstract or index of it—and references to Books where it may be perused—the dicta sapientum—he blew off to gossip on the Napoleonic family . . . " But Babbage continues, in the same chapter, his coverage of his acquaintances amongst continental aristocracy by telling of dining at the family table of Princess Charlotte of Spain and her husband, the Compte St. Leu. They seemed not at all odd, he recalls, but "reminded me much of a sensible English couple, in the best class of English society."

Lack of experience or even theoretical knowledge did not prevent Babbage from publishing papers in technical fields alien to his regular pursuits. Although he was aware that Fulton's experiments with the French and British navies had been

pronounced failures, he published an article in 1826 describing a submarine vessel which, he says in the present work, "could be propelled by a screw, and might enter, without being suspected, any harbour, and place any amount of explosive matter under the bottoms of ships at anchor." "Woe be to those who would attempt it," writes Lee. "How could they carry explosive matter down with them —or even gunpowder," and then, as though gaining interest upon closer reflection, "How many would the *crew* consist of?"

Although he writes on several occasions of "my eldest son, B. Herschel Babbage" (named for Sir John, the astronomer, a lifelong friend) and thereby implies that there was more than one offspring, no mention is to be found of the rest of his family. It might be charitable to assume the existence of a Mrs. Babbage, but one must then also assume the lack of reference to her in the book to have been for a reason. (His forebears are traced so far back that the author gets involved in a discussion of the Darwinian theory). This omission is not, however, to be taken as a mark of general insusceptibility to female charm.

Although he generally avoided the theater ("Tragedy I disliked, and comedy, which I enjoyed, frequently excited my feelings more than the dignity of the philosophic character sanctioned"), he did once partake in a tableau of which "I still remember my delight when personating a dead body, with my head towards the audience, I lay motionless at the feet of three angels, entranced by their beauty, and whose charms still fascinate my imagination, and still retain their wonted power over my own sex." Lee wonders, beating me to the punch by 100 years, "What could have been the plot—or scene to be represented?"

The volume is dedicated to Victor Emmanuel II in recognition of Italian scientists' efforts (in particular Count Menabrea's) in bringing about "the first public and official acknowledgment" of the Difference Engine. This respect for the king's subjects, however, did certainly not extend to those of his realm who, migrating to London, took up the trade of organ grinding. For these and other "street nuisances" is reserved his most hearty invective. At the outset of a chapter devoted to "instruments of torture permitted by the Government to be in daily and nightly use in the streets of London," is a compilation of those groups the author considers most guilty of encouraging street music. So listed are children, servants, tavern keepers, visitors from the country, ladies of doubtful virtue, and occasionally titled ladies, "but these are almost invariably of recent elevation and deficient in that taste which their sex usually possess." To this inventory Lee adds "Gentlemen of undoubted defect of virtue," but his case is not so clear against them as is Babbage's against "ladies of elastic ('Why elastic?' asks Lee) virtue and cosmopolitan tendencies to whom it (that music) affords a decent ('Why decent?') excuse for displaying their fascinations at their own open windows."

The basic offenders are mostly "natives of Italy, chiefly from the mountainous districts, whose language is a rude patois, and who are entirely unacquainted with any other. It is said that there are above a thousand of these foreigners usually in London employed in tormenting the natives."

Babbage expended from his own pocket as much as 104 pounds in a year in attempts to bring organ grinders to trial, but with the invariable result that the laws against them were found to be imperfect. "I claim no merit for this resistance," he writes, "although I am quite aware that I am fighting the battle of every one of my countrymen who gains his subsistence by his intellectual labour . . . The Government itself is notoriously afraid to face it." Lee concurs that the "Government has no moral courage—nor have the Whigs—the Conservatives —or any political club."

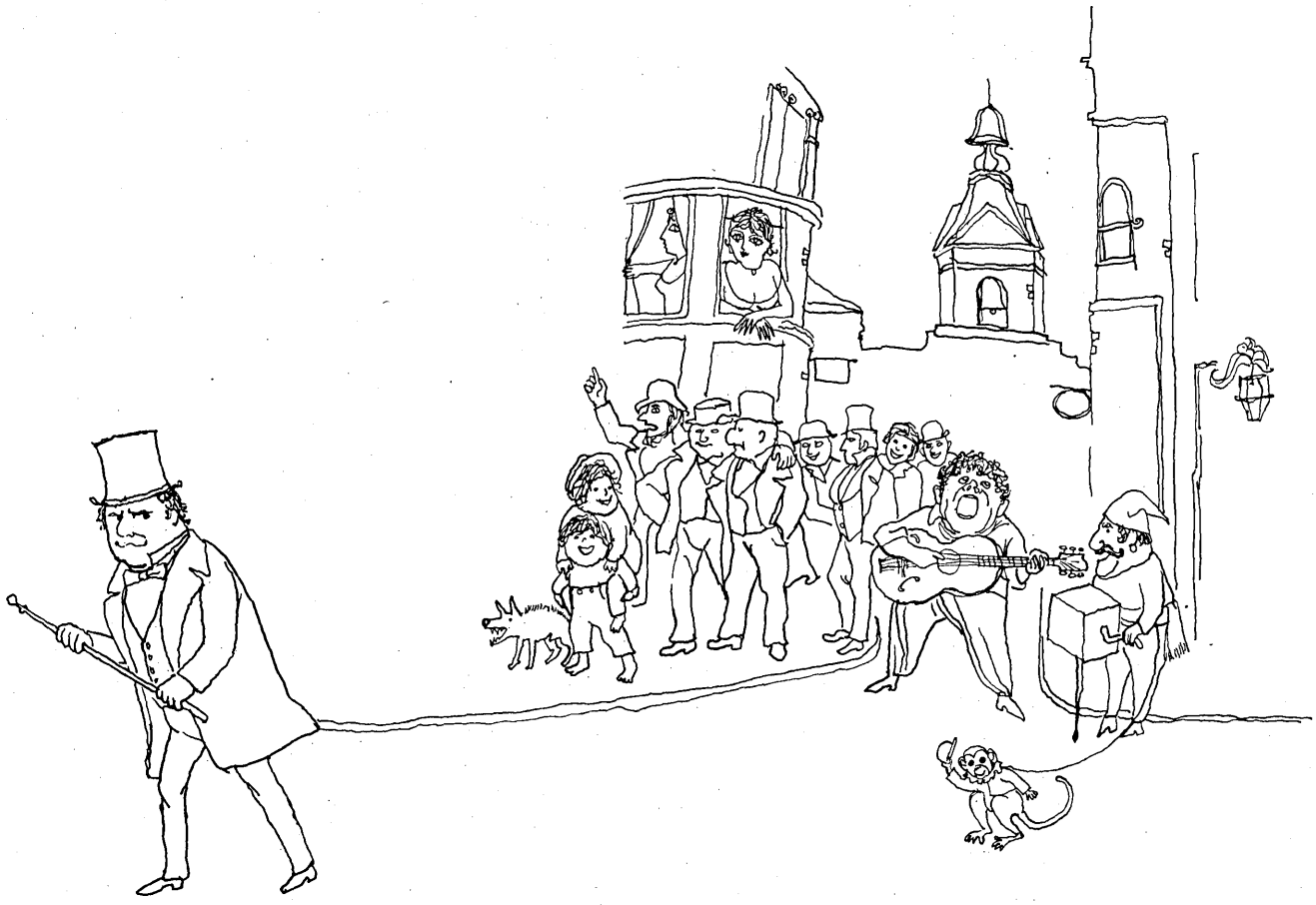
The consequence, perhaps inevitable, of Babbage's ceaseless persecution is recorded in this passage:

Some of my neighbours have derived great pleasure from inviting musicians, of various tastes and countries, to play before my windows, probably with the pacific view of ascertaining whether there are not some kinds of instruments which we might both approve. This has repeatedly failed, even with the accompaniment of the human voice divine, from the lips of little shoeless children, urged on by their ragged parents to join in a chorus rather disrespectful to their philosophic neighbor.

The enthusiasm of the performer, excited by such applause, has occasionally permitted him to dwell too long upon the already forbidden notes, and I have been obliged to find a policeman to ascertain the residence of the offender. In the meantime the crowd of young children, urged on by their parents, and backed at a judicious distance by a set of vagabonds, forms quite a noisy mob, following me as I

the
author of the A.E.

pass along, and shouting out rather uncomplimentary epithets. When I turn around and survey my illustrious tail, it stops; if I move toward it, it recedes: the elder branches are then quiet—sometimes they even retire, wishing perhaps to avoid my future recognition. The instant I turn, the shouting and abuse are resumed, and the mob again follow at a respectable distance. The usual result is that the deluded musicians find themselves left in the lurch at the police-court by their enthusiastic encouragers, and have to pay a heavier fine for having contributed to collect this unruly and ungenerous mob.



"This is more than provoking," sympathizes Lee. "One would have suffered that the ministers, churchwardens, and overseers would in a body levee come forward on civil, if not also on Christian, principles, to protect or shield the suffering transgressors (sic)." "I had heard that the author had been occasionally interrupted in his studies by street musicians and organ grinders but . . . . I had no just idea of the misery and loss of time which he had suffered."

It must finally be emphasized that neither Babbage nor Lee were completely without humor. One hazard the reader of this volume subjects himself to, though, is the frustration of not knowing for sure when they are serious and when otherwise. I am reasonably certain, for example, that Lee was indulging in deliberate pedantry when he penned this note in the margin: "If a pocket Chronometer be set by a Clock going to sidereal time in an observatory and compared day by day, the error or difference between them will be ascertained, and if the error by (sic) daily the same—or a constant quantity—the error becomes of use—and the erring Chronometer as much to be relied upon as the accurate Clock."

However, when Babbage tells, in the course of describing a long and complicated vision that came to him, of how the lone angelic survivor of a heavenly cataclysm split himself in two parts, and Lee asks, "Were his parts three feet each or six feet? Was the division ⊥ or horizontal?" then I feel they are both pulling my leg. But I wouldn't be sure of it. ■

MR. KEAN *is a senior engineer and assistant for technology to the manager, Systems Development Div. Laboratory, IBM, San Jose, Calif. Previous assignments with the firm include early design work on the 305 Ramac. He is also a member of the Santa Clara County Board of Education. Previously, he was associated with the Natl. Bureau of Standards and the Naval Ordnance Test Station. He holds a BS in EE from Tufts Univ.*

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

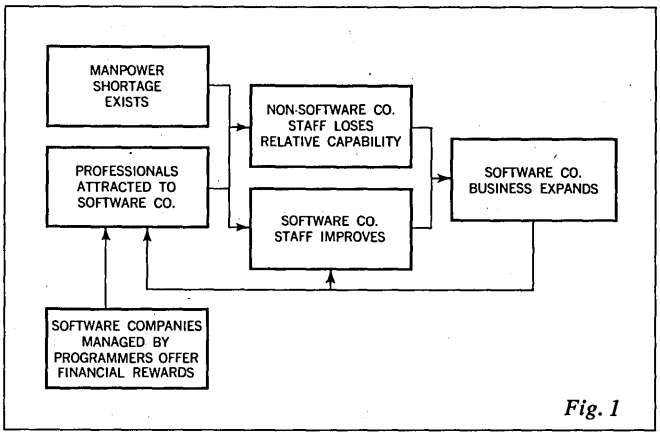


Fig. 1

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.

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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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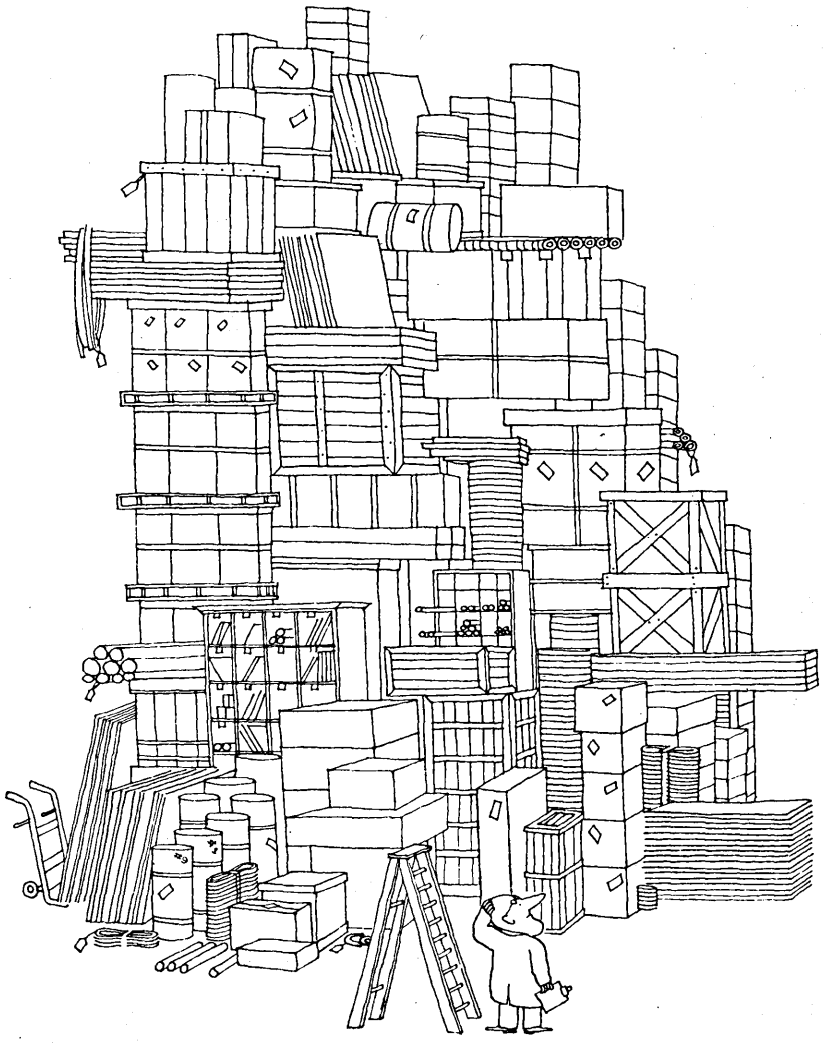

How to put your finger on one item out of 36,000

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THE POST-IMPLEMENTATION FEASIBILITY STUDY

by LOUIS FRIED

As business firms continue to increase their use of large-scale computing equipment, management is presented with the requirement for investment in analysis and programming for new systems utilizing this equipment. This investment may amount to 50% or more of the total operating cost of the EDP installation.

The decision to invest in a new system is generally based on the findings of a preliminary analysis of the problem area. To provide management with the information on which to base decisions, the results of this analysis are usually stated in terms of two or more alternative proposals (one of which may be the continuation of present methods). Each alternative proposal is accompanied by a description of the problems inherent in, and benefits to be derived from, its implementation. These problems and benefits may be presented as potential gains or losses in operating efficiency, profit, operating costs, savings, and intangibles (such as the increased availability of information).

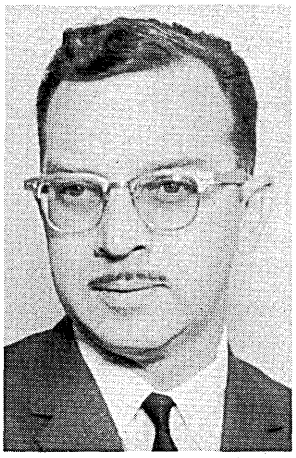
Experience indicates that this preliminary analysis is often the only survey of economic feasibility performed for the system. Unfortunately there is, as the Bureau of the Budget states, ". . . a general tendency among ADPS users in both Government and industry to underestimate the amount of operating expense associated with a large scale, tape operated ADP system".[1]

When the firm's operating costs or profit statements do not reflect the benefits anticipated for the system, management often becomes dissatisfied with the results of the entire data processing operation rather than with the specific system at fault. This attitude of management has become increasingly evident in articles appearing in business and data processing trade publications as well as in expressions of opinion within individual firms.

It is possible that this generalized dissatisfaction is due to the lack of follow-up surveys which might serve to pinpoint the responsibility for payoff failure to specific systems.

Excluding the discomfort of the average data processing manager in having to maintain a defensive attitude toward other members of his organization's management, the size of our collective national investment in data processing applications emphasizes the need for serious examination of the actual results of systems implementation. All of the 100 largest companies in the United States today, and many smaller firms, are completely committed to the use of computers for performing repetitive clerical functions. The ability to achieve the massive size and continuing growth of many of these firms has often been contingent on management's receipt of more accurate and more timely information. Due to the volumes of data involved, the required speed of reporting can often only be achieved by computer equipment.

The cost of maintaining and developing the ability to provide this information is high. It has been estimated (by Gen. David Sarnoff at the 1964 Fall Joint Computer Conference) that private computer programming cost two billion dollars in 1964 and (by Milton E. Mengel at the 1964 BEMA show) that the cumulative value of computers and peripheral equipment installed through 1965 will be near six billion dollars. Mengel also predicted



Mr. Fried has recently joined the Bourns Corporation as assistant for special projects to the vice president, finance. He was previously supervisor of financial systems for the Guidance and Control Systems Division, Litton Systems, Inc. He holds a BA in public administration from Los Angeles State College and an MS in business administration from San Fernando State College.

[1] Bureau of the Budget, Executive Office of the President, "Automatic Data Processing Case History, Department of the Navy, Electronics Supply Office" (Harbridge House, Boston, 1964) p. VIII-31.

that the value of installed equipment will continue to increase by two billion dollars a year through 1970.

As these estimates represent a sizeable expected commitment on the part of business firms, a true realization of the actual benefits derived from each system must become increasingly important to management.

Many publications in the field of data processing have discussed systems follow-up, cost of information, and feasibility studies. However, in actual practice within business firms the post-implementation review of new systems for economic feasibility and performance efficiency has been largely ignored. The failure to perform such reviews may be blamed on lack of personnel, inadequacy of present methods for determining feasibility, or even on a subconscious desire to avoid finding that a system is not feasible.

It is true that most sources discuss post-implementation studies in such vague generalities as, "compare the operating costs of the new system to those of the previous system." Other sources present brief lists of elements of cost that should be examined, but are generally incomplete.

The Bureau of the Budget has pioneered in the development of post-implemenation study of economic feasibility through actually performing such studies. While the results of these studies are available, unfortunately they relate to specific cases, and no generalized rules or guidelines for performing these studies are reported.

Any comparable work which may have been performed for a private business firm is, so far as research can find, unpublished.

This situation lends weight to the arguments for the inadequacy of present methods and calls for the suggested solution that follows.

These methods have been tested successfully in a case study performed in private industry and the resulting suggested approaches are based on the problems encountered in that case study.

the answers desired by management

The goal of post-implementation system study is to inform management of the results of implementing a specific system. This information is generally expected in terms of changes in cost of operation, changes in efficiency, and changes in output production. This change can be measured by comparing the new system with the previous system and with what the new system was expected to accomplish.

To turn this generality into useful information, the criteria for determining feasibility and the elements of information to be compared must be examined.

The study of economic feasibility may be divided into two major segments, the first being composed of those elements of cost pertinent to the problem, the second being the nature of the comparisons by which economic feasibility is to be judged and the standards established for its determination.

cost elements

As a practical matter, it will be found in the performance of feasibility studies that the elements of cost to be considered are a function of the system under examination and are conditioned by the data available. (More of this later.)

The process of selecting the appropriate elements of cost should include removing those elements in which changes are either insignificant or do not occur. This preliminary examination may result in simplifying the entire task, as well as the final reports.

The elements of cost to be considered are of two types: nonrecurring costs and operating costs. Nonrecurring costs are those such as the costs of analysis, programming, training of operating personnel, conversion from the previous system, new equipment acquired for the system, program and systems test expenses, parallel operation of the new system, and the added cost of operation resulting from inexperienced operation of the new system (the beginning of a new learning curve).

Occasionally nonrecurring costs may include the loss incurred by disposition of equipment and stocks of operating supplies or forms not usable in the new system.

Operating costs consist of equipment rentals, wages, operating supplies, forms, floor space, power and light, communications costs (such as telephone, telegraph, leased communications lines, microwave or other transmission), employee fringe benefit costs, normal training costs resulting from turnover or increased personnel requirements, and amortization of the nonrecurring costs over the expected life of the system.

When data processing operating costs are examined they may be broken down into elements such as input (keypunching or data transmission) costs, production costs, rerun costs, clerical costs for data processing control, and system maintenance costs such as those for analysis, programming, and program assembly and testing.

Operating costs may also include gains or losses in the firm's profits resulting from the operation of the system. For example, storage costs may change as a result of implementing a new inventory control system or transportation costs may be saved as the result of implementing a new traffic control or delivery routing system.

It must be emphasized that the above lists are by no means complete and that additional elements of cost may be found relating to the system under study.

determination of economic feasibility

It is often assumed that the objective of systems development is cost saving. If this is true for the system under study, then the results of a comparative analysis of costs between the new and the previous systems is sufficient to conclude the matter. If, however, the system is developed to increase efficiency, enhance profit potential, or provide information previously lacking, then other comparative analyses must obviously also be considered.

Comparing only the costs of the new and previous systems involves being subject to distortions from changes in the composition of elements of cost over the time period elapsed and from the differences in the objectives and parameters of the two systems. If the cost of the original system is analyzed at a certain point in time and then compared to the cost of operating the new system after implementation a year or more later, the price of labor, equipment, and supplies may have changed enough to make the comparison meaningless.

If the new system performs functions that the old system did not, comparing the total cost directly would place the new system at a disadvantage.

A cross-check on the above comparison may be provided by comparing the actual cost of the new system operation to the estimated cost prepared at the time the system was proposed. This comparison will aid in assuring that all elements of cost are included and that the proper functions of the system are being examined.

Establishing a relationship only between the new system operating cost and the estimated cost would serve only to evaluate the validity of the estimate upon which management made the decision to implement the system and, perhaps, to indicate the reliability of the estimates provided by systems analysts.

To overcome the apparent weaknesses of these compari-

sons when used alone, some combination of these would seem most practical in establishing the comparison and criteria to be used.

Before suggesting some comparisons that may be used in presenting a post-implementation analysis, some attention must be given to the dollar values themselves. Care must be taken that the values are equivalent in terms of the operation of the system. For example, if the business is seasonal, comparing the costs between a peak load period and a relatively light period would be invalid. Similarly, comparing costs between a four-week and a five-week month would be invalid.

If sample costs are used, the sample must be large enough to be representative, i.e.: it is generally better to sample three or more months out of a one year period than to assume that one month is representative of the entire year's activity.

If actual costs are used for the comparison and collected over a longer period of time, the presentation of these costs may indicate "peaks and valleys" resulting from variations in the volume of work. This irregular curve may tend to obscure the essential comparison being performed. In these cases it is often better to present average costs for the month or quarter (or for the number of transactions processed, etc.) which has the effect of smoothing the curve.

It should be remembered that the cost of the new system includes amortization of the implementation cost. The size of this amortization amount is partially dependent upon the estimated life of the system during which the amortization must take place. For this reason it is important to identify this cost separately in any comparisons, since this information could influence management's viewpoint on modification or future replacement of the system.

There are four basic sets of information representing the minimal requirements for an adequate presentation of the analysis to management. These are:

1. New system operating costs
2. New system costs including amortization of the implementation cost
3. The projected cost of continued operation of the original system
4. The estimated cost of the new system including amortization of the estimated implementation cost

The cost of the new system is not directly compared with the cost of the original system in the above list. Such a comparison might not take into account the differences arising from changes in the cost of personnel or equipment or from changes in the volume of transactions processed.

In addition to the above list, if the new system performs functions that did not previously exist, the users of the system may be asked to place some reasonable value on these new functions or outputs. This value should be added to the cost of continued operation of the original system for another comparison.

comparing operating efficiency

Certain obvious comparisons may be made to determine the relative efficiency of the original and new systems. Some of these might be such as the number of transactions processed during a given period of time, the average time required for processing different types of transactions, or the average elapsed time for processing a cycle of the system.

Other measures of efficiency which may be applicable to certain systems are less obvious but are equally valid. In a batch processing system the average age of the data being processed provides a good measure of the efficiency of the system.

The cost of the employees operating the system (such as the clerks in an accounts payable section) has been included in the cost analysis but the clerical efficiency of the system is often overlooked. This must be considered in any measurement of comparative efficiency. On this basis a reduction of operating employee headcount for the same volume of transactions provides a good measure of relative efficiency. Equally good are measures such as the comparative backlog of transactions to be processed or the comparative averages of transactions processed per operating employee.

Some data must be processed within a certain time or its value changes. Some examples of this might be that a delay in recording receipt of materials into inventory would cause the production of an invalid purchase order in an automated ordering system, or delay in processing an invoice may result in the loss of a discount in an accounts payable system. The volume of these types of transactions could provide another good measure of efficiency.

These comparisons, just as those made for cost, should be performed between equivalent periods of time and volumes.

At a minimum, the comparisons should be made between the new system and the original system, but it is also desirable to compare the new system to the efficiency estimated at the time it was proposed. If the new system does not compare favorably with the estimate it may indicate that some functions are not being performed properly.

environment of the feasibility study

It is apparent from the foregoing sections that a considerable amount of data must be collected to perform a post-implementation analysis. This requirement is not nearly so formidable as it may appear.

The prime requisite of any post-implementation analysis is pre-planning. It is this planning that determines the environment in which the study will be performed, and ultimately determines the success or failure of the study.

Since the performance of the study requires the expenditure of some time and money on the part of the firm, it is contingent upon a management decision to incur the expense. An actual test of the methods presented here resulted in a cost of 0.5% of the yearly operating cost of the system.[2] This does not appear to be excessive, recognizing the fact that it would permit timely discontinuation or modification to the system if it were found to be unfeasible.

The decision to perform the study must be made early enough. If this decision is made after the new system has been installed, much of the data required for comparison of the original system may no longer be available. A timely decision will also help to assure that the documentation and operating data for both the original and new systems will be maintained and collected over a sufficient period of time to be a statistically meaningful sample. Maintenance of such documentation and data must be performed in a formal manner independent of specific personnel. The failure to maintain formal records could result in the loss of much necessary information from turnover or loss of personnel.

The information to be retained consists of three basic types:

1. Information relating to the design and intent of both the original and new systems for determining what functions may be properly compared
2. Information relating to the operating costs of both the original and new systems
3. Information relating to the cost of implementing the new system and to changes in scope or definition

[2] Post-implementation feasibility study of a procurement and accounts payable system at Guidance and Control Systems Division of Litton Systems, Inc., April, 1965.

which may affect the costs of implementing or operating the new system

Information of this type provides the ability to determine not only the comparative efficiency and costs of the two systems but also the reasons underlying any changes or unexpected results appearing in these comparisons.

Systems design and programming specifications for both the original and new systems will provide basic source material for examining the design and intent of the two systems. If the systems are basically manual paperwork flow charts, work flow studies and standard policies and procedures will provide much of this data.

Operating cost and performance data may often be derived from reports regularly produced for accounting or management control purposes, or special reporting may be required for the period of time covered by the study. In this regard, two particular problem areas should be noted.

First, at the time that a proposal for replacement of an existing system is approved by management the criteria by which the performance and economic feasibility of the new system may be judged should be determined and documented. This statement would provide a basis for the definition of the data to be collected and, being made at the time of the proposal, insure that such data will be collected and retained from that time forward.

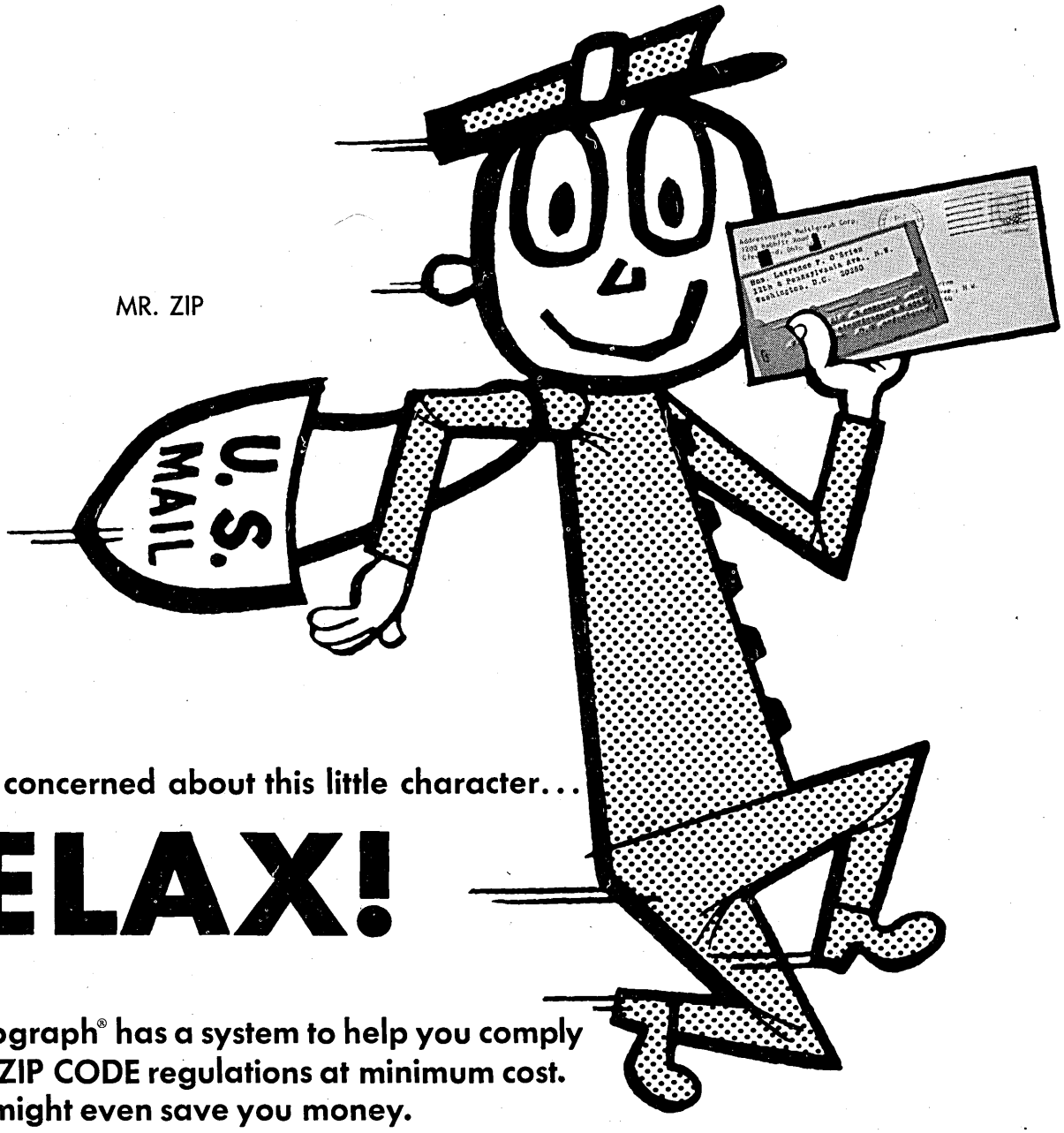
Second, after definition of the data required for the feasibility study, the current reports of the firm should be examined to assure that the necessary data is available. If these sources prove incomplete or inadequate suitable means for collecting the data should be established.

Documentation such as letters, contracts, reports and requests for changes in the parameters of the new system during the time of design and implementation should be collected to provide the information necessary for the analysis of discrepancies from the expected results. (Of course, any final report of a feasibility study to management should contain explanations of any discrepancies indicated.)

Since one purpose of performing a post-implementation feasibility study is the prevention of continuing loss from an unfeasible application, this study should be performed as soon as possible after installation of the new system to minimize the extent of the potential loss. The data relating to the operating cost of the new system should, however, be obtained during a period in which the system is fully operative and functioning in the manner for which it was intended. This will prevent unwarranted conclusions based on the inclusion of costs which may actually be a part of the costs of implementation such as inefficiency during the learning period, system or program debugging, or excessive rerun costs.

The performance of the feasibility study by an interested party, such as one whose job security or chances for advancement depend upon the favorable outcome of the study, should obviously be avoided. The possibility of introducing bias into the results of the study through selection of the elements of cost, criteria for evaluation, or the comparisons performed will then be minimized, if not eliminated.

Finally, the determination of economic feasibility or relative efficiency should not be made on the basis of a single criterion since, if the post-implementation analysis provides doubtful or marginal results, management cannot be provided with a conclusive evaluation of the system. The use of several different criteria will generally provide stronger support for the final conclusions. ■



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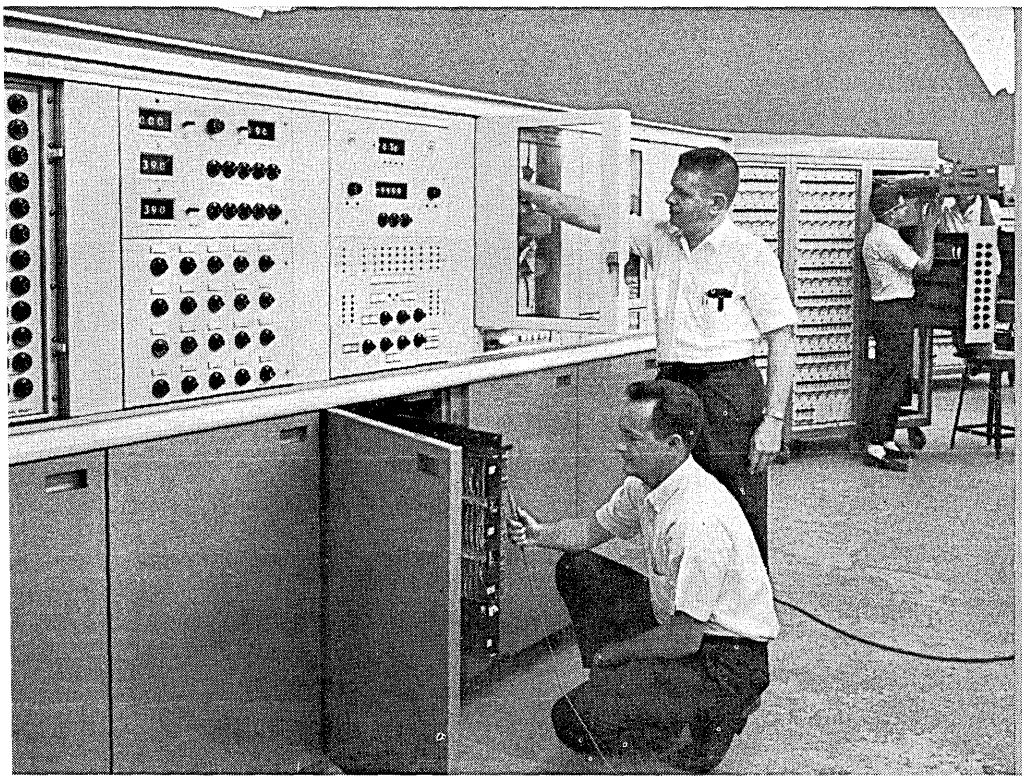

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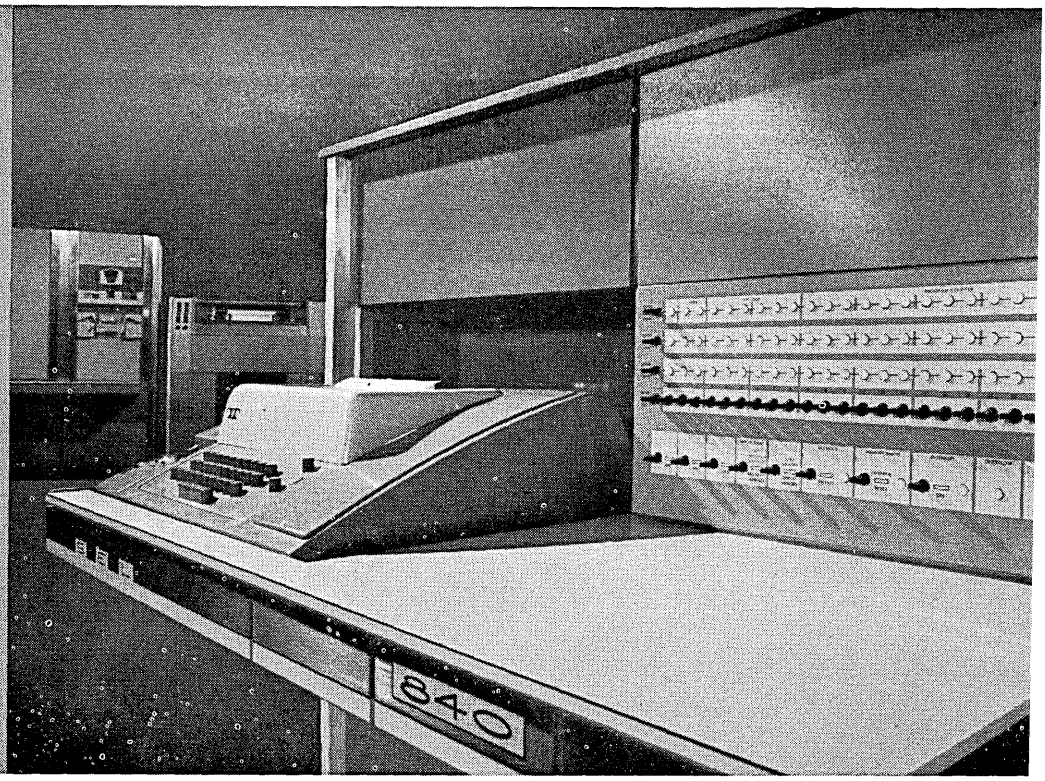

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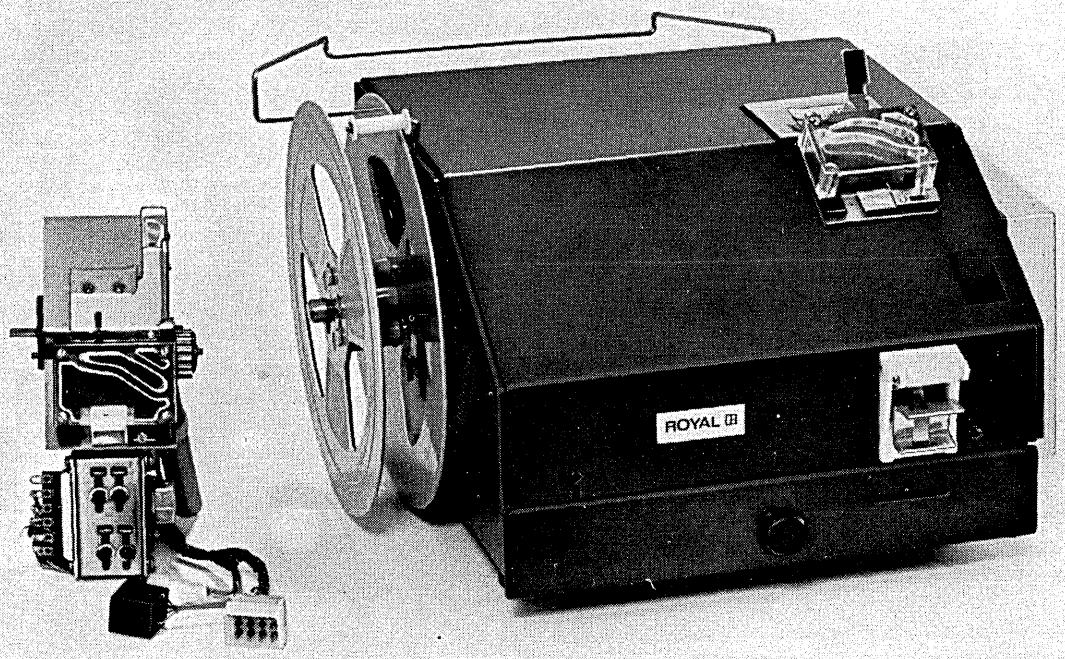

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CIRCLE 30 ON READER CARD

COMPUTER CHARACTERISTICS

by DAVID E. WEISBERG

Although the pace of new announcements in 1965 slackened slightly from that of the previous year, more than 35 general-purpose computers were added to the Computer Characteristics Quarterly, ranging from the very large Burroughs B8500 to the Data Machines 610 at the other end of the spectrum. This was the year that IBM filled out its System/360 with the high-performance Models 65 and 75, the Model 44 for smaller scientific users, and charged into the time-sharing battle with the Model 67. The other manufacturers were also running with the throttle wide open, and the arrival of new systems shows little sign of slowing down from the current rate.

Several discernible trends became apparent as the year drew to an end. Perhaps the most important of these is the broad acceptance of time-sharing employing remote consoles as a technique to be used now rather than as an object of exploratory research. Among the computers to enter this market were the CDC 3500, SDS 940, UNIVAC 494, Burroughs B8500, IBM 360/67, GE 645 and UNIVAC 1108 II (the last two being announced too late for inclusion in the January 1966 issue of the Quarterly).

The use of fully integrated circuits as well as various types of hybrid modules is becoming more common as a number of computers utilizing these components were announced during the year. Although "third generation" may

SECTION I

	Monthly Rental Typical Range	*First Delivery* Month and Year	*Processor Speed* Complete Add Time in Microseconds	Storage Cycle Time in Microseconds	*Internal Storage* Capacity in Thousand Words	Word Size	*Magnetic Tape* Thousands of Characters per Second	Buffering	Read Forward and Reverse	*Disc Storage* Capacity per Unit	Access Time in Milliseconds	Thousands of Characters per Second	*Drum Storage* Capacity per Unit	Access Time in Milliseconds	Thousands of Characters per Second	*Peripheral Devices* Cards per Minute In–Out	Paper Tape Characters per Second In–Out	Printer Lines per Minute	Off-line Equipment	*Other Features* Program Interrupt	Index Registers	Indirect Addressing	Floating-point Arith.	Memory Protection	Byte. Manipulation	Console Typewriter	*Software* Algebraic Compiler	Business Compiler
BURROUGHS B8500	$250,000 (100-350)	—/67	.2[C]	.5	16-262	48b	24-72 MR WC	√		9.6 M 20[K]	1600	—	—	—	—	1400 300	1000 100	1040	—[Q]	√	—[S]	√[T]	√	√	√	√	√[Y]	√

C. Parallel execution of instructions and memory overlap allows increased speed. Multiple processor modules can be attached. K. Disc access time can be reduced in multi-unit systems by optimally scheduling read and write requests. Q. The large number of channels in each I/O module (512) eliminates the need for off-line equipment. S, T. Any word can be used as an index register or for indirect addressing. The last 12 words used are stored in a 100 nanosecond associative memory so that references need not be made to working storage each time a word is so used. Y. Extended ALGOL in addition to FORTRAN.

SCIENTIFIC DATA SDS 940	$18,000 (14-25)	4/66	3.5	1.75	32-65	24b	1.5-96 MR WC	—		67 M[K] 199	—	—	—	—	—	800[M] 300	300 60	1000[P]	92	√	1	√	—	√	—	√	√[Y]	√

E. Memory mapping sequence included. K. 8M rapid access disc with 17 or 34 ms. access time also available. M. 400 cpm reader also available. Y. ALGOL in addition to FORTRAN. An on-line debugging and editing package is also included. Note. This computer system is designed for time-sharing.

CONTROL DATA 3500	$13,900 (6-28)	3/67	1.3[C]	.8	8-262	24b[F]	7-120[G] MR WC	√		33 M 195	83	4 M	17	2000		1200 250	1000 120	1000[P] 150	3500[Q] 160[A]	√[R]	3	√	√[U]	√	√	√	√	√

C, P. See CDC 924/A. F. Plus parity. G. Tape units are IBM compatible. Q. Second 3500 processor may share memory and act as satellite system. R. 64 levels. U. 48-bit precision floating-point available. Note. Dynamic hardware address relocation included.

IBM 360 Model 44	$10,000 (5-25)	10/66	1.75	1.0	32-131	1a[F]	30-340 MR WC	√		207 M[K] 75	312	4.1 M[L] 8.6	1200			1000 300	— —	200 1800 1100[P] 360		√	√[S]	—	√[U]	√	√	√	√	√

F. Each character is eight bits or two decimal digits. K, L, P, S. See IBM 360, Model 92. U. Double-precision floating-point included.

RCA SPECTRA 70/35	$7,300 (3-25)	10/66	23.08[C]	1.44[D]	16-65	1a[F]	30-120 MR WC	√		7.25 M[K] 97.5	156	1 M	8.6	117		1435[M] 300	200 100	1250 625	√[Q]	√	43[S]	—	√	√	√	√	√	√

C, F, K, M, S. See RCA SPECTRA 70/55. D. Per 2 bytes. Q. RCA SPECTRA 70/15, 70/25.

UNIVAC 1005 Models II, III	$2,300 (1.6-2.9)	2/66	208	6.5	2-4	1a	8.5-34 none[H]	—		—	—	—	—	—		615[M] 200	400 110	600	—	√	0	—	—	—	√	—	—	—

H, M. See UNIVAC 1004, Models II, III.

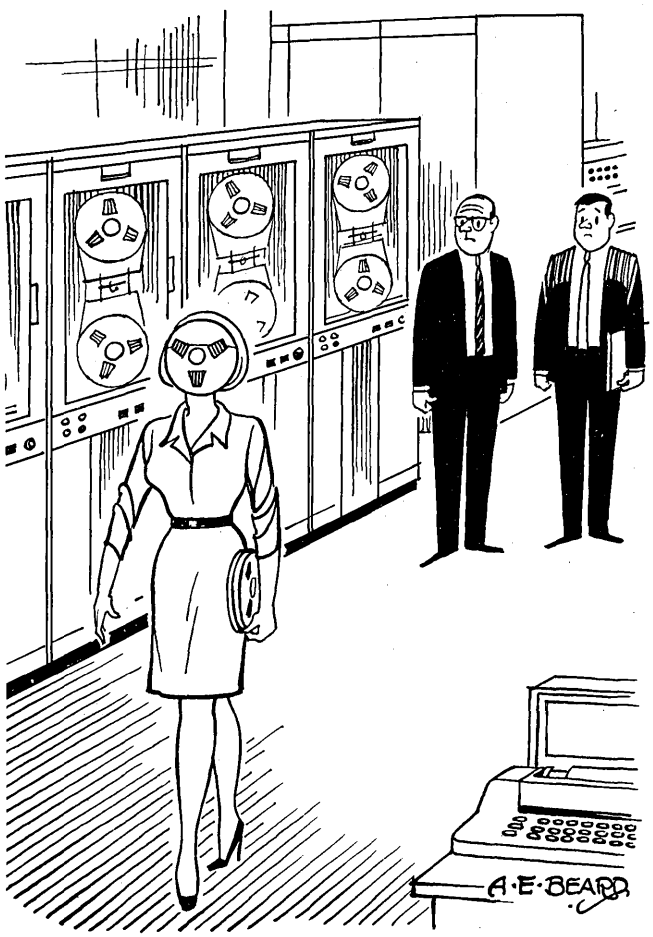
UNIVAC 1005 Model I	$1,700[A] (1.4-2)	2/66	256	8	2-4	1a	—	—		—	—	—	—	—		300[M] 200	400 110	400[P]	—	√	—	—	—	—	√	—	—	—

A, M, P. See UNIVAC 1004.

not be a proper term when referring to these computers, the increased use of such circuits will tend in the future to reduce the cost of computing power and increase the level of reliability. Unfortunately the inherently unreliable electro-mechanical peripheral devices will have to await some other breakthrough in technology.

In the area of file storage, small removable disc memories are becoming more common with units announced by SDS, GE and CDC. In fact, IBM has replaced its large monolithic disc file units with the 2314, which consists of eight of their previously highly successful removable-disc storage drives integrated into one unit. Magnetic strip memory units, for which a great future was forecast in some circles a short while back, had only moderate acceptance with Honeywell being the only manufacturer bringing out new units during the past year.

A trend which seems to be catching on is the use of computer-aided display, both small alphanumeric consoles and large-screen line-drawing graphic units. Indeed, some people feel that this may be the next major development in computer technology. For instance, we at Adams Associates are devoting substantial effort to an in-house study of available graphic display equipment. The two big deterrents in this area in the past have been the lack of software techniques and the high cost of the equipment. Both these problems are rapidly being solved and although the era of two displays in every office is some time away, the data processing industry will shortly find them a familiar sight. ■



CIRCLE 33 ON READER CARD →

There is a

length of

U.S. Tape

affixed

to the back

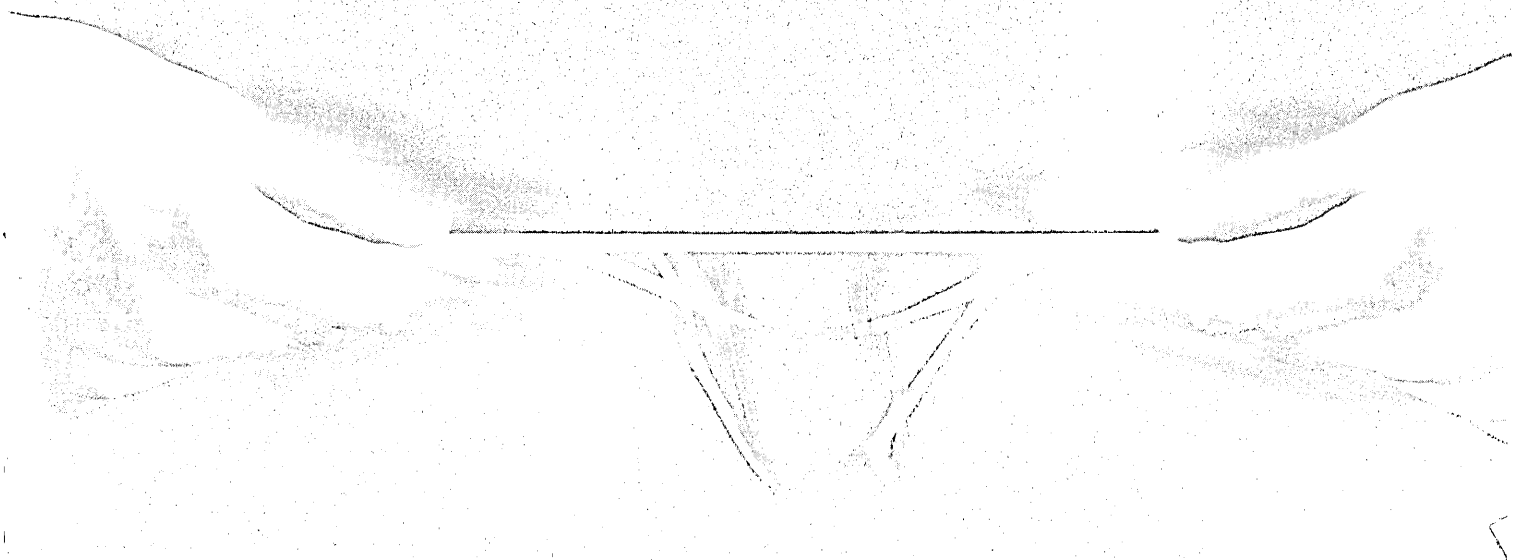
of this page.

You are

cordially

invited to

TORTURE it!



This is your test sample of U. S. Tape.

TEST #1

The Cellophane Tape Test. Your sample of U. S. Tape is mounted oxide surface up. Press a 3" or 4" length of cellophane tape along any portion of the sample. Then, holding the sample down, pull the sticky tape away at a low angle. Note the tenacity of the oxide bond.

TEST #2

The Solvent Test. Moisten the oxide surface with carbon tetrachloride, then wipe with cotton or cloth. This, too, will not remove the oxide.

TEST #3

The Snap Test. (To accomplish this test, remove sample.) With oxide surface up, grasp tape with thumbs on top and fingers underneath. Try to pop the oxide off by snapping vigorously.

TEST #4

The Scratch Test (before elongation). With tape lying on glass or metal, dig index fingernail into coated surface. U. S. Tape's coating will resist this punishment until the tape itself tears.

TEST #5

The Scratch Test (after elongation). (To accomplish this test, peel pressure sensitive mounting away from sample.) Stretch your U. S. Tape sample and dig again. Results will be similar to those above.

RESULTS/ Those who have tried these oxide-removal tests on the nine leading magnetic tapes for digital computers tell us: Only U. S. Tape consistently passes them all.

If sample has already been removed, write us for another.

TEST #6

TRY U.S. TAPE ON YOUR OWN DIGITAL COMPUTER EQUIPMENT

See for yourself how U. S. Tape delivers superb performance pass after pass, week after week, month after month . . . on all IBM and compatible systems. ✲

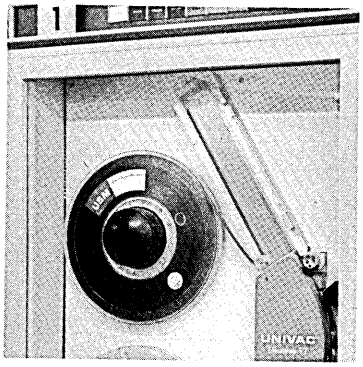
A born leader, this heavy-duty, long-life polyester magnetic tape is produced in the most modern plant facility of its kind in the country. Exclusive formulation, gravure coating, polishing, slitting, tension winding — all are precisely controlled to provide you with the finest, most reliable tape you can buy.

To prove it, the U. S. Magnetic Tape Company offers the **longest, strongest guarantee in the tape industry:** a unique, 90-day life guarantee from date of use . . . plus . . . a 3-year performance warranty!

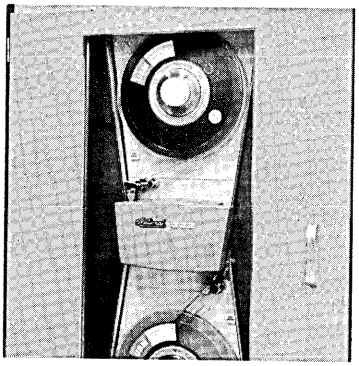
✲ *See equipment listing next page.*

US TAPE

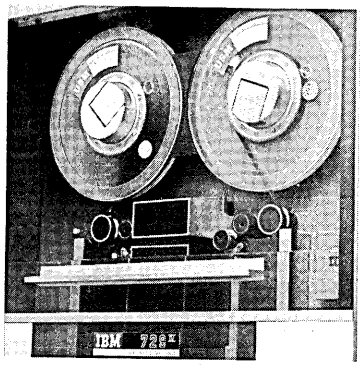
If your computer manufacturer and tape drive model are included here, you can enjoy the performance and reliability advantages of U. S. Tape.



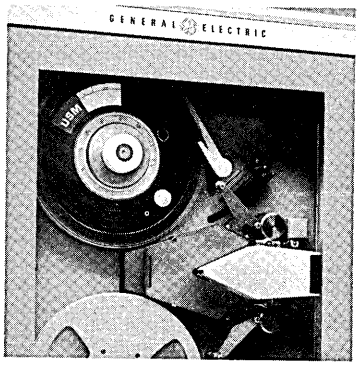
Univac
UNISERVO III-C, IV-C, VI-C, VIII-C



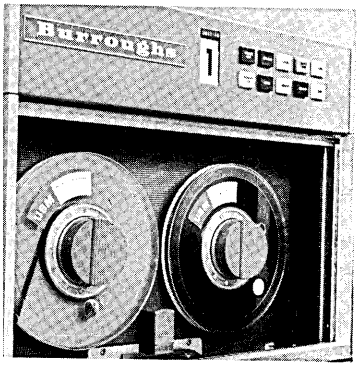
NCR
332-204, 333-102, 334-101, 334-131



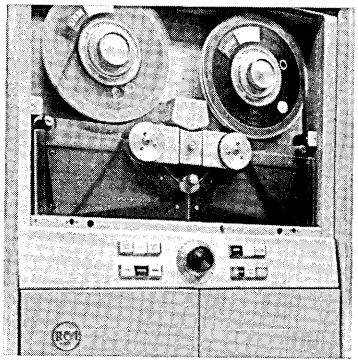
IBM
727, 729, 7330, 2400 Series



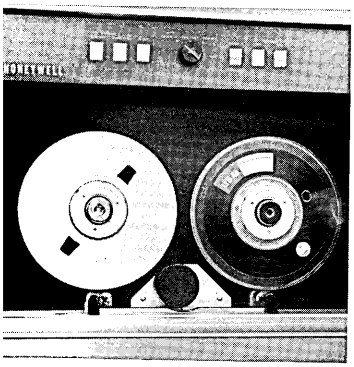
GE
MTH 680, 690; MT 17, 19, 21, 23, 24, 26



Burroughs
B421, B422, B423, B424, B425



RCA
3485, 3487, 70/432, 70/442, 70/445



Honeywell
204B Series

CDC
601, 603, 604, 606, 607, 692, 694, 696

Every reel of U. S. Tape is supplied "certified tested" to industry-wide, error-free test standards in 7, 8 and 9 channel and full width, with BPI of 200, 556 and 800.

Reel sizes of 8", 8-1/2" and 10-1/2" are standard, with a wide selection of "trailers" and "leaders" for your specific drive system. Standard lengths are 1200 and 2400 feet per roll.

A complete line of compatible accessories is available, making U. S. Magnetic Tape Company a complete source of supply for your data storage needs.

U. S. MAGNETIC TAPE COMPANY

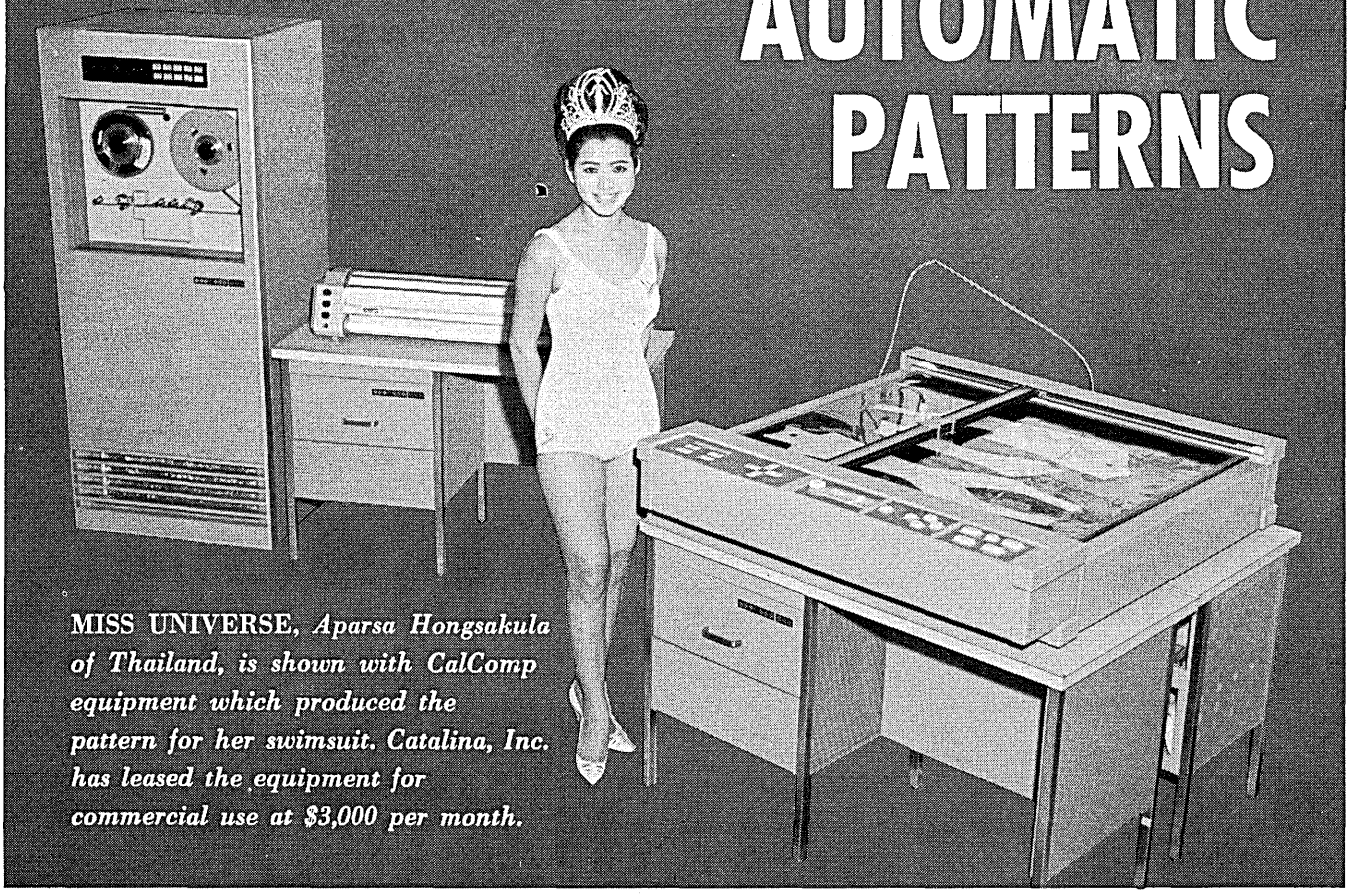
A Subsidiary of Wabash Magnetics, Inc.

HUNTLEY, ILLINOIS 60142 Telephone (312) 669-5181

US TAPE

Printed in U.S.A.

FOR THE APPAREL INDUSTRY: AUTOMATIC PATTERNS



MISS UNIVERSE, *Aparsa Hongsakula of Thailand, is shown with CalComp equipment which produced the pattern for her swimsuit. Catalina, Inc. has leased the equipment for commercial use at $3,000 per month.*

Another industry has learned that a computer combined with CalComp plotting equipment can speed production and increase operating efficiency.

Catalina, Inc. has demonstrated that a sample size swimsuit pattern can be "size graded" (modified and produced in various sizes) in about 1/6th the time required manually. One man in one day grades a maximum of 2 swimsuit patterns. A computer and CalComp's Curve Follower/Plotter grades a minimum of 12 patterns in a day —automatically and with precise accuracy.

The Curve Follower/Plotter, leased by Catalina, Inc. at $3,000 per month, eventually will be followed by an automatic "marker," now being perfected by CalComp to optimize the placement of pattern parts on material for maximum use of cloth.

The automatic pattern is but one way the CalComp equipment will benefit the apparel industry. "Piece work" efficiency—relating wages to time—will be plotted as a cost control tool. Sales charts of forecasts measured against current orders will provide a graphic hedge against over-production.

CalComp pioneered the development of automatic plotting of charts, graphs, maps or drawings from computer data—providing pictorial presentations instead of extensive, and often less meaningful, numeric or alphabetical listings. Among the many applications today: traffic studies, weather maps, brain waves, mechanical drawings, oil field contour maps, highway profiles and jet engine performance curves.

If you own, or have access to a computer, chances are you need a CalComp plotter, too. Write "Marketing" for further details.

CALCOMP
STANDARD OF THE PLOTTING INDUSTRY

CALIFORNIA COMPUTER PRODUCTS, INC.
305 Muller Avenue, Anaheim, California • (714) 774-9141

CIRCLE 34 ON READER CARD

Yes, there is a real-time systems computer better than the Raytheon 520.

It's the Raytheon 520 with 1μ Sec Memory, Keyboard CRT, Real-Time FORTRAN IV, Disk Pack, Direct Memory Access and Drum.

1. **NEW ONE MICROSECOND MAIN MEMORY** improves typical execution times by 25 per cent. For example, floating point add (24-bit mantissa) 18-33 μ sec; floating point multiply (39-bit mantissa) 65-67 μ sec; convert 12-bit data to engineering units, 10.5 μ sec; add register-to-register, 1 μ sec.

2. **KEYBOARD-CRT DISPLAY STATION** for high-speed output of test data, system status information, reference tables or text, program lists, register or memory contents, etc. Up to 520 characters displayed on 6½" x 8½" CRT. Instant erasure of character line, or message. On-line program debugging is faster and easier. Suggestion: use keyboard-display station for test direction and quick-look or remote inquiry/display.

3. **DISK PACK** provides fast random access mass storage for bulk data or program storage. Capacity approximately 3 million characters; transfer rate 74,500 characters per second. This new drive reads and writes on IBM-compatible disk packs.

4. **DIRECT MEMORY ACCESS** for direct connection of external device to main memory on time-shared basis without interrupting central processor. DMA can handle up to four external devices simultaneously and provides 24-bit word transfer rates up to 1MC.

5. **DRUM MEMORY** transfers 50,000 words (200,000 characters) per second with maximum access time of 10ms. Single drum stores up to 262,656 words (1,050,624 characters).

6. **REAL-TIME FORTRAN IV**, a one-pass processor operating in 8000 words of memory—provides optimum combination of scientific problem-oriented language with real-time systems-related capabilities. Raytheon 520 FORTRAN IV features Boolean and logical operations including logical IF, labeled COMMON, DATA initialization statement; double precision and complex arithmetic operations; recursive subprograms; dynamic storage allocation; and easy library modification and expansion. Users have direct access to 520 System interrupts and direct communication with data system devices and hybrid systems is provided.

7. **ANALOG INTERFACE.** Another exclusive Raytheon 520 feature — real-time analog data acquisition with Multidevice Controller—provides standard, low-cost expandable systems interface. Analog units include the Multiverter®, with up to 96 channels of integrated circuit multiplexing, a sample-and-hold amplifier and an A-D converter in a 5¼" drawer. Typical over-all accuracy of 0.02%, 50 nanosecond aperture time and conversion rates from 30 KC (15 bits) to 50 KC (12 bits) are standard. Digital-to-analog conversion at high precision and speed are also available.

The Raytheon 520 is a 24-bit small/medium-scale computer now being specified for systems in the $100 000 to $200,000 range. All the information is in Data File C-121.

RAYTHEON COMPUTER
2700 South Fairview St.
Santa Ana, Calif. 92704

RAYTHEON

CIRCLE 35 ON READER CARD

news briefs

UNIVAC BEATS OUT BUNKER-RAMO FOR BIG UNITED AIR LINES JOB

Univac has come up winners in the long and hard-fought battle with Bunker-Ramo for the huge United Air Lines order. The reward, counting programming services and maintenance contracts as well as hardware, comes to about $39 million for Univac. From the airline's point of view, it's a grand total of $56 million—including a new building and loose change for AT&T.

For their share, Univac has agreed to provide a three-cpu 1108, nearly a billion characters of random-access storage, some 2000 CRT displays for agents, and 700 printers. Deliveries start in 1967 with operation hopefully scheduled for early the next year. United estimates they will be using only about 27% of system capacity to start with, leaving growth room to handle increasing passenger volume until 1975. The estimates rest on the assumption of traffic doubling every five years.

Some of the 17 applications planned: reservations; crew, aircraft, and maintenance scheduling; flight planning, air freight loading, and meal planning.

The displays should get a good workout: they will handle 140K transactions an hour altogether, covering 116 cities on the airline's 18,000-mile flight network.

A customer-service feature calls for inquiries about seat availability to produce not only a display for the time requested but also 10 other flights that day between the same two cities.

The system will be put together in St. Paul—and they are cagily including diesel-generated backup power.

LOS ANGELES ACM GROUP TO PUBLISH PL/I PERIODICAL

The Special Interest Group on Programming Languages of the Los Angeles ACM chapter plans to start publication of a bulletin on PL/I to appear at about two-month intervals beginning early in 1966.

The publication will resemble the ALGOL Bulletin, produced under the auspices of IFIP WG 2.1, and will be the responsibility of Working Group 4, which was formed about a year ago to study the new language. Editor will be Dr. Richard N. Southworth of Logicon Corp., 205 Avenue I, Redondo Beach, Calif.

INTERNATIONAL FIRM TO SHARE ENGINEERING PROGRAMS

A group effort to promote application of computer techniques to civil engineering, traffic, and survey projects in Europe and North America has begun with the formation of Incedata Limited, standing for International Civil Engineering Data Association.

Founding members are independent of computer manufacturers and include organizations in Canada, England, Holland, Spain, Switzerland, West Germany, and Sweden. Purpose of the group is to coordinate development and exchange of computer programs, using jointly agreed standards, to reduce costs. The organization is also looking forward to later use of data transmission facilities for sharing of computer centers. Headquarters for the first two years will be in Stockholm, with Goeran Waerner of Nordisk ADB as managing director.

TELECREDIT/LIBRASCOPE CREDIT-CHECKING SYSTEM

A small and inexpensive credit-checking system has been introduced by Telecredit and the Librascope Group of General Precision, Inc., aimed mainly at markets and banks. Built by Librascope, it was designed and will be marketed by Telecredit, the Los Angeles firm that has successfully linked California's permanent driver's license numbers to a telephone credit-verification system.

The new unit comes in two models, the Telecredit 100 or 200. Each uses a 10-inch disc file with minor logic built in. The 100 has a capacity of 10,000 records and can handle up to 16 inquiry units; the 200 holds 100,000 records and will take 32 inquiry units. The disc unit comes with recorded addresses; other brief information can be entered through a lockable programming unit, like the book-sized inquiry stations but with an extra row of buttons.

When a customer applies for a card permitting him to cash checks he is

KEYDATA OPENS CAMBRIDGE TIME-SHARED FACILITY

With full fanfare, Keydata Corporation has opened its Cambridge, Mass., information utility for general business use. The official opening was signaled by a program-loading command, keyed in by Dr. M. V. Wilkes from his laboratory in Cambridge, England, that prepared the Univac 491 central computer for action.

Ceremonies included addresses by Governor Volpe of Massachusetts and MIT professor Martin Greenberger, who compared opening of the center to the first local electrical utilities. Other guest speakers were Dr. James R. Killian, Jr., of MIT, Gordon N. Thayer from AT&T, Frederick R. Raach of Univac, and Vico E. Henriques from BEMA.

In addition to the 491, the facility uses a DDP-116, Univac 1004, drum and Fastrand mass storage.

IBM's new Basic Operating System is not really basic.

IBM's new Basic Operating System is a unique programming support package designed for the small and intermediate size SYSTEM/360.

It contains a full range of processing programs and control programs that enable you to get big system capabilities from your moderate sized installation.

BOS is similar to other larger IBM Operating Systems that have been in use for some time.

Improved job throughput

BOS provides job stacking for rapid job-to-job transition.

It allows you to overlap input/output operations with processing tasks.

And you can perform peripheral operations or special data communications concurrently with a stacked job.

Reduced job turn around

BOS enables all language compilers, service programs, control programs, even your own applications programs, to reside on-line.

To achieve efficient communications between operator and system, BOS provides implicit instructions regarding all input/output devices, job continuation and similar processing activities.

Five languages

By providing a powerful and extensive group of high-level languages, PL/I, COBOL, FORTRAN, RPG, and Assembler, BOS enables you to use the language that best suits your particular needs.

BOS affords you the ability to segment your application programs in order that each segment can be written in the most appropriate language. All segments can then be combined by the BOS linkage editor into a single program—more flexible, more powerful.

And if you and your people are less familiar with operating systems in general, IBM's new BOS, with its ease of implementation, is the logical place to start getting more productive work from your computer installation.

Your IBM representative will be glad to show you how BOS is a *lot* of operating system—much more than basic.

SYSTEM/360–The Computer with a Future.

IBM®

CIRCLE 36 ON READER CARD

given a number, after credit verification. When he presents the card, the number is keyed in and the disc checked. If all is well a green light goes on and the check is accepted. If, however, he has caused trouble before, a red light warns the operator.

Only automatic part of the operation is that the disc accumulates the number of checks cashed by each customer and warns, with a yellow light, of unusual activity. Information on bouncing checks is inserted manually.

Prices start at $55/month for the disc plus $2.50/month per inquiry unit.

CIRCLE 149 ON READER CARD

LONGSHOREMEN WILL GET PAY AND ASSIGNMENTS THROUGH COMPUTER SYSTEM

A small example of how employment services could make use of computer techniques is shown by the dual IBM 360 system to be installed at the Port of New York by the New York Shipping Association, Inc. Developed for the main purpose of keeping accurate records to ensure that longshoremen who qualify get their guaranteed annual wage, the system—using two Model 40's—also provides an unusual job availability information network.

Some 24,000 longshoremen are employed at the port, working varied hours and often for more than one employer. Thirteen hiring halls, in Manhattan, Brooklyn, Staten Island, and New Jersey, will be equipped with a total of 56 terminals. Each dockworker will have a plastic, wallet-sized card. When he checks in at a hiring hall, he inserts the card in a terminal, notifying the computer that he is available for work—and thus qualifying for the guaranteed wage. If there is no work available for him from that center, the computer will poll the other hiring halls and print out a list of job openings at the other centers.

MORE COMPUTER JOBS IN FEDERAL GOVERNMENT

The recent Congressional discovery of the importance of improved management within the government also loosened the federal purse strings somewhat, with the result that senior, intermediate and even some junior computer people are being ardently sought by the government's housekeeping agencies.

Among those actively soliciting new hired hands are GSA's Data Processing Coordination Office, which recently received a supplemental appropriation of $200,000, and the Bureau of Standards' Center for Computer Sciences and Technology, which has a half-million-dollar mandate to build up a staff. The Budget Bureau has also received authorization, and the money, to double its small staff of dp experts. And with the passage of the Brooks Bill, it's expected GSA will be in the market for the tip-top dp help needed to cope with the multitude of procurement-related problems likely to be confronted by that agency.

DUN & BRADSTREET GETS FIRST WESTERN UNION SYSTEM

The first installation by Western Union's new Management Information Systems division has been completed for Dun & Bradstreet—a computer-based, 15,300-mile communications system.

Using a CDC 8090, the network is serving 93 stations in 77 cities. It has facilities for handling 4 million characters per day and can be expanded to 72 million characters/day.

Primary application is for orders and inquiries related to D & B's credit investigation and rating services. The computer will be able to control delivery times of messages to correspond with different time zones, storing information for later delivery when a given office is open. It will also handle multiple-address messages and diagnose format errors for retransmission by the sending station.

FCC STRIKES FOR SHARED MICROWAVE SYSTEMS

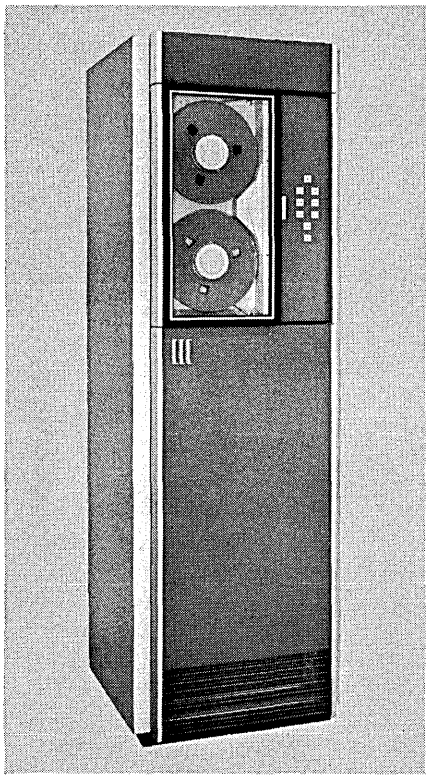
The Federal Communications Commission recently gave notice of a proposed change in its regulations to permit two or more non-regulated companies—e.g., steel producers, oil distributors, etc.—to construct and operate, on a non-profit, cost-sharing basis, private microwave systems. The only criterion to be observed is that they be eligible for licenses in the same radio services.

Presently, such cooperative ventures are confined to companies whose rates and services are publicly regulated—airlines, railroads, etc. Under the proposed change, these regulated companies would be able to offer "cross services" to each other on a similar cooperative basis as, for instance, a gas company and a trucking firm. The commission, now soliciting comments on the proposed rule change, could make the modification official early in '66 if no hitches develop.

If approved, the rule change would give extra impetus to implementation of computer "netting," load transfers,

New from CEC...

the first truly universal digital magnetic tape system



The new DR-3000 offers unequalled versatility and performance — at the lowest cost of any comparable digital tape system available today.

Check the following advantages, and you will see why the DR-3000 is the obvious answer for so many digital data processing requirements.

1 Compatibility. The DR-3000 will guarantee complete machine-to-machine compatibility with any other DR-3000, or with any IBM-compatible tape system operating within IBM specifications.

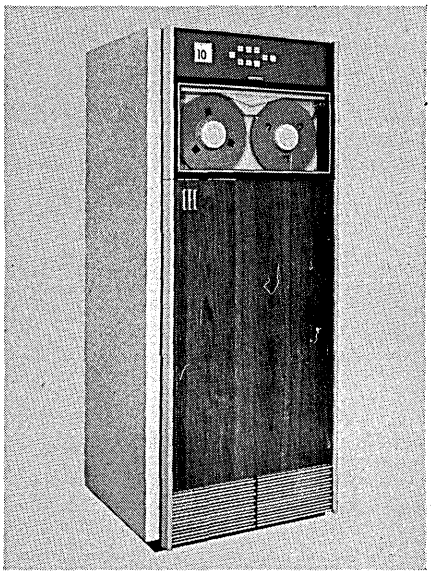
2 Versatility. *Both* high or low speed applications. The most compact system made, it will mount 2 or 3 to a rack — even fit through a submarine hatch. It is available in horizontal or vertical cabinets. Ruggedized for semi-mobile or extreme environments, it provides a complete selection of input/output logic levels. It is the ideal unit for most commercial or laboratory data processing systems.

3 Operator convenience. The DR-3000 is the easiest of all to load due to a straight tape loading path which requires no threading. The entire operation takes less than 10 seconds. Front access only is required for all normal maintenance. In addition, a complete selection of IBM-compatible accessories is available.

4 Formats. 7 channel 729 series or 9 channel 360 series formats are standard, reading and writing at 200, 556, or 800 bpi — plus 1600 bpi phase-encoded format available on special order.

5 Reliability. Only field-proven design concepts are used. Dual capstans with rugged drive actuators provide positive drive. There are no belts or mechanical linkages to cause tape slippage or creep. Air bearings virtually eliminate tape friction. CEC-built all-metal-front-surface read/write heads have achieved *over 12,000 hours* operational life in field environments. All electronics are modular and solid-state.

6 Performance. The DR-3000 assures the most performance per dollar available today. Fast start/stop characteristics provide complete unrestrictive programming up to 200 commands per second. There are 84 inches of tape buffering. Tape speed variation is less than ±0.5%.



Transport Specifications:

Standard ½″ tape, 7 or 9 channels • Tape speeds — 37½ or 75 ips standard IBM formats • Operates at 200, 556, 800 bpi NRZ or 1600 bpi phase-encoded • Start time — less than 4 msec • Stop time — less than 3 msec • Rewind — 2400 feet in 2½ minutes • Bit dropout rate less than 1 in 10^7 • Maximum total skew — within full IBM machine-to-machine compatibility at all speeds • Average tape speed accuracy — within ±0.5% of absolute • Cycling rate — 200 commands-per-second without programming restrictions • Power — 1 kva • Size — 19″ x 24½″ x 13½″ • Weight — 135 lbs.

For all the rewarding facts about the DR-3000. call CEC or write for Bulletin 3000-X3.

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CIRCLE 38 ON READER CARD

even time-sharing, presently hung up on high data transmission tariffs. The communications common carriers are, however, expected to cry foul.

● Two reports are now available from the Clearinghouse, U.S. Dept. of Commerce, describing GE's work on DEACON (Direct English Access and Control), an experimental computer developed for the Air Force. According to GE, the model establishes the feasibility of using conventional English for input and control; it is able to make decisions about both the meaning of words individually and about the semantic implications of the sentence structure. A report describing the breadboard model is available as AD-612 165 and another, AD-612 171, covers the language characteristics. They can be ordered from Clearinghouse, U.S. Dept. of Commerce, Springfield, Va. 22151.

● Universities composed of a scattering of small colleges linked to a computer-based central facility were proposed at a week-long conference held at the Irvine campus of the University of California. These central facilities could then serve as part of national information networks available to universities throughout the country. Workshop sessions at the conference considered the computer as an aid to instruction, research, information storage and administration. The conference was supported by the U. S. Office of Education and cosponsored by the University of Michigan; proceedings are to be published.

● A preliminary inventory of information services in linguistics and related fields has been undertaken by the Center for Applied Linguistics, 1755 Massachusetts Ave., N.W., Washington, D.C. 20036. Those engaged in such services are requested to contact the center.

● A state-wide communications system, designed to handle data processing for up to 225 savings and loan associations, will begin operation under the Savings and Loan Bank of the State of New York in mid-1966. Thirty savings and loan members are planning to go on-line to the system, which initially will include two IBM 360/30's, five disc storage units, and 100 model 1062 terminals. The biggest use will be on-line savings accounting, although the system will also handle mortgage accounting, money

news briefs

order reconciliation, general ledger, and other jobs.

● The National Science Foundation has awarded a grant of $61,350 to the ACM for development of an undergraduate curriculum designed to train computer scientists. Dr. William F. Atchison, chairman of the ACM's Curriculum Committee on Computer Science, notes that the committee has identified 15 existing undergraduate programs and many more in preparation; the committee intends to develop a program leading to a standard. Scientists and educators are invited to direct their comments to Dr. Atchison at the association's national headquarters, 211 E. 43rd St., New York, N.Y. 10017.

● Philippine Air Lines will install an NCR 315 system next fall to handle inventory control, aircraft maintenance scheduling, and passenger-load analysis. In providing management information, the system, operating on a "condition alert" basis, will produce only exceptions to operational plans and, if action is not taken, will print out a more emphatic alert. Other equipment included are a high-speed printer, card reader, paper tape reader and punch, and four CRAM units. Since telephone communications are limited in the Philippines, NCR and PAL are now studying other means of using the 315 for on-line reservation handling—possibly by radio.

● Four grants have been awarded to Lehigh University by the National Science Foundation and the Air Force Office of Scientific Research, amounting to $189,000. They will support research projects already under way at the university's Center for the Information Sciences. These programs involve the development of graduate courses for training in information science and studies of the application of computer methods to storing and using information.

● Opening of a graphic data processing center has been announced by IBM. Set up at western region headquarters on Wilshire Blvd. in Los Angeles, it will be used as a demonstration and customer service facility. Controlled by a 360, the system includes a film recorder and scanner, plus a 2250 display with light pen. The operator can add or delete lines, modify a curve, change a physical dimension, or identify information shown on the screen.

If you're renting more computer than you need, it's like burning money.

NCR's new 500 Series costs less than other low-cost computer systems. Its unique building-block design enables you to start small — then grow as your needs expand. You never pay for more than you need or more than you can use.
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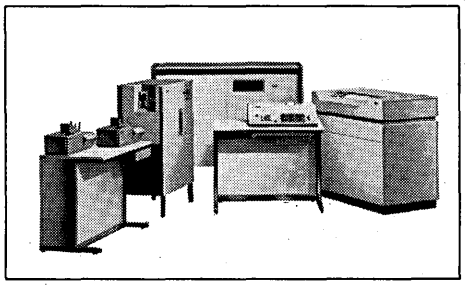

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CIRCLE 42 ON READER CARD

world report

PRAGUE SHOW MAY OPEN SALES TO E. EUROPE

The coming spring will see the opening shots in a battle for the East European market. For the first time, many of the world's major main frame makers will congregate in Prague to peddle their wares to purchasing agents from most communist countries. Run by the Czech State Commission for Technology, the event is a combined exhibition and applications-oriented conference from May 12 to June 8. Rules for participation are being released this month, together with lists of charges. Already approaches have been made by IBM, GE-Bull, and the West-German firm, Eurocomp, for permission to show. Iron curtain countries, such as East Germany, Russia, Czechoslovakia, Poland and Hungary, are expected to produce orders worth more than $100 million in the next 12 months.

Till now British companies such as ICT, English Electric-Leo-Marconi, and Elliott Automation have been doing steadily increasing business with little competition from Americans. Marketing direct from the U.S. brings machine makers in conflict with the government. A little more leeway is achieved with overseas subsidiaries who can sell from a West European base, although a strategic embargo list maintained by COCOM -- an organisation of NATO countries -- follows a close parallel with that maintained in the States. Anomalies in the COCOM list enable European-made computers to be sold to communists even though many contain technology licensed from the U.S.

2,000-BPI TAPES FROM CERAMIC RECORDING HEADS?

Expected to help accelerate general use of magnetic tapes with packing densities in excess of 2000 bits/inch is a magnetic recording head produced entirely from ceramic material. Manufacturer is Philips, Eindehoven.

NEWS NOTES FROM DOWN UNDER

An Australian Computer Society was formed Jan. 1 by the five state computer societies. The Canberra and South Australian groups have ratified the constitution, and approval is expected from the New South Wales, Victorian and Queensland bodies... Five keynote speakers and more than 80 papers are expected for some 800 registrants at the third Australian computer conference in Canberra, May 16-20. Speakers are G. Kendall, CEIR-UK; F.P. Brooks, U. of North Carolina; K.E. Grainger, Commonwealth Public Service Board; J.E. Thornton, Control Data, and R.M. Gordon, Raytheon Computer...April delivery is expected for the U. of Adelaide's CDC 6400, most powerful unit to be imported.

U.K. TO SET UP RESEARCH CENTRE

Britain's Ministry of Technology has revealed plans for a National Computing Centre costing $1.5 million, to be headed by Professor Gordon Black, a technical manager to the Atomic Energy Authority and part-time professor of adp, Manchester Univ. Black's brief is

(Continued on page 109)

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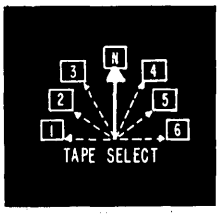

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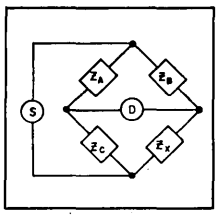

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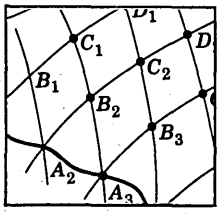

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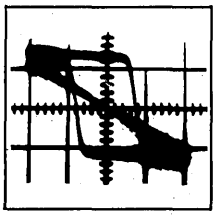

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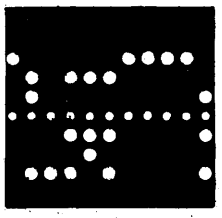

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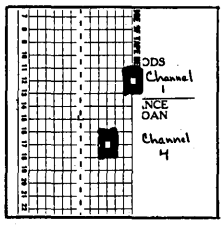

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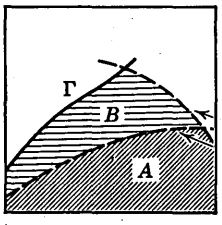

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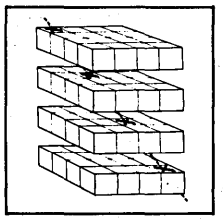

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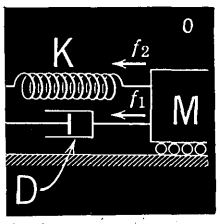

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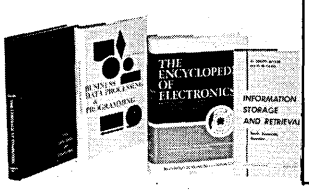

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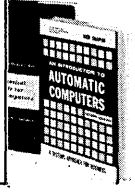

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new products

microfilm plotter

A digital, CRT/microfilm plotting system, the model 835 is designed for off-line operation with the firm's tape drives. In the search mode, plotting is at a tape speed of 60 ips. The CRT display is recorded on 35mm microfilm at up to five frames/second; an optional desk-top film viewer is offered. Producing an 11 x 17-inch plot with 15X magnification, accuracy is 1% of full scale, and stability is ±0.5% drift in eight hours. CALIFORNIA COMPUTER PRODUCTS INC., Anaheim, Calif. For information:

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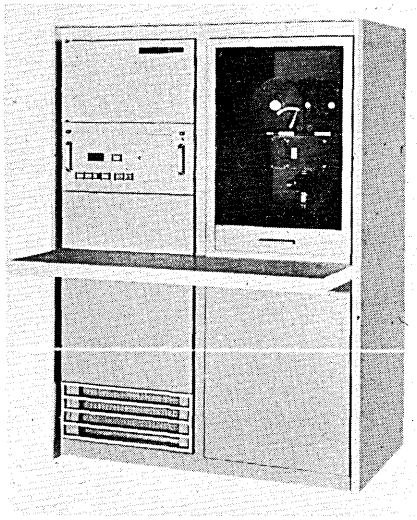

arbitrary functions

The model 701 generates digitally, from its own core memory, essentially any desired waveform, which can be constructed point by point internally or recorded from external sources. Voltage and time are segmented to provide resolution of better than ±0.2% of full scale, or full cycle. Cycling—continuously, or cycle by cycle, or segment by segment—is at clock rates from 0.2 to 2 x 10^5 segments/second. EVANS ASSOCIATES, Berkeley, Calif. For information:

CIRCLE 131 ON READER CARD

portable tape drives

Operating from 12-volt DC supplies and using less than 100 watts, these units use one- and half-inch tapes to record digitally in either field or lab applications. They feature "permanently-aligned" tape tracks, single-capstan drive without pinch rollers, and transport speed that can be changed manually or by program. The unit weighs 40 pounds. TEXAS INSTRUMENTS INC., Houston, Texas. For information:

CIRCLE 132 ON READER CARD

data gatherer

The Mobidac is a mobile data acquisition system designed to produce computer-compatible tapes at remote sites. It accepts 50 low-level analog inputs, seven high-level analog inputs, and two digital inputs which may originate internally or externally. Patchpanel programming permits selection of binary or BCD formats, any of several acquisition rates, and allows high- and low-level inputs to be intermixed in the program sampling sequence. SYSTEMS ENGINEERING LABORATORIES INC., Fort Lauderdale, Fla. For information:

CIRCLE 133 ON READER CARD

gp computer

Using monolithic integrated circuits, the DDP-124 has a memory cycle time of 1.75 usec, access time of 0.8 usec, and multiplies in 14 usec. It has 4-32K words of core, and has applications in the control and simulation market. Compatible with the DDP-24 and 224, the $65K machine also joins the firm's DDP-116. COMPUTER CONTROL CO. INC., Framingham, Mass. For information:

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logic trainer

The LK 253 performs 20 experiments in combinational logic, and may be

PRODUCT OF THE MONTH

Gun-shy installation managers are directed to a "no-fail" power system that takes over the moment commercial power begins to go—without the loss, reportedly, of even a millisecond. The unit is available in sizes ranging from 10 to 250 kilowatts.

Under normal operating conditions, closely-regulated electrical energy is supplied by the unit's alternator, which is coupled to a synchronous motor driven by commercial power. (Frequency is maintained to a tolerance of ±0.25 cycle).

Line deviation is sensed at the alternator output, starting a hydraulic motor to maintain the alternator at synchronous speed. Simultaneously, a diesel engine is started to take over the supplying of rotating power for the alternator as long as the power failure lasts. Shutdown of the diesel engine is also automatic, after commercial power resumes and is found to be stable over an adjustable period of time (15 to 60 minutes). FERMONT DIV., DYNAMICS CORP. OF AMERICA, Bridgeport, Conn. For information:

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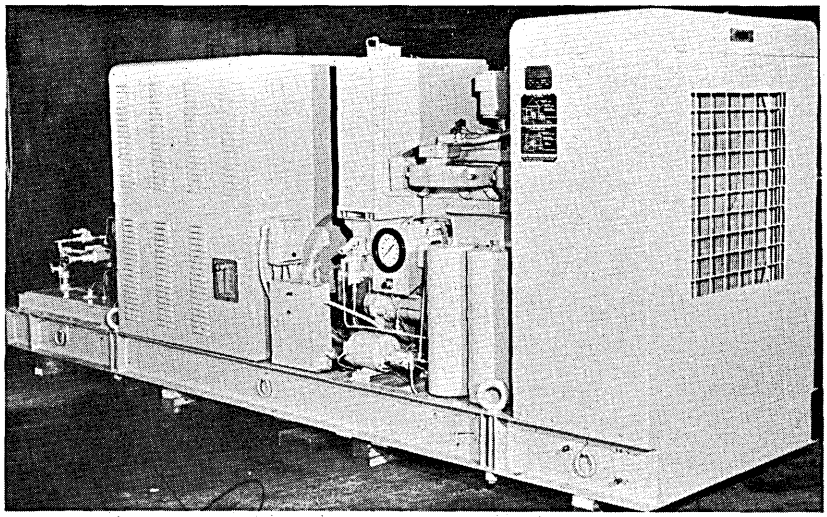

extended to the LK 250, which includes the course on combinational, sequential, synchronous and asynchronous applications. Units feature plug-in, multi-function modules that line up with the logic circuit and are interconnected with jumper leads. Functions include and/nand, or/nor, not/buffer, bistable, monostable, transfer, manual input, manual sequence, pulse former, delay, 10 Kc/s, clock generator, and decade input. Made by Feedback Ltd. ELECTRONICS ENGINEERS INTERNATIONAL, San Francisco, Calif. For information:

CIRCLE 136 ON READER CARD

on-site tape drive

The ATM-13 is designed for airborne, shipboard, and land-mobile use, recording blocks of data with ¾-inch record gap. Maximum tape speed is 75 ips, 100 ips in gapless mode. Packing density is up to 800 bpi on seven

or nine tracks. The ruggedized unit is available as a basic transport or with full electronics; the latter weighs 150 pounds. AMPEX CORP., Redwood City, Calif. For information:

CIRCLE 137 ON READER CARD

upgraded computer

Changes and additions to the 520 computer announced last year include a 1-usec main memory expandable to 32K (24-bit) words (the 2-usec unit is still available), keyboard/display station for editing and on-line debugging, and a disc pack with a capacity of 2.9-million (7-bit) characters. Maximum access time of the latter is 145 usec. There's also a one-pass FORTRAN IV that takes up 8K words of memory, allows interrupts to be armed/disarmed, enabled/disabled, or released. In addition to this real-time provision, the F-IV also includes capabilities for communication with hybrid systems. RAYTHEON COMPUTER OPERATION, Santa Ana, Calif. For information:

CIRCLE 138 ON READER CARD

new products

multiprocessor

The 1108 II large-scale computer is an upgraded 1108. Using integrated-circuit control registers with a cycle time of 125 nanoseconds, the processor is said to be capable of executing 1.5-million instructions/second. Core storage is expandable from 65-262K (36-bit) words of core. Cycle time is 750 nsec, effectively reducible by half through memory overlap. Redundant storage features allow two or more processors to reference the same program or data simultaneously. Deliveries begin the second quarter of '66. UNIVAC DIV., SPERRY RAND CORP., New York, N.Y. For information:

CIRCLE 139 ON READER CARD

remote graphic i/o

The Teleputer system consists of a display/keyboard console which can be linked by phone and telegraph lines to a computer. Both alphanumeric and graphic information–lines, drawings, functions and arbitrary forms–can be communicated simultaneously in two directions between user and computer. Bandwidth compression enables a controller to handle 16 consoles operating simultaneously. The system was developed by the Drs. Culler and Fried and the Bunker-Ramo Corp. BOLT BERANEK AND NEWMAN INC., Van Nuys, Calif. For information:

CIRCLE 140 ON READER CARD

tape drive

The DR-3000 series is IBM-compatible, and operates at from 200 to 1600 bpi. Obviating tape threading, it features straight-line loading, vertical and horizontal mountings of the transport, dual capstans, all-metal-surface heads. CONSOLIDATED ELECTRODYNAMICS CORP., Pasadena, Calif. For information:

CIRCLE 141 ON READER CARD

line printer

The HSP 3502 is a chain printer with only 200 electrical and mechanical parts. It runs at 600 lpm and has up to 192 characters in the set, up to 128 columns. Interfaces allow on- and off-line operation, as well as use with DataPhone. POTTER INSTRUMENT CO. INC., Plainview, N.Y. For information:

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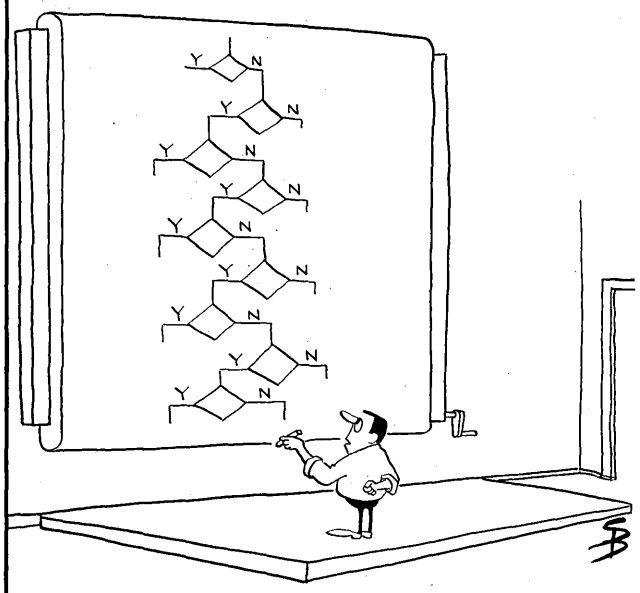

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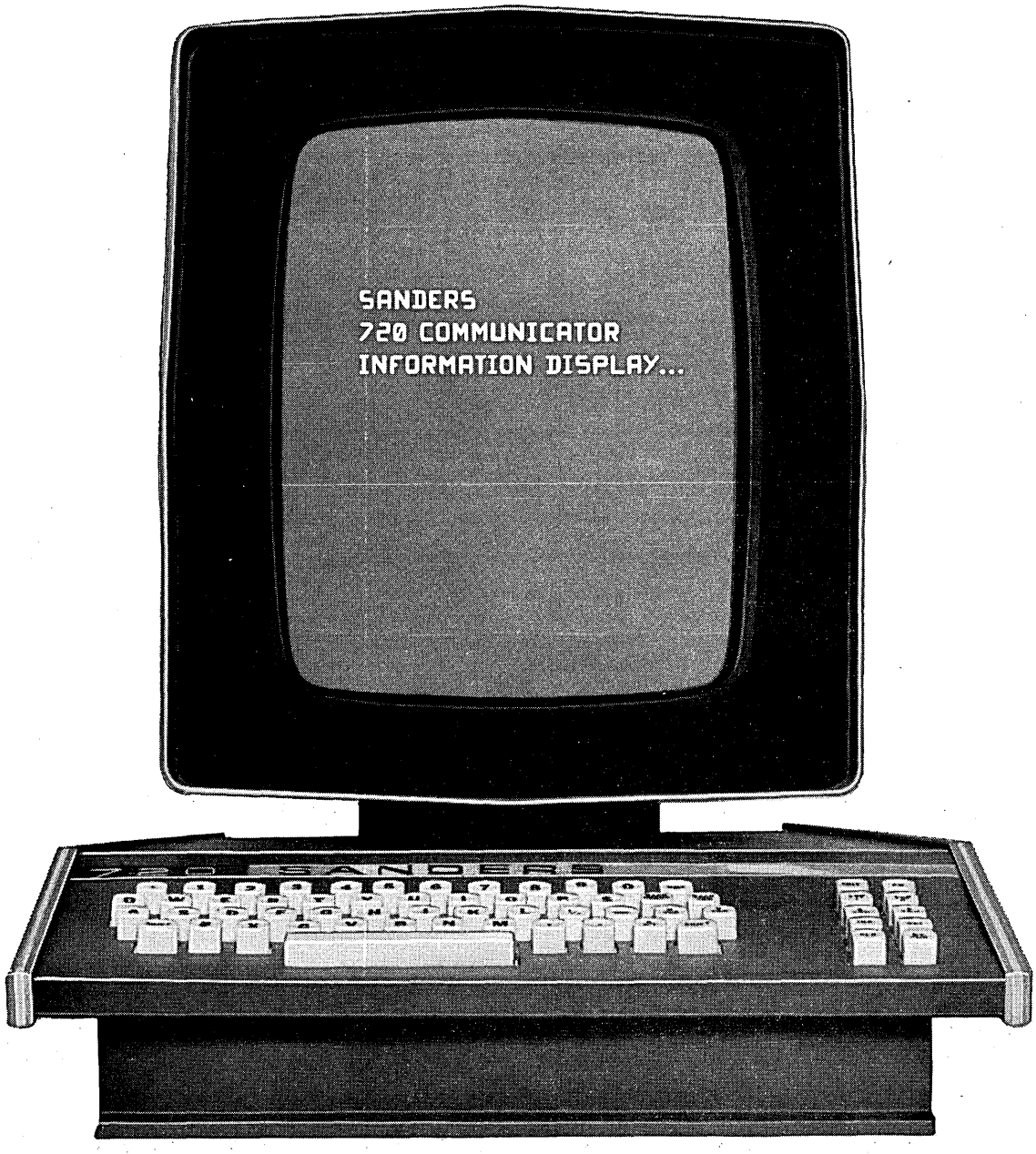

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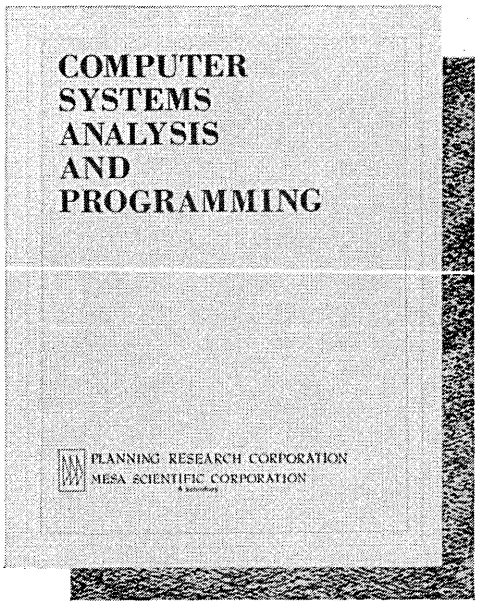
Here, described for the first time, are the combined ADP capabilities of Planning Research Corporation and its subsidiary, Mesa Scientific Corporation.



To obtain a complimentary copy, address: Vice President, Computer Systems Division, Planning Research Corporation, 1100 Glendon Ave., Los Angeles, California 90024.

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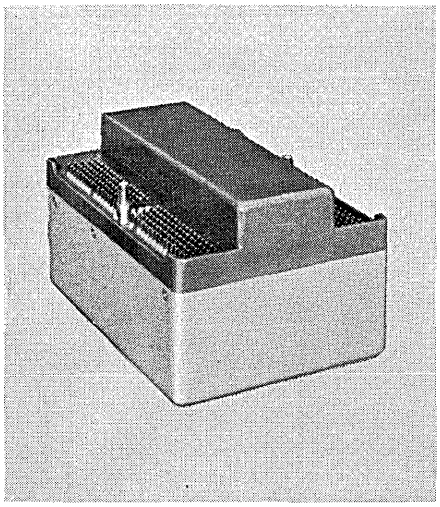
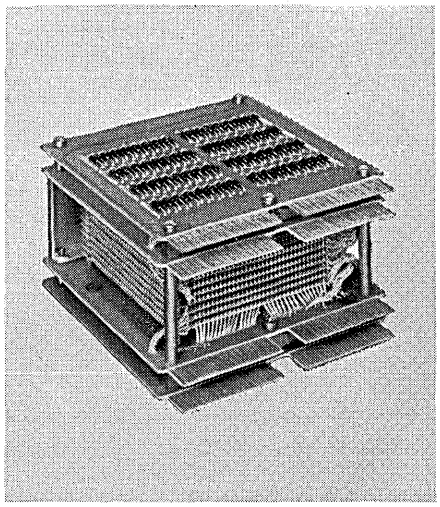
MESA SCIENTIFIC CORPORATION
A Subsidiary

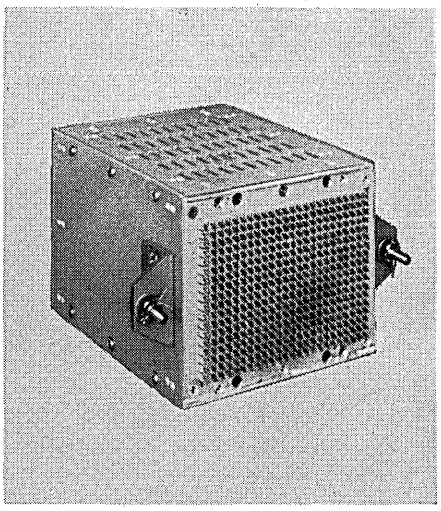
CIRCLE 50 ON READER CARD



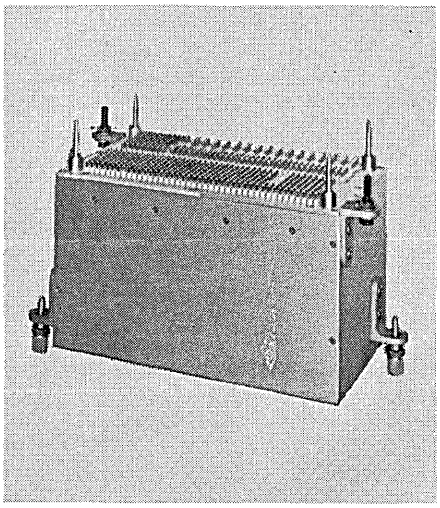
Customer: Control Data Corporation
128 x 64 x 12 capacity, temperature controlled stack for Polaris program



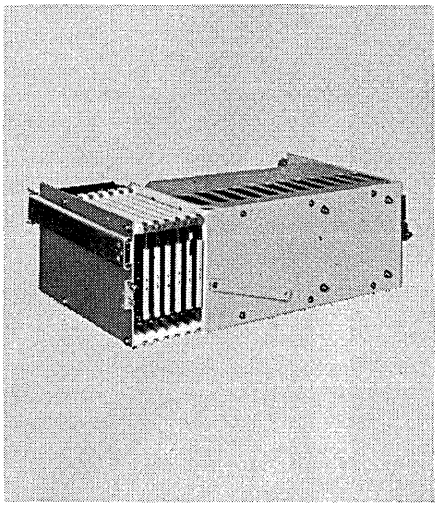
Customer: Honeywell
64 x 64 x 9 stack for H-200 computer



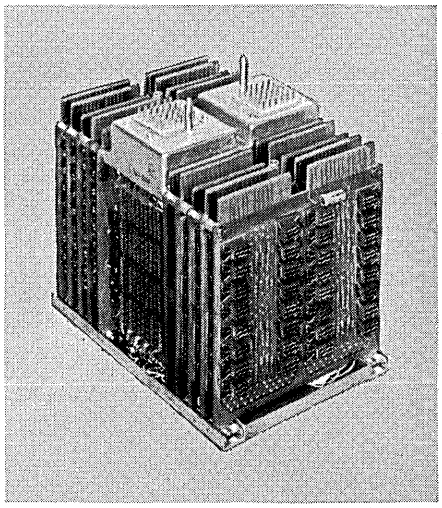
Customer: General Electric Company
2048 x 74 stack for 635 computer



Customer: Bunker-Ramo Corporation
16,384 x 16 stack for BR 133 computer



Customer: Dynatronics
2048 x 19 stack for simulator system



Customer: Honeywell
128 x 128 x 9 stack for H-2200 computer

Whatever you need in a core memory stack... FABRI-TEK can build it!

These stacks are typical of the diverse requirements our customers ask us to meet. Their problems range from speed to packaging, from temperature to size.

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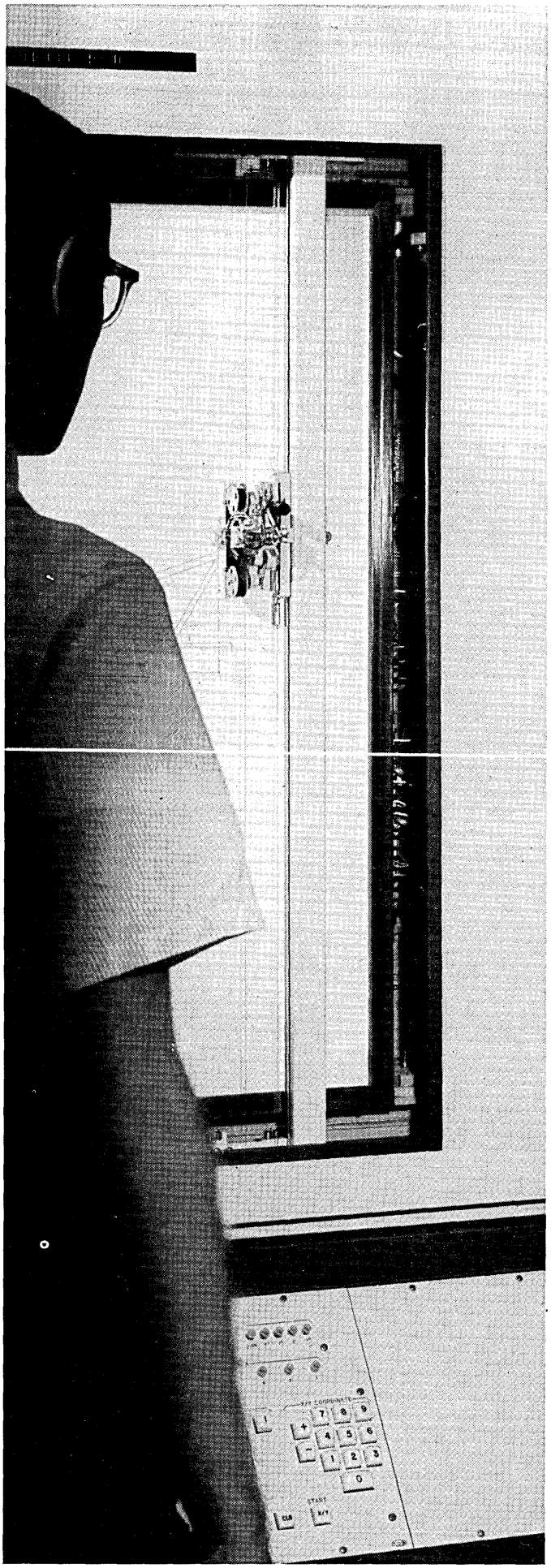

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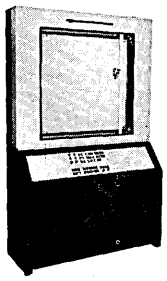

Compare Milgo's new 30"x 30" Vertical - plotting X-Y Recorder feature for feature.

Compare it for speed. Repeatability. Accuracy. Reliability. Plot visibility. Add-on flexibility. Versatility. Quality. Floor space. Delivery time.

The Milgo solid-state 4021D X-Y Recorder accepts on-line digital inputs from any digital computer; off-line inputs from magnetic tape, punched paper tape, punched cards, a manual keyboard or an analog source. The pen/printer draws lines, curves and point-plots; it symbol prints with a 50 character symbol printer. Pen and symbol printer interchange electronically in milliseconds. The pen/printer has a slew of 30 ips, with a continuous writing speed of 20 ips. The pen/printer point-plots in either pen or symbol mode at 500 ppm. It prints a random selection alpha-numeric character at 300 per minute. The plotting surface is evenly back-lighted by a variable powerstat control. Plots are clearly visible for 10 feet or more. The complete unit only occupies a 50 by 18 inch floor space.

The 4021D was developed and is produced to military standards of quality and reliability. It is rugged and of modular construction. Installed and operating, it has the lowest feature-for-feature price tag of any 30 by 30 inch plotter available to industrial and commercial users.

Take a cold, hard look, for instance, at the symbol printer and its integral pen and inking system.* The complete unit is ⅓ to ¼ smaller than competitive units. It has no dangling umbilical cord. Pens are low-mass, solenoid actuated. Capillary action prevents spilling at any slew speed or acceleration, and the ink reserve can be filled without disassembly. Ink supply is indicated visually. The arm, only 1¼ inches wide, is servo-motor driven at both top and bottom. It is ball-bearing mounted on stainless steel rails, precision ground to within 0.004 inch. It allows accelerations of 400 ips^2 in both X and Y; provides static accuracy within ±0.05% of full scale, and repeatability of ±0.02%.

Milgo offers analog and/or digital recorders in vertical or horizontal models with plotting surfaces up to 45 x 60 inches. If you need to know what your "data-display dollar" can buy, call Tom Thorsen, Marketing Department.

*U.S. Patent No. 3,120,214.

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new literature

INFORMATION SYSTEMS: Bibliography compiled by Carnegie Institute lists 73 references to systems employing mathematical models, contains more than 10,000 secondary references. Cost: $1. U.S. Dept. of Commerce, Clearinghouse, Springfield, Va. 22151.

DATA SYSTEMS: Research report gives information on experimental system designed to test and demonstrate on-line storage and retrieval of formatted data based on complete internal descriptions of the file. System is implemented by remote use of the time-sharing facilities of MIT's Project MAC. Cost: $2. Clearinghouse, U.S. Dept. of Commerce, Springfield, Va. 22151.

COURSE OUTLINES: Study outlines for home study or review for dp certificate cover mathematics for data processing, statistics, systems analysis and design, and introduction to scientific computing. Cost: $25. DATA PROCESSING MANAGEMENT ASSN., Park Ridge, Ill.

DATA MODEMS: Short form catalog lists specifications for 3600, 4800, 2400 and 1200-bps data terminals. Included also are factors governing selection of a data modem. RIXON ELECTRONICS INC., Silver Spring, Md. For copy:

CIRCLE 150 ON READER CARD

INCREMENTAL RECORDING: 4-page leaflet describes differences between conventional digital tape recording and incremental recording, and advantages of incremental recorders in preparing IBM-compatible mag tapes from random or asynchronous data sources. KENNEDY CO., Pasadena, Calif. For copy:

CIRCLE 151 ON READER CARD

COMPUTERS IN OCEANOGRAPHY: Eight-page pamphlet discusses role of the computer in studies of the ocean, describes specific applications, and lists some of the programming aids available to the oceanographer. DIGITAL EQUIPMENT CORP., Maynard, Mass. For copy:

CIRCLE 152 ON READER CARD

DIGITAL PRINTERS: Brochure gives mechanical and electrical specifications, and pricing schedules for solid-state digital recorders capable of printing 1040 or 1380 lpm. MONROE DATALOG, San Francisco, Calif. For copy:

CIRCLE 153 ON READER CARD

COMPUTER SYSTEMS: 20-page brochure describes how SDS 900 series computers are used for real-time data acquisition, data processing and control applications. Booklet includes description of the SDS modular approach to system design, analyzes benefits of general-purpose computers, digital and analog instruments, modules and peripherals. SCIENTIFIC DATA SYSTEMS, Santa Monica, Calif. For copy:

CIRCLE 154 ON READER CARD

COMPUTER PERIODICALS: Directory includes over 70 listings, more than 40 are non-U.S. magazines. Each entry lists title and subtitle, date of origin, frequency of publication, price, circulation figures and item characteristics. Cost: $15. R. R. Bowker Co., New York, N.Y.

TAPE TRANSPORT: Booklet describes single-capstan digital tape transport which operates at bidirectional speeds to 150 ips without program restrictions. Tape life and data reliability

new literature

are increased by newly-designed tape drive in which oxide side of tape touches only read/write head. POTTER INSTRUMENT CO., INC. Plainview, N.Y. For copy:
CIRCLE 155 ON READER CARD

CIRCUIT MODULES: Data sheet details modules designed to be compatible with electromagnetic characteristics of fixed or flying head magnetic drums and disc files. BRYANT COMPUTER PRODUCTS, Walled Lake, Mich. For copy:
CIRCLE 156 ON READER CARD

MEASUREMENT RECORDER: Five-page bulletin describes electromechanical device that measures and converts analog data to visual display form, or drives adding machine, typewriter, tape punch or card punch. GIANNINI SCIENTIFIC CORP., Richmond, Va. For copy:
CIRCLE 157 ON READER CARD

TRAINING CLASSES: Catalog announces classes in computer programming, languages and operating systems, available only under contract to industry and government. COMPUTER USAGE EDUCATION INC., New York, N.Y. For copy:
CIRCLE 158 ON READER CARD

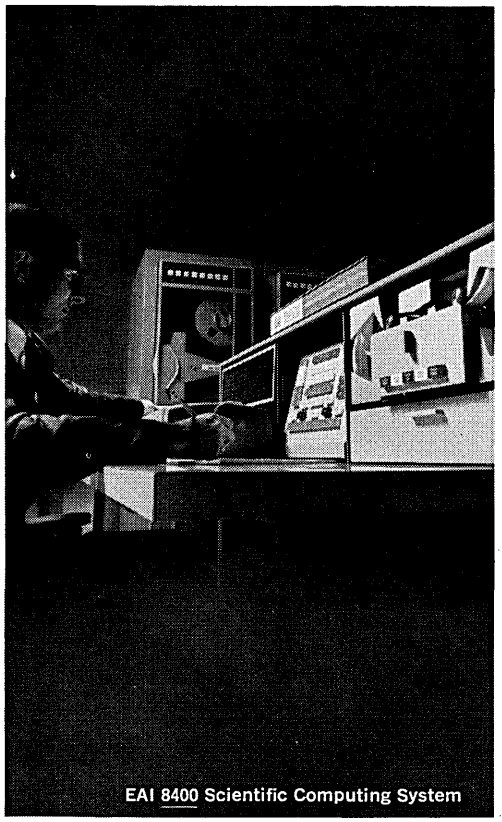
MEMORY SYSTEM: 10-page brochure tabulates 10 systems in a fold-out chart designed to let users compare access speeds, word and bit capacities, logic levels, power requirements, operating parameters, accessory equipment and physical dimensions. FABRITEK, INC. Amery, Wisc. For copy:
CIRCLE 159 ON READER CARD

DATA PRINTERS: Six-page brochure gives mechanical and component description; specifications for basic control, count modules, and frames; information on circuits, time and date; print samples for Moduprint Data Printer. PRESIN COMPANY INC., Bridgeport, Conn. For copy:
CIRCLE 160 ON READER CARD

PROCESS CONTROL SYSTEM: 40-page booklet describes system that measures, transmits, indicates, records and controls pressure, temperature, differential pressure, flow, level pH and other process variables. Electronic error sensor operates on null balance principle; feedback circuit provides a signal for maintaining the systems in continuous balance. Signals are transmitted on two-wire circuits. ROBERTSHAW CONTROLS CO., Anaheim, Calif. For copy:
CIRCLE 161 ON READER CARD

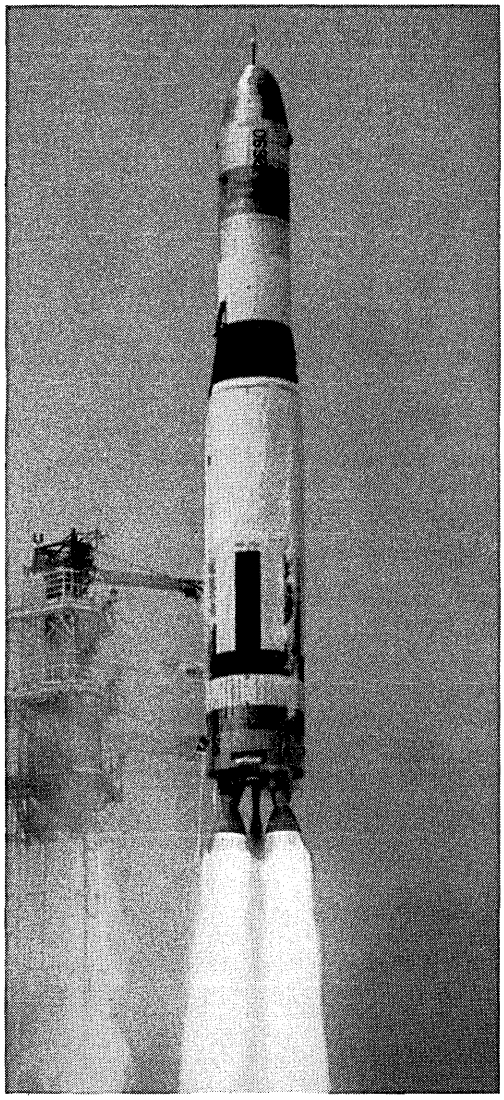
DIGITAL COMPUTER: Two bulletins detail operation and programming of EAI 8400. 16-page brochure includes a summary of computer characteristics and explanation of system hardware, operation, programming and instruction repertoire. 14-page bulletin describes 8400 programming system. Special attention is given to real-time features which include standard and simulation monitors, two-pass symbolic assembler, and a device to handle off and on-line checking. ELECTRONIC ASSOCIATES INC., West Long Branch, N.J. For copy:
CIRCLE 162 ON READER CARD

EAI® software is the difference



EAI 8400 Scientific Computing System

The development of a software system for simulation is among the most challenging tasks presented to the computer industry. Not only must it include conventional scientific software, but it must be capable of performing under on-line, real-time constraints. With a heritage of over 15 years as both a supplier and user of scientific computing systems, EAI has produced the EAI 8400 operating system—the first software system to meet the demands of today's simulation laboratories.



The EAI 8400 operating system delivers a new high level of man/machine communication throughout all phases of program preparation, debug and program execution. Its time-sharing mode offers efficient throughput, by permitting a background of batch-processing to continue during man/machine communication or on-line dead-time.
Error-free recovery from real-time, multi-level interrupts is provided during any phase of system operation—and the entire operating system—from monitor, through language processors, debug, and run time controllers, is operational over the spectrum of EAI 8400 expansion and peripheral configurations starting with the basic system.
EAI is setting the software standard in the field of simulation. How about your field... does a real-time, on-line system with batch processing capability sound interesting? If so, write for details.

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OKLAHOMA CITY	Development and maintenance of programs involving communications switching for air weather information.

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books

Understanding Automation, by Enoch Haga, The Business Press, 1965.

The purpose of this book, according to its author, is to help teachers learn about computers and automation, and then to plan and prepare courses in them. To achieve this purpose, the author has written chapters labeled Historical Perspective, Principles of Digital Computation, Principles of Analog Computation, The Business of Data Processing, in addition to chapters devoted to describing curricula for "automation" in the high school, junior college and private business schools, and curricula for junior college data processing courses. Two chapters are titled, Automation in Higher Education – The Integrative Approach and Automation in Higher Education – Certificate, Degree Approaches. To complete this potpourri, the author has mixed in chapters and appendices on planning an automation day or workshop, playing business games in the classroom, automation on the screen, educational computers and devices, and automation associations.

The title of the book and many of its chapters are misleading, to say the least. This book will not enable its reader to understand automation. The chapter Principles of Digital Computation is nothing more than a modified reprint of several pamphlets on logic (Boolean and Symbolic) and design of digital systems put out by Computer Control Co., Inc. Similarly, the chapter Principles of Analog Computation is a conglomeration of the analog-device descriptions borrowed from such companies as General Electric and Heath Company. The procedure for doing particular analog computer applications is given in this chapter but no explanation is provided to show the principles involved in processing such applications.

The chapter The Business of Data Processing is a treatise on service bureaus, contributed by the executive vice-president of the Association of Data Processing Service Organizations, Inc. While it is true that information about service bureaus may contribute to the reader's understanding of automation, it would have been more useful for the readers to be referred to the association for appropriate pamphlets if they were sufficiently interested. In fact, this book could have easily been condensed to a few

books

dozen pages listing the companies, associations and schools to contact for literature on selected subjects.

The need exists for teachers to know about computers and automation. It is unfortunate that this book fails to satisfy that need.

—SOLOMON L. POLLACK

Programming Real-Time Computer Systems, by James Martin, Prentice-Hall, 1965.

"A real-time computer system may be defined as one which controls an environment by receiving data, processing them, and returning the results sufficiently quickly to affect the functioning of the environment at that time," according to the author. He then goes on to qualify this definition by requiring that the response time—i.e., the interval between the occurrence of an event and the system's response to the occurrence—shall be "short." If the response time is greater than "half an hour or more . . . it becomes arguable whether the system should still be described as 'real time'." Despite this handicap—the inability to provide a precise verbal, operational definition of real time—Mr. Martin has written a book that can be of inestimable value to anyone who is about to be associated for the first time with a real-time computer application.

In fewer than 400 pages with approximately 100 diagrams, flow charts and pictures, the author provides a comprehensive survey of the world of real-time applications. What he has to say is of interest to designers of hardware and software, to applications programmers, and to the technical and administrative management of both groups. The book is replete with the evidence of actual experience, so that anyone who is to be involved with a real-time activity can have the luxury of standing on the shoulders of many persons who have trod laboriously and (perhaps) painfully up that same real-time road.

The book is marred by few typographical errors. With one exception, the careful reader will be able to correct them. The exception occurs on page 261 in text that is concerned with the Test Supervisor Program, one of the programming aids required to facilitate program testing. At least one line of the author's text is missing so that the printed text is quite meaningless.

In sum, "Programming Real-Time Computer Systems" is a welcome addition to the literature, and to the Prentice-Hall Series in Automatic Computation.

—ROBERT M. GORDON

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Two new cores, **RCA types 1100M5** and **1101M5,** are specially designed and characterized for the new "2½D" and "3D" schemes for memory system operation. Check the table below for the basic characteristics of these new cores which also feature extra-square hysteresis loops.

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YOUR SYSTEM CYCLE-TIME	RECOMMENDED RCA CORE TYPE		RECOMMENDED COINCIDENT CURRENT DRIVE CONDITIONS PULSE CHARACTERISTICS @ 25 C				TYPICAL OUTPUT CHARACTERISTICS @ 25 C				CORE SIZE OD/ID
(Coincident Current)	Conventional	Wide-Temp Range	I_m in Ma	I_{pw} in Ma	t_r in μsec	t_d in μsec	dV_1 in mv	dV_z in mv	t_p in μsec	t_s in μsec	(in mils)
<1 μsec	NEW! 1100M5	0181M5	875	437.5	0.05	0.2	35	5	0.10	0.18	20/12
			875	437.5	0.05	0.2	40	5	0.10	0.18	23/15
1 to 2 μsec	0183M5		550	275	0.1	0.5	55	7	0.21	0.41	30/18
	0172M5		700	350	0.1	0.4	60	5	0.18	0.36	30/18
	0175M5		700	350	0.05	0.3	40	5	0.13	0.25	23/15
		270M1	800	400	0.1	0.5	65	6	0.21	0.41	30/18
		0187M5	820	410	0.05	0.25	35	5	0.11	0.22	20/12
		NEW! 1101M5	850	425	0.05	0.25	38	4	0.12	0.24	23/15
2 to 4 μsec	0173M5		450	225	0.2	0.8	50*	4	0.36	0.60	30/18
		0167M5	625	312.5	0.2	0.8	50	4	0.36	0.58	30/18
4 to 6 μsec	232M1		480	240	0.2	1.5	80*	10	0.45	0.95	50/30
		264M1	630	315	0.2	1.5	80*	12	0.45	0.90	50/30
6 to 8 μsec	226M1		400	200	0.5	1.5	80*	7	0.70	1.25	50/30
		269M1	480	240	0.5	1.75	55	7	0.80	1.50	50/30
over 8 μsec	225M1		250	125	0.5	3.0	35*	3	1.15	2.40	50/30
	222M2		400	200	0.5	3.0	75*	10	1.15	2.30	80/50
		269M1	480	240	0.5	1.75	55	7	0.80	1.50	50/30

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CIRCLE 61 ON READER CARD

washington report

COMPUTERS FOR CONGRESS: DON'T HOLD YOUR BREATH

Publicity drums have lately been a-thumping over the possibility of an electronified Congress using computers on a routine basis. Object: to lighten oft-staggering workloads and to pierce the inscrutable expertise with which many Executive agencies now cloak their activities. An exciting prospect but one not likely to be soon realized. A major obstacle is the Congressional hierarchy, composed of many independent satraps who are unsympathetic, if not downright hostile, to changes that might be entailed in a computerization program.

Nonetheless, the Joint Committee on Congressional Reorganization is investigating a few preliminary actions that might be taken. Under consideration is the scheduling by computer of committee assignments, committee meeting dates and other Congressional obligations to optimize work time. Other postulated uses are for data banks on bills passed or under consideration, and for analysis of budget appropriation requests. A faint possibility for the future: establishment of a Congressional Computer Center with a full-time professional staff available to Congressmen and committees. And a danger: "There's always the chance a Congressman might use a computer facility as a tool for his re-election rather than for improved federal management," noted an aide. (For a look at how it might happen, see p. 33.)

GAO NIXES UNIVAC COMPLAINT

The Univac complaint over the Marine Corps' selection of IBM to provide five large-scale systems for its logistics operation (Oct., p. 21) was rejected by the General Accounting Office. Univac contended that IBM had given the benchmark demonstration on a machine configuration other than that specified in its proposal, and that IBM had not provided all the "operational software" by the demo date fixed by the Corps. Both contentions were shot down by GAO, the first as largely irrelevant, the second on the ground that "operational software" referred only to the software needed to power the benchmark demonstration.

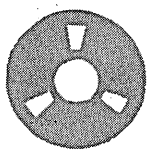
Disagreeing with the reasoning, one computer sales executive noted: "If the purpose of a benchmark demonstration is to provide a valid test of the machine being considered, it's reasonable to presume this will involve all system compilers and executive routines. Otherwise, there's not much to the demo."

AIR FORCE STRIVES FOR STANDARD JOVIAL

In a major standardization breakthrough, the Air Force is planning shortly to adopt comprehensive Jovial language and compiler specifications for all its C&C computers. The specs, developed by SDC and believed to be a software first, were writ down after a study of the pertinent characteristics of nine different large-scale machines, including the granddaddy Librascope 3055. The AF is hopeful that other big Jovial users, the Army, Navy and the FAA, will also take the new specs for their own.

The Popularity of our new 600 Series Carries a Price...

High-Level Staff Additions at General Electric's Computer Department in Phoenix



Call it the price of success. Of course, we're happy with the number of orders coming in for our new GE complex of computers... and what really pleases us is that orders are coming from some of the most knowledgeable, technically sophisticated users in the world. Does anything confirm the superiority of the line better than winning out in today's hard, nose-to-nose competition?

But this means heavy demands are being made on our senior group of computer systems development engineers to extend the capability of the 600 series beyond the fringes of present knowledge... in the fields of business, scientific, real time, and time-sharing applications.

And, in addition, we are right now starting on a whole new "line," and numerous company-funded development programs are under way. All this means that a wide number of openings are now available in many areas. The men we're looking for must be equal in stature to the calibre of the present staff. Preferably they should have a strong academic background in Math, ME, EE or Physics. This group is part of the headquarters complex in Phoenix, Arizona.

PROGRAMMING — BS or MS degree with 3-5 years experience preferred. ■ **Business Systems Applications** ■ **Scientific Programming** ■ **Software Package Development** ■ **Systems Programming** ■ **Data Center Services** (customer-oriented programming in time-sharing applications. BS/MS Math is highly desirable.)

MECHANICAL ENGINEERING — BS or MS required with extensive experience in packaging or high-speed small mechanisms design.

SYSTEMS ENGINEERING — BSEE or MSEE required with 5 or more years in large scale digital computer or related systems.

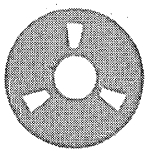
LOGIC DESIGN & CIRCUIT DESIGN ENGINEERING — BSEE or MSEE with 3-5 years circuit and/or logic design experience with computers or related digital hardware.

CUSTOM ENGINEERING, MAINTAINABILITY & CONTINUATION ENGINEERING — A number of key spots for engineers with interest in these areas and a background in basic computer hardware design. Engineering degree required.

MARKETING — Specialist, Customer Training — with 2 years experience in the computer industry in customer training. College degree required.

Computer Sales — with 3 to 5 years experience with medium to large scale computing systems.

If you want a chance to better your own past performance, and have experience in any of the areas mentioned above, we invite your further inquiry. There are many other openings, too, in the G.E. Computer effort in Phoenix and other major cities throughout the U.S. If you have a solid academic background and computer-related experience in design, applications, sales, service or administration, you are invited to explore these opportunities.



Please write to **STEPHEN K. STEWART** Administrator —
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A-12, P.O. Box 270, Phoenix, Arizona

COMPUTER DEPARTMENT

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CIRCLE 99 ON READER CARD

THE FJCC–65

When a Las Vegas hotel-guest/conference registrant asked the operator to awaken him at 7 a.m., she responded: "SEVEN ayem?" Much to the consternation of casino operators there, the AFIPS crowd showed a disconcerting loyalty to the Fall Joint Computer Conference that drew them there; some 1,350 showed up at the remote convention center to register on Monday, the eve of opening day. In fact, rumor has it that the Vegas hotel people are not at all pleased with the quality of people who attend the FJCC—though exhibitors are.

This is not to imply that DATAMATION's guide to gambling ("Casinos, Cards & Computers," by Dr. Allan N. Wilson, Nov., p. 62) was so effective. Fact is, we watched one man, blithely unaware of Wilson, double down on a 12, and pick up a 9 to win. He ended up, after five hours, $460 ahead, after paying off the $10 loan that got him into the game. (As for Wilson, see this issue's Letters to the Editor).

As noted earlier, however, the casinos received little play. The 4,000-plus registrants, instead, exposed themselves to an inordinately large number of technical papers and a commendable experiment in technical communication (discuss-only sessions, an entire day devoted to the impact of computers on government, industry, and education, and an epilogue session). Not all of these came off well, but they indicate a decreasing parochialism of computer professionals; and discuss-only sessions, which work well at smaller meetings, may yet prove effective at a joint conference.

As at many conferences this past year, time-sharing continues on its crest of (or quest for) popularity. Also gaining in attention-value, however, are social implications and memory systems. Hardware people working with storage media in many forms were well catered to; the number of papers on this topic couldn't be counted on four hands. But generalists, too, gained some appreciation for the value placed on computers by users in various fields.

Its effects on education, for instance, may include the disappearance of the physical campus (use remote terminals) as well as the semester system (progress at your own rate), according to Dr. Ralph W. Gerard of the Univ. of California at Irvine. Speaking at an all-day session, "How Will We Affect the World Around Us?" Dr. Gerard said: "It is high time that we stopped batch-processing of students." How? By allowing each pupil to proceed at his own pace, using a machine that facilitates computer-aided instruction. The development of the computer, he noted, is probably more important than printing, and equal to the development of language. Thus he is not alarmed by the effort to have "artificial intelligence replace natural stupidity." The most immediate benefit in formal education, he continued, is in allowing educators to prove or disprove theories about how people learn; it should change the art of education into a science.

The computer's contributions to medicine have been minimal to date, but the possibilities are many and the rewards great, according to James V. Maloney Jr., M.D., of the UCLA Medical Center. The removal of an appendix, untouched by human hands, is not exciting, he continued, but one area is: helping physical scientists to solve problems. Physicians, he noted, have available many facts; the problem is to help him derive meaning from these facts so that he can apply this to the treatment of his patients.

One other area: diagnosis, a very unscientific process. Not all diagnosticians use the same logic; indeed, doctors use "clinical intuition." Now, how do you develop software for this?

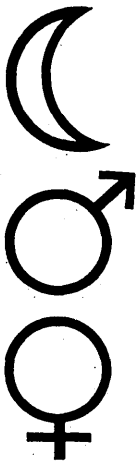
Ingenious software developers appear to have a casino-full of lucre awaiting them. In urban transportation, too, the need is for mathematical models for land area and transportation design, for forecasting and distribution of traffic. Kenneth Schlager of the Southeastern Wisconsin Regional Planning Commission points out, however, that the best-laid traffic patterns won't eliminate air pollution and crowding. Perhaps electric cars that carry you from your home to a group vehicle (also electric) are an answer, he suggested.

Software thus continues to be a problem area, sharing this distinction with I/O gear. In an experimental epilogue session, the RAND Corp.'s Willis Ware also saw weaknesses in the management of computer centers. There isn't enough data about the population of problems, we don't understand the configuration and we're not instrumented to get the data we need. Says he: we're still in the learning stage.

Education, both about and with computers, attained an enhanced position of prominence at this conference. It was considered the most exciting topic there by RAND's Paul Armer, chairman of the epilogue session. Armer called for more resources to go into education, which was referred to as the energy source of all progress by Dr. Laurence Heilprin of the American Documentation Institute. Another long-time conference-goer found consultant Robert Albrecht's demonstration of the teaching of computing to grade-school kids to be the outstanding feature of the week. As usual, local students and teachers were given orientation courses, then set free in the exhibits area.

Being exhibited was little that was new, some exciting and some not. More impressive were the number of new exhibitors (as many as a dozen, mostly new companies) and the trend toward more diversified products by old exhibitors. Those who attended the IFIP or BEMA shows in New York this year didn't miss much. This convention reversed the usual show-biz pattern; they had the try-outs in New York City.

Both the technical sessions and exhibition floor were well attended. Indeed, many of the sessions overflowed, people lining the walls to hear panel discussions and watch slides. The discuss-only sessions, for many reasons, were generally a flop, but we understand steps are being taken to correct the faults and continue the idea in San Francisco—next stop for the Fall Joint. Before then, on April 26-28, there's the Spring Joint meeting in Boston, testing ground for voice-input systems. ■



COMPUTER SPECIALISTS:

BELLCOMM has immediate openings for work on Computer Systems and Data Processing in Advanced Manned Missions

Bellcomm is interviewing now for imaginative computer specialists who can define the functional requirements, equipment configuration, software concepts and reliability objectives of advanced spaceborne computers for Manned Space Flight missions.

The work involves study of the onboard and ground data processing needs associated with the preparation for and conduct of advanced manned missions. It includes analysis of data to be transmitted between space vehicle and ground-based computer systems, and investigation of data compression and encoding techniques to insure reliable data communications under power and bandwidth constraints.

We need people who will perform systems engineering studies and establish performance characteristics of computer systems to meet these requirements.

If you are qualified, and interested in Bellcomm's work—systems engineering for the Office of Manned Space Flight, National Aeronautics and Space Administration—you are invited to send your résumé to Mr. N. W. Smusyn, Personnel Director, Bellcomm, Inc., Room 1400-E, 1100 17th Street, N.W., Washington, D. C. 20036. Bellcomm is an equal opportunity employer.

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- ☐ **Scientific Computation**— Analog or Digital; Math Analysis or Synthesis; Data Reduction; Modeling and Simulation
- ☐ **Systems Development/Design**— Real Time; Message; On-Line or Process Control; Massive Data Handling or I.R. Systems
- ☐ **Technical Representatives**— Systems or Programming Support to Sales
- ☐ **Logical/Digital Design**
- ☐ **Fortran or Cobol Programming**
- ☐ **Management Sciences**
- ☐ **Marketing/Sales**— Computers or Systems

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Digital System Designers — Participate in the design and evaluation of real time computer controlled systems. Must be experienced in computer design and familiar with signal conversion I/O control, displays, digital transmission and programming techniques. BS/MS/PhD EE or Physics, and 5 to 10 years experience.

Software System Design — Determine the programming requirements and specify the software system required for an airborne real time control system and multi-programming techniques and the development of compilers, assemblers, simulators and executive control programs. BS/MS/PhD EE, Math or Physics, and 5 to 10 years experience required.

Digital Circuit Designers — Develop and analyze signal conversion and memory system design of A/D and D/A converters or DRO and NDRO memory systems. Familiarity with digital transmission techniques and digital display systems desirable. BS/MS/PhD EE or Physics with 5 to 10 years experience.

Programming Engineers — Develop operational and support programs for a real time computer controlled system. Experience in both machine language and problem oriented language is necessary. BS/MS in EE, Math or Physics with 5 to 10 years minimum experience.

Many other openings exist right now. Please send your resume, including salary history, to Mr. C. A. MacDonald, DOUGLAS Missile and Space Systems Division, 2730 Ocean Park Boulevard, Santa Monica, California.

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CIRCLE 113 ON READER CARD

THE MINNEAPOLIS STAR

Control Data Has Expansion Pattern

NEW PLANT EVERY YEAR

By DICK CALDWELL
Minneapolis Star Staff Writer

Control Data Corp. has what most communities seem to "Our spacing is just a desir not to dominate any one area

ELECTRONIC NEWS

Control Data Buying Howard

MINNEAPOLIS.—Control Data Corp. here has reached an agreement to acquire assets and business of Howard Research Corp., Arlington, Va., electronic systems engineering company.

The acquisition, subject to approval of Howard's stockholders, will be in exchange for shares of Control Data common stock, the amount was not disclosed.

Howard Research, which specializes in underwater systems, missile systems and information systems, will become a part of Control Data's Government Systems division, headquartered in Minneapolis. Howard will remain in Arlington.

William C. Norris, president of Control Data, said his firm's acquisition of Howard will further expand Control Data's total systems capabilities in electronic military and weapons systems programs.

Howard Research will continue to be operated under that name as a part of the Control Data's Government Systems division. James H. Howard, president of Howard Research, will join Control Data in a position not yet disclosed.

BUSINESS WEEK

Computers speed up

Control Data's 6800 model is the largest, swiftest electronic brain yet

Living up to expectations, Control Data Corp. has wrested back from International Business Machines Corp. the title for the biggest, fastest, most powerful computer.

This week, the Minneapolis company announced it has added the 6800 model to the top of its line. The 6800 operates at speeds four times those of the company's 6600, which held the title for size before IBM expanded its System 360 line with the model 92 last August. Control Data also came out with a model 6400. As the numbering suggests, this is smaller than the 6600.

WALL STREET JOURNAL

Control Data Unveils Two 'Super' Computers For High-Speed Service

One Model Will Execute 1 Million Instructions in a Second, and The Other, 12 Million a Second

By a Wall Street Journal Staff Reporter

MINNEAPOLIS—Control Data Corp. has strengthened the heavy end of its computer line with the introduction of two "super-scale" machines—the 6400 and the 6800 models.

The 6000 series, including the previously announced 6600 computer, gives Control Data one of the most extensive lines of super computers of any company in the electronics industry.

Last August, International Business Machines Corp. introduced the model 92 to its

FORBES

Control Data: Big Success,

Brilliant engineering and managerial boldn
Control Data to the third spot in com
second spot in profits. But Bill Norris ca

ARDLY THREE YEARS ago the nancial pages were awash with entific-sounding names of brand- little companies. In most cases y consisted of little more than a Ph.D.s working in rented loft e on a bit of a Pentagon subcon- It didn't matter. Investors bid heir prices. But since the collapse e new-issue boom in early 1962, have gone out of business and was only four years old, and in name hardly distinguishable from scores of other new science companies.

Control Data, however, was the one in a thousand that had what it takes. It was founded in 1957 by Chairman and President William C. Norris, who had recently quit as general manager of Sperry Rand's Univac division. Norris' whole staff consisted of a half-dozen fellow Univac refugees. To- later became part of Univac. ... in their late thirties and early forties, this team is among the most experienced in the young computer field.

But Norris is oversimplifying when he attributes CD's success entirely to "brains." Control's technical people produce fine equipment. But so do the top technical people of rival companies. What has made a good deal

Good news travels fast...

Find out how you can join the Control Data Success Team that's making the news

There's a lot of good news going around about Control Data – new products and systems making headlines, sales increasing year after year, and *GROWTH* born of bold management, frequent technological advances, and effective selling. Along with this growth we've created excellent opportunities for the kind of people that have made Control Data the most dynamic force in the computer field.

If you'd like to be a member of one of industry's fastest growing teams and have a share in its success, get the details on positions that are now available. Check the opportunities listed here, then contact us for more information on these and other positions.

ADVANCED DESIGN: Electrical Engineers with 2-3 years of experience in the development of high speed digital circuits or high performance core memories are needed to work with state-of-the-art techniques. This position in advanced design requires exceptional degree of creativity and engineering competence along with desire to play a significant role in development of future generation computers. Minnesota location.

SYSTEMS INSTALLATION: Represent Control Data technically at various nationwide customer sites. Responsibilities will include orientation, training, programmer consultation, and software systems installation for customers. Math degree preferred. California and Minnesota locations.

SOFTWARE DOCUMENTATION: Assist in the development of reference manuals, sales aids and other forms of documentation on programming systems. Should have three years' programming experience and working knowledge of time-sharing systems, monitors, assemblers, PL1, FORTRAN, COBOL and/or ALGOL. Must have a strong interest in writing and editing. Minneapolis, Los Angeles locations.

SYSTEMS PROGRAMMER ANALYSTS: New application areas for high-speed digital computers and programming systems. Positions require varied backgrounds in command and control, real time, monitor systems and knowledge of scientific programming languages. A degree in math, physics or engineering and a minimum of three years' experience are required. Los Angeles location.

PROGRAMMER ANALYSTS – INDUSTRIAL: Responsibilities include analysis, synthesis, and implementation of real-time communications systems. Experience is desired in assembly language programming, software development, real-time applications, and systems programming in the communications area. Other positions exist in on-line data collection, terminal recordings, and message and data switching. Minneapolis location.

PROGRAMMER ANALYSTS: Analyze Data Center Customer problems for customer's computer applications. Responsibilities also entail work in sales support and the preparation of programming proposals. Experience on large-scale machines in either commercial or scientific programming is necessary. Commercial applications background should include payroll, A/R, A/P, inventory control, school scheduling, etc. Los Angeles, Palo Alto, Washington, D. C., Minneapolis, Houston, Long Island locations.

SALES REPRESENTATIVES / DATA CENTERS: Individuals should have experience in selling computer hardware and/or services and desire to join a dynamic sales group which offers outstanding financial rewards through a salary base plus an excellent commission plan. Nationwide locations.

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CIRCLE 108 ON READER CARD

people

■ David Forst has been appointed director, S/360 real–time systems, Automation Sciences, Inc., New York City. He will also serve on the ASI Series/360 consultant panel.

■ Dr. R. G. Selfridge is the new director, Univ. of Florida Computing Center, Gainesville, Fla.

■ Jules I. Schwartz has been appointed director of technology, System Development Corp., Santa Monica, Calif.

■ Appointments at Sperry Rand Univac: Harry A. Steinberg is now controller and treasurer, Data Processing Div., replacing Donald A. Graham who has been named vp and controller; Adrian Boss will be national sales manager, large systems.

■ Daniel A. Goldstein has been chosen director, special projects, Honeywell EDP Div., Los Angeles, Calif.

■ Will A. Cummins has been appointed director, computer technology, Information Systems Co., Los Angeles, Calif.

■ Robert A. Leonard has been elected executive vp and general manager of the new ITT Data Services Div., Paramus, N.J.

■ Robert S. Taylor, director of Lehigh Univ.'s Center for Information Sciences, has been chosen consultant in information sciences to the Div. of Graduate Education in Science, National Science Foundation.

■ Richard P. Irelan has been named director, systems and data processing, Phoenix Steel Corp., Claymont, Delaware.

■ Joseph J. Malin has been appointed manager, banking and special systems applications, Bunker-Ramo, Stamford, Conn.

Would you have invested your talents and energy and resources in his epic voyage? A small band did. And when Columbus returned triumphant, each knew he had had a hand in the greatest adventure of that time and age.

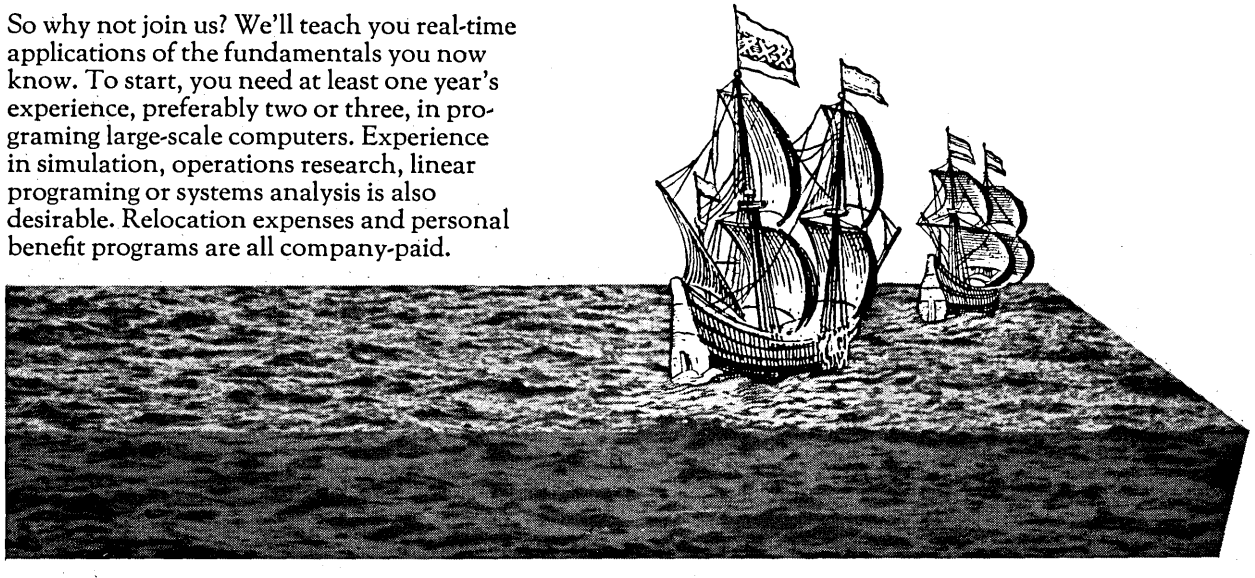
Another great adventure beckons today. The manned exploration of the moon. And, as in Columbus' time, a relatively small band is privileged to share in it. IBM programers are in the forefront of that band.

At NASA's Manned Spacecraft Center in Houston, IBM programers help steer men through space. They chart the course of each Gemini/Apollo flight—*in real-time*. They sit at the consoles in the Real-Time Computer Complex and monitor the computer performance of hundreds of thousands of programed instructions. They do every kind of programing job there is to do. They often work in real-time themselves, since their knowledge of programing detail may be called upon to support the system during its period of critical operation.

Tomorrow, programers will write control programs for post-lunar launches. They'll develop time-shared systems for overlapping missions. They'll work on multiprocessors, dynamic storage allocation, and adaptive, self-organizing systems. The manuals they write will be the textbooks for real-time systems of the future. Think what you would learn working with them! You would gain experience that cannot be equalled anywhere. And this experience will be even more useful to you in fulfilling the programing needs in the decade to come.

So why not join us? We'll teach you real-time applications of the fundamentals you now know. To start, you need at least one year's experience, preferably two or three, in programing large-scale computers. Experience in simulation, operations research, linear programing or systems analysis is also desirable. Relocation expenses and personal benefit programs are all company-paid.

Programers: would you have sailed with Columbus?



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IBM®

(Continued from page 71)

to initially build a team of 50 top men capable of establishing research into operating standards, applications packages, and high-level languages. Formed as a non-profit company, the centre will be governed by a council comprising users, manufacturers, and government. Subsidiaries of foreign companies have been invited to participate, and discussion has already taken place with IBM.

EUROPEAN USERS THINK SMALL, STUDY SHOWS

European users tend to work from small dp systems to small computers before graduating to large computers. Ambitious large projects are a rarity. These were the main themes of a review of dp activity made by Dr. Roland Oberle, Ideal Standard Gmbh, Germany, at a conference, International Computer Usage, organised by the part-owned GE concern, De la Rue Bull Machines. Part of his survey showed that Britain lagged behind Continental countries, particularly Germany and Scandinavia, in the application of computers to manufacturing industry.

From a study of 86 manufacturing concerns in Germany, Dr. Oberle indicated the disparity in management's policy in dp equipment. Only one firm spent more than $10/month on dp for each employee; 14 spent between $5-10; 21 between $3-5; 25 between $2-3; 19 between $1-2; and six less than $1.

BRITONS SUSPEND PL/I EVALUATIONS STUDY

Aware of a slow acceptance of Cobol in Europe, it was proposed to the Ministry of Technology to start work immediately on a PL/I-and-subsets evaluation for the U.K. At advanced stages of negotiation, however, local manufacturers stepped in and blocked the project. Apart from fear of any advantages that may accrue to IBM, machine makers are suffering acutely from over-committed software manpower resources.

INFORMATION UTILITY GAINS FAVOR IN U.K.

The main focus of Britain's electronics effort should be in process control and automation. This is the main conclusion of a comprehensive and statistically-supported survey conducted by the National Institute for Economic and Social Research, London. It suggests that there is a good case for establishing a computer grid as an information utility in Britain.

BITS & PIECES

The third combined university/IBM research centre to be established in Europe has opened at Pisa. Similar to a Scandinavian and British scheme, it involves a 7090 plus a scholarship fund extended to prospective post-grads from other institutions. IBM has 35 installations in the science and education field in Italy, Olivetti 24, Univac four. Forecast for the total market by 1970 is 1,000 computers...Siemens of W. Germany is plowing $120 million into a dp expansion program. The firm makes Spectra 70's under license, holds about 7% of the German market...Results from ICT lived up (or down) to earlier gloomy forecasts. A pre-tax loss for the year ending Sept. 29 was $1.5 million, down from a $6.5-million profit the year before. Losses are attributed to the marketing of the 1900 series, orders for which now total $120 million...The sale of used computers in Switzerland is the goal of a joint venture by the U.K.'s Computer Resale Brokers Ltd. and the Swiss Intronic S.A...On a cash-raising exercise in Europe, IBM World Trade will sell debenture stock worth about $30 million...

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ELECTRONICS DIVISION

CIRCLE 115 ON READER CARD

DATAMATION FEATURE INDEX–July-Dec. '65

JULY 1965

Automated Banking

A variety of discussions on banking edp begins with a critical review and appraisal of developments, by Robert V. Head, showing banks now moving toward real-time and no-check operation. In a fictitious report, Dale L. Reistad states the problems facing computerized banks. Advances in checking account operations include a study of a commercial bank handling its own accounts on-line by J. T. Berryman, and a report by John R. Roche and Earl S. Rogers on an experiment in voice-answerback systems. The bank of the future is described by Arthur S. Kranzley. In the final article, Merle D. Courson explains one bank's shift to integrated account numbering.

The Used Computer Market p. 48
by George H. Heilborn

The sale and purchase of computer equipment is broadening the data processing field. A broker in dp systems discusses the effect of new equipment on the market, the types of available equipment, advantages of purchasing used systems.

AUGUST 1965

The RAND Symposium p. 24

The first of two articles defines problems facing the profession, and outlines the knowledge necessary for military leaders, college graduates, etc., who confront computerized operations. Discussion also includes implications of current trends toward remote console time-shared systems and interactive languages.

Telephone Switching by Computer p. 31
by Dr. Erna S. Hoover

Supervisor of systems planning group describes the new electronic switching system (No. 1 ESS) in use by Bell Telephone Labs. A specially-developed stored program technique facilitates addition of normal and special services for phone subscribers.

Choosing a Set of Computers p. 37
by Alan C. Bromley

Article describes studies that led to recommendation for next step in computers for a large corporation. Study group utilized a scoring method that itemized the goals of management and characteristics of company's data processing in order to determine needs.

Programmers and Cheap Computing p. 58
by T. B. Steel, Jr.

Article describes the effects on programming of a batch-fabrication technology leading toward increased speed, capacity, reliability and complexity of digital computers—and a large reduction in cost/performance ratio.

SEPTEMBER 1965

Data Acquisition pp. 24-52

Although the new generation of hardware and software features designed to enhance on-line operation encourage centralization, Justin A. Perlman suggests—in the lead article—that key factors to consider should be company's operation, history and character. Data transmission/acquisition charts list major manufacturers according to input-output, speed, transmission medium, special capabilities, and pricing. In the third article, James D. Edwards discusses the operation of Lockheed's Automatic Data Acquisition application. R. W. Parker concludes the section with a description of American Airlines' SABRE.

Patients On-Line p. 57
by Robert L. Patrick and Marshall A. Rockwell, Jr.

The Shock Research Unit of the USC School of Medicine has an on-line system in the most critical of environments. Article studies computer-assisted medical treatment, discusses input-output problems and future system requirements.

OCTOBER 1965

Hybrid Computers pp. 24-37

Three articles include a tutorial that fits hybrid developments into historic perspective and classifies systems into four types (Hybrid Computation, by Thomas G. Hagan); a description of one company's software package for real-time simulation, applicable to both all-digital and hybrid simulation (Simulation Software, by Ralph T. Dames); and a look at the latest hybrid computer (The EAI 680, by Paul Landauer).

How to Tell if It's FORTRAN IV p. 38
by Daniel D. McCracken

More than two dozen languages are called FORTRAN IV, but they differ widely in source language features. Article includes two tests to determine which is the real F-IV. Comparison charts list some of the more important features offered in compilers of leading manufacturers.

Programming Documentation p. 44
by Robert G. Snyder

Although documentation is a byproduct of a good systems job, this laborious task becomes even more important during computer system conversion. Systems analyst describes what goes into an effective job manual.

Operating Systems: One Installation's Experience p. 54
by Robert F. Brockish

Covering both business data processing and scientific computing, the author considers the advantages and disadvantages of operating systems in discussing job throughput and programmer productivity.

Computer Science Education in Europe p. 77
by Peter C. Patton

Author describes variety of approaches to the teaching of this subject by European

FEATURE INDEX

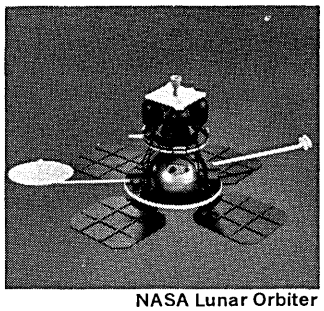
universities. While still behind some U.S. schools, increasing attention is being devoted to the need for qualified computer scientists.

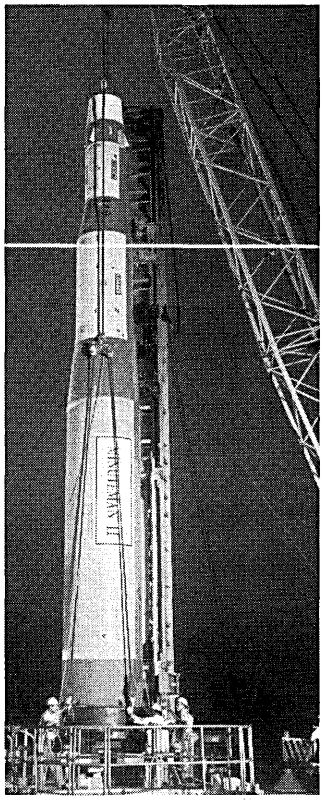
NOVEMBER 1965

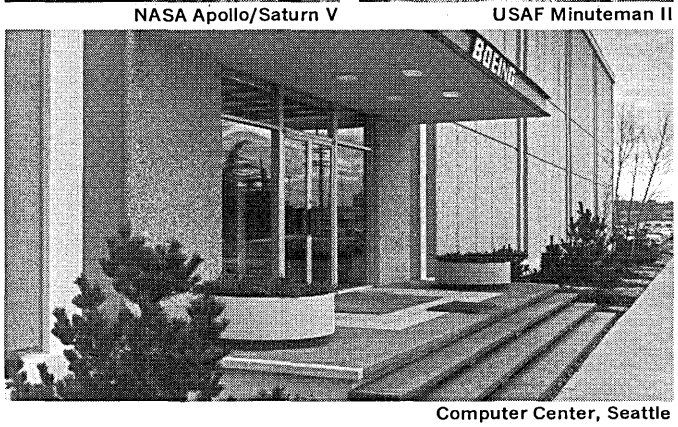
DECEMBER 1965

Computer Systems Engineering Openings

NASA Apollo/Saturn V


NASA Lunar Orbiter


USAF Minuteman II



Computer Center, Seattle

The Boeing Company's deep involvement in the nation's most important missile and space programs is providing challenging openings for qualified graduate computer systems engineers. Requirements are a B.S., M.S., or Ph.D. in engineering, physics or mathematics, preferably with experience in computer applications, computer systems analysis or related fields.

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Design and implement real time and near real time spacecraft performance computer programs. Assignment will involve coordination with other contractors and participation in space flight control.

Analyze and design computer programs and information processing systems to be used in support of operational command and control systems. Experience in the fields of information retrieval or query languages is desirable.

Computer Systems Analysis—Evaluate, develop and implement programming languages and compiler systems for scientific computing systems. Experience in large scale systems, design and development of compilers or major applications programs is desirable.

Develop and implement software systems for small and medium size computers used for on-line data acquisition and processing, military and space systems simulation and crew training simulators.

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CIRCLE 117 ON READER CARD

advertisers' index

the surprising role of programming at Xerox

or **(how to quietly put your skills to work on the mainstream of some very unusual corporate and scientific problem-solving... decidedly upstream.)**

The first surprise generally comes with the comment that throughout the corporation's many operating divisions, as well as within the more centralized business and scientific computing groups, Xerox already employs a healthy number of programmers (upwards of 100). Not neophytes. And we have ample room for more. Also not neophytes.

The second surprise surrounds the kind of work we'll invite you to do, and the way we encourage you to do it.

To begin with, we've toppled the concept that a lot of people have—that computers are merely data processing machines, no matter how wondrous. We've had the good fortune to participate in (maybe precipitate) a thorough organizational awakening to the fact that a computer in a scientific environment should be used to enhance the *insights* of scientists and engineers—not just be used to *process* a problem they may have. And the same goes for non-technical, decision-making management.

If these be platitudes, they're platitudes in action.

And so you'll find many of our "programmers" acting as *consultants* to managers of fundamental and applied research, advertising, marketing, manufacturing, finance, etc.

This is not routine programming. And a routine programmer wouldn't be up to it.

In addition, there's some interesting work in progress on time-sharing systems. The software aspect is a challenge all its own.

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the forum

ADVANCED PROGRAMMING AND THE AIMS OF STANDARDIZATION

Some of the most advanced programming techniques have emerged either because of the complete lack of coordinated standards, or because there was too rigid standardization and too soon, whether it was planned that way or not. The standardization that was lacking, or too rigid, was in programming techniques, languages, and terminology, equipment techniques, available equipment, and specification and documentation methods for equipment, programs, languages, and problems to be solved.

For example, common programming languages developed because of the lack of standardized equipment or languages for their use. We are fortunate that the standardization was lacking, because otherwise we would have both equipment and language only for the type of scientific problem which can be solved by numerical approximation, and both equipment and language would in all probability have been too clumsy for symbol manipulation, for automatic coding, compiling, translating, for simulation, or for process control, or business data processing; they are still too clumsy for natural language processing and for the generally flexible requirements for mass information storage and retrieval.

It was originally thought that competition among manufacturers and users would inhibit the development of common programming languages; those who thought so had to face the apparent paradox that competition was the major force causing, rather than inhibiting, such development.

The available tools were so clumsy that reprogramming costs actually equalled the original equipment costs; the only recourse was to provide the customer one wanted to entice away from the competitor with a ready-made translator, to be delivered with the new equipment or programs; companies even had to do this for their own customers to keep the old facilities they offered from competing with their new products. This was the story of FORTRAN.

Thus, here, lack of standards automatically produced standards; no formal standardization activity was even needed to produce the effect.

An example where too rigid a standard produced an advanced technique was in the development of list-processing techniques by chaining data together in a way in which only programs had been chained. It seems that, without our being aware of it, all storage was considered to be purely sequential, whether specifically addressed or not . . .

But most information that people want to use is not produced by any single line of development, like one enormous piece of spaghetti, and furthermore, even if some information is produced that way, one doesn't want to use it that way. Is a linear file in an office ever used in the chronological order of appearance? The association of information, both in the way it is produced and in the way it is used, is not sequential but in ramified and intricate network structures which are never alike in two productions or uses. We are almost certain not to want to use the information in the same order that we produced it, and absolutely certain that neither the production nor the use will be sequentially fixed . . .

Here is an example where the lack of standardization in our programming for simultaneous actions is calling forth all our ingenuity in developing programming techniques for executive systems, real-time systems, time-sharing and multi-programming. If we had had a standard computer and programming system for one of these tasks, might this not have had the effect of blinding us on how to attack the others?

These examples of how either lack of standardization or of too rigid a standardization produce advanced programming techniques, and advanced equipment, teach us the following things.

A. Lack of standardization can be a nuisance.

B. Standardization can be a nuisance.

C. Standardization can be automatic, without any organization responsible for it.

So why try? Why should we even lift a finger to either advance or retard it?

The answer is that we can't even prevent ourselves from trying. We are caught in a treadmill of communication traffic; the very process of trying to communicate is one of building up or breaking down standards. Learning to communicate is itself a standardization of people—a process called education.

And there is something very important that this standardization of people, languages, and things teaches us. Standardization must not be too rigid; those who agree to such standardization are only signing a delayed suicide pact because the equipment, the languages, or the people they do this to will surely become obsolete.

Any processor or language system must be able to grow or it will surely die. If we permit unique standards at all, it must be only of the control structure that permits continued growth. Until we have enough theory developed to understand that we are not standardizing ourselves into a blind alley, we must permit a carefully selected variety of standards; but surely we must give immediate attention to a carefully selected and controlled variety of standard ways to specify these standards.

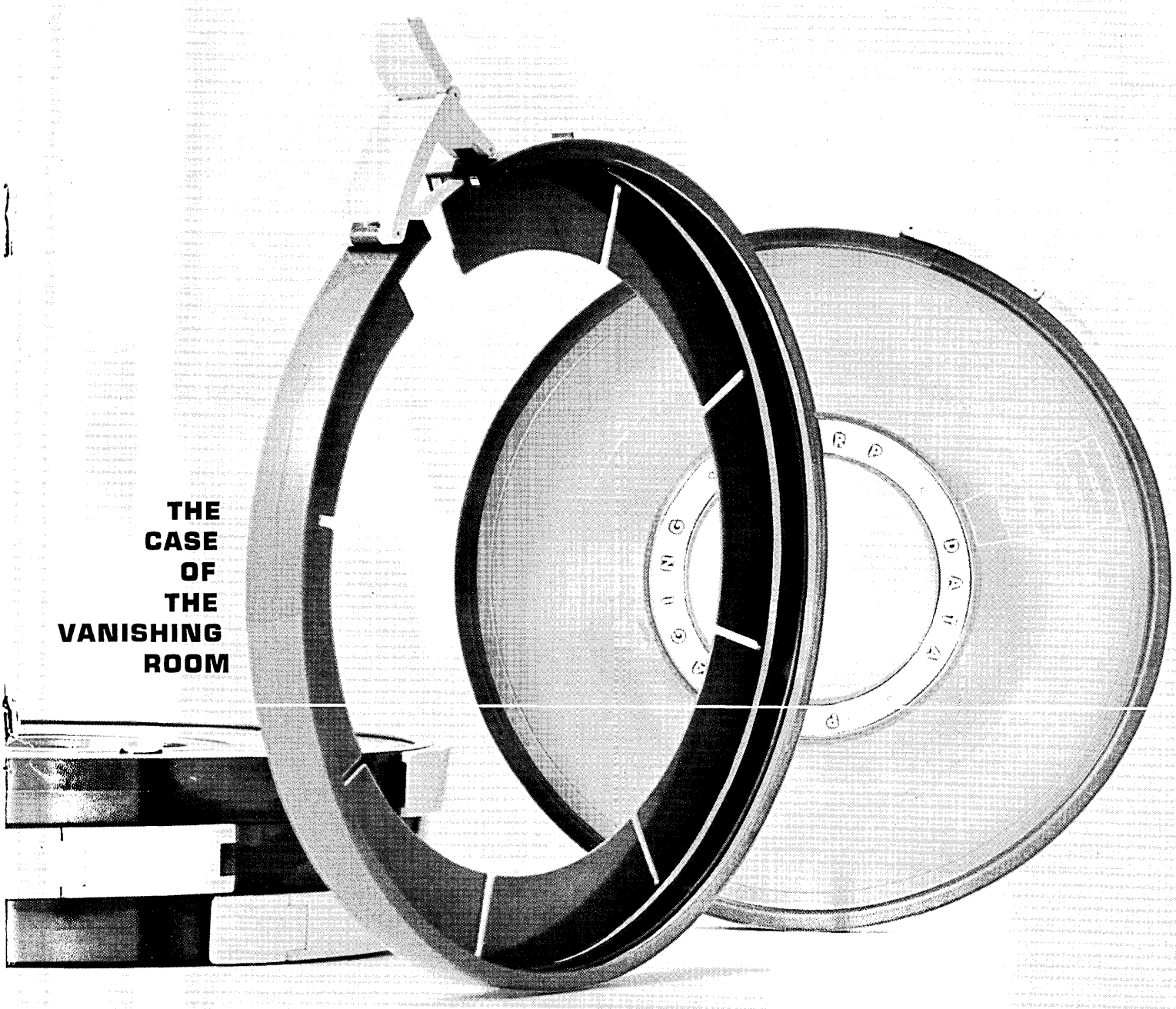
The development of the necessary theories, standard terminology, and specification methods is best done, however, by supporting a healthy percentage—say, 10 to 15%—of purely academic types who are willing to spend up to 20% of their time in contact with the industrial and commercial community . . . To them, knowledge is to be broadcast, where in highly competitive industry knowledge is to be kept secret because of its power . . .

So our final philosophic lesson is that formal standardization must continue, in spite of the dilemmas it presents. But to be a healthy activity, a decent fraction of its personnel must be pure academic theorists to counterbalance the industrial and commercial manufacturers and users.

—SAUL GORN

This paper was presented in a panel discussion at the Institute on Advanced Computer Programming, American Univ., Washington, D. C., and was used at the ACM Working Conference on Programming Languages and Pragmatics, San Dimas, Calif., Aug. 1965. Papers from the latter will appear in the March issue of ACM Communications.

THE CASE OF THE VANISHING ROOM



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This new case is available from most every computer and tape manufacturer with their reels of tape. A ring of color around the hub of the reel identifies it as a quality reel with an aluminum winding surface from

DATA PACKAGING CORPORATION
205 Broadway, Cambridge, Massachusetts

Case patent number 3209904.

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