September, 1967

DATAMATION®

15TH ANNIVERSARY

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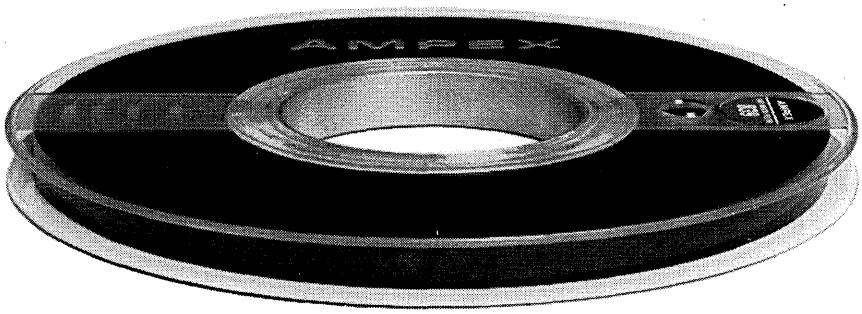
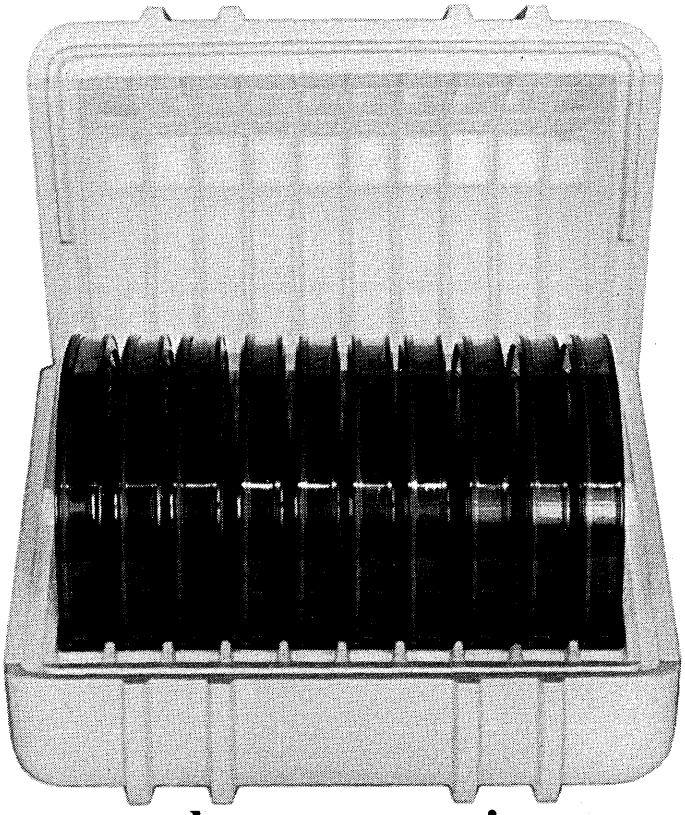
Clean and comfortable



when we ship it



when you store it

Our computer tape is clean and error-free. We think that our superior cleaning process makes it cleaner than anybody else's, but of course we're prejudiced. Point is, to be computer tape at all, it has to be clean and free from dropouts.

But we don't stop at merely making clean tape; we make sure that it gets to you clean and that you can keep it clean. Here's how:

Our exclusive environmental shipper which we call the Tape-Safe keeps dust out and your tape "clean and comfortable." Clean, because the polystyrene foam won't shed like cardboard; comfortable, because it cushions the tape in transit against shock and damaging fluctuations of temperature and humidity. Best of all, it's free with your minimum order of Ampex tape for IBM and IBM-compatible computers.

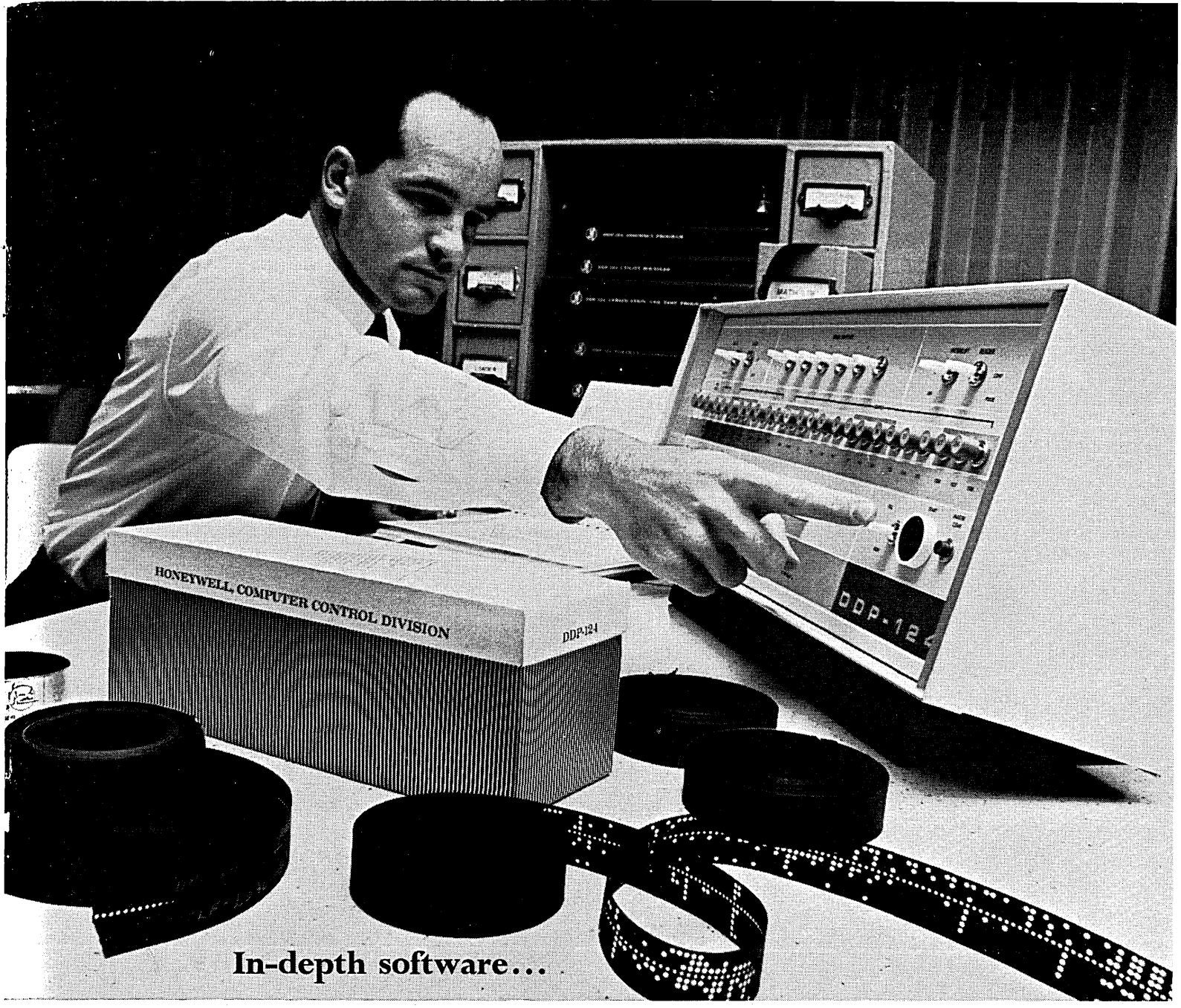
Then, for the only sure protection in storage, we pack our tape in a unique all-plastic canister. It keeps tape clean because it cannot generate contamination and its positive seal prevents outside dirt from getting in; comfortable because it protects against shock and humidity. This canister is even encased in an airtight poly bag during shipment. From then on, it's up to you.

FREE! If you'd like a few suggestions on how to keep tape clean, write Tape-Safe, Ampex Corporation, 401 Broadway, Redwood City, California 94063, for a copy of our TRENDS Bulletin No. 12, "Care and Storage of Computer Tape."

AMPEX

Career opportunities? Write Box D, Redwood City, California 94064.

CIRCLE 1 ON READER CARD



In-depth software...

...at your fingertips for the finest 24-bit I/C computer buy ...DDP-124

NOW— 60 DAY DELIVERY ON BASIC SYSTEMS NEW LOW PRICES

Every μ-***COMP*** DDP-124 includes 253 field-proven software programs, FORTRAN IV compiler with Boolean capabilities, compatible symbolic assembler . . . *and more.* That's a lot of 24-bit software strength at your fingertips to help solve your programming problems.

Hardware? DDP-124 features I/C μ-***PAC*** logic modules for high reliability, high performance, high speed at low cost . . . and its specs make it an ideal computer for flight simulation, message switching, physics research, radar tracking, data acquisition, scientific computation, missile tracking, impact prediction.

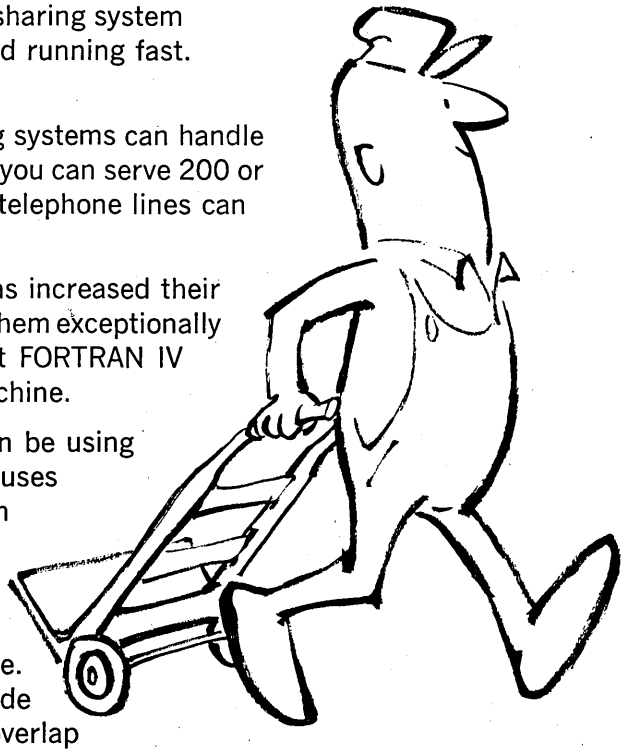
Interested in the finest 24-bit I/C computer? Write today for new DDP-124 brochures with complete software listing. Honeywell, Computer Control Division, Old Connecticut Path, Framingham, Massachusetts 01701.

Honeywell

COMPUTER CONTROL DIVISION

CIRCLE 4 ON READER CARD

So we have positive proof that the new GE-420 time-sharing system can be delivered fast . . . put on-line fast . . . up and running fast. We can do it for you, too.



This first member of a family of GE-400 time-sharing systems can handle 30 communication lines simultaneously. This means you can serve 200 or more people using 100 remote terminals wherever telephone lines can reach.

Scientists and engineers report that time-sharing has increased their productivity by 50 to 500 percent. The GE-420 gives them exceptionally fast floating point hardware and the industry's best FORTRAN IV compiler for a medium-scale business/scientific machine.

Training is easy. In less than a day, your people can be using BASIC, the simplest of all computer languages. It uses familiar English words, so learning time is fast even though the language is surprisingly powerful. Extended BASIC will be available soon, making the system more powerful than ever before.

Each program can have 10,000 words of core storage. Response time is better because two programs reside in-core simultaneously, not just one. This lets you overlap computation with disc input/output.

One of the system's strongest points is that you don't always *have* to use the system for time-sharing. Merely change the mode and you have full batch processing capability.

Get in on the ground floor now, while fast delivery is still available. Call your GE Information Systems Sales Representative or write General Electric, Room 912, 2721 N. Central Avenue, Phoenix, Arizona 85004. 290-10

GENERAL ELECTRIC

CIRCLE 5 ON READER CARD

DATAMATION

september
1967

volume 13 number 9

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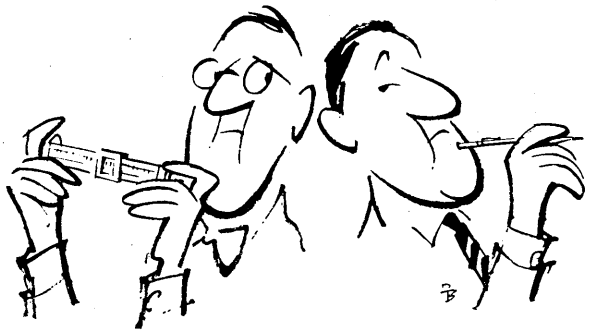
Printed by Beslow Associates, Inc.

This issue 71,536 copies

Can scientists and businessmen be happy with the same computer?

Ask about a GE-400



Information Systems

GE-400 Systems

Many installations have proved the GE-400 can handle engineering and scientific problems as easily as business problems. This growing list of features shows you why:

- **FORTRAN IV** — the GE-400's come complete with one of the industry's best FORTRAN IV compilers for a medium scale machine. It has optimum compilation and execution speed.
- **Floating point hardware** — the GE-400's exceptionally fast floating point hardware has a price/performance ratio that invites comparison.
- **Extended memory** — memory has been expanded on the GE-400's in multiples of 16k to a peak of 131,072 words. You can now handle more complex problems and run them concurrently.
- **48 bit floating point number** — gives you 11-plus digits of precision — the four additional you really need.
- **Engineering software** — basic math routines plus a wide range of application systems are available now.

So you see the GE-400's don't *just* mean business. They now offer you the broadest capabilities available today on a medium scale information system — all the way from everyday business runs to complex scientific problems.

To learn more about how you can grow with a GE-400, contact your General Electric Information Systems Sales Representative. Or write General Electric, Room 912, 2721 North Central, Phoenix, Arizona 85004.

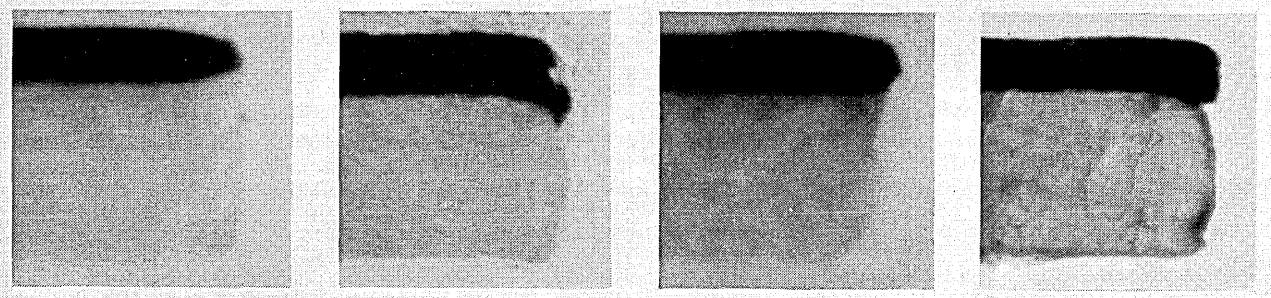
290-08

GENERAL ELECTRIC

CIRCLE 7 ON READER CARD

TAPE EDGE COMPARISON

TVP 2 BRAND A BRAND B BRAND C



EXCLUSIVE PRECISION SLITTING

TYPICAL INDUSTRY SLITTING

NOW... pick your computer tape

☐ You have probably never worried about how your computer tape looks in cross-section, but believe it or not, it's an angle worth considering.

☐ The unretouched photos above are representative cross-section views (at approximately 500X) of three leading "premium" tape brands, together with Computron's new TVP2.

☐ You can see at a glance that, of the four specimens, only TVP2 displays a clean, rectangular edge. Why is this important? Primarily because in this way TVP2 greatly reduces the possibility of error-producing edge debris.

☐ When oxide overhang is present, small fragments are almost certain to break off in use. With a non-rectangular cut there is uneven edge wear between the oxide and backing, weak spots develop and the edges fracture and chip. This means an increased probability of dropouts, both transient and permanent.

☐ In addition to solving the debris problem TVP2's clean, uniform edges result in skew characteristics which rival those of master skew tapes.

☐ TVP2's exceptional edges are the result of an exclusive new Computron slitting technique . . . another important factor in the Total Value Performance of this exceptional new tape.

☐ Consider it the next time you select computer tape.

HOW THESE PHOTOGRAPHS WERE MADE

1. The two ends of the tape were inserted into a plexiglass tube.
2. The tube was then filled with epoxy and allowed to cure.
3. When completely cured, the cylinder was put on a lathe.
4. The ends of the cylinder were then polished in several stages until the required smoothness was achieved.
5. The edges were then photographed under a microscope using a parallel light source, eliminating shadows which might result in undefined tape edges.

TVP2

COMPUTRON INC
CROSBY DRIVE, BEDFORD, MASSACHUSETTS 01730

CIRCLE 8 ON READER CARD

DATAMATION 67®

september
1967

volume 13 number 9

automatic
information
processing
for business
industry & science

datamation departments

WE JUST OBSOLETED EVERYBODY ELSE'S COMPUTER GRAPHICS.

Our new CRT computer terminal makes all other graphics systems suddenly look like Theda Bara vamping Rudolph Valentino. Nostalgic, maybe, but very, very obsolete. □ The difference is that the Adage Graphics Terminal is a fully-integrated general-purpose system. It has its own internal computer and is delivered complete with operating software for communicating with the remote central computer and for local image control and console I/O. □ Hybrid processing techniques exclusive with Adage (our Ambilog 200 hybrid computer is standard in every terminal) produce dynamic displays of 3-dimensional objects which really move continuously. Pictures are bright and clear. Even complex images don't flicker. □ You can start with the Model 10 Graphics Terminal at $75,000, and get 4K of 30-bit core memory, CRT console, and Dataphone interface to the central computer.□ For around $250,000 the top-of-the-line Model 50 buys you 16K of core, extended arithmetic capability, and disk memory for local storage of image and program libraries. The console has a full complement of operator's controls for image translation, rotation, and scaling. Options include a hard copy display recorder and an analog input tablet. □ Would you like a demonstration? In your office? Write David Sudkin, Manager of Marketing Services, at Adage, Inc., 1079 Commonwealth Avenue, Boston, Mass. 02215, on your company letterhead. We will send you a 16mm demonstration film showing the system in action. □ The movie is on us. You bring the popcorn.

Adage INC

CIRCLE 9 ON READER CARD

In case you missed our first test, here's another chance to find out if you belong at CSC

1. How do you think a software firm can help contain the information explosion?

(a) By trying to keep half the junk from being published in the first place.

(b) A lot more than half.

(c) First get rid of the information gap.

(d) By hiring me.

2. How would you speed up program writing?

(a) As a senior programmer, I think you can quickly check the program logic by whipping up a lot of good test data for trial runs.

(b) As a lead programmer, I think there's just too much testing and de-bugging going on. If the flow charts are right in the first place, much of that stuff wouldn't be necessary.

(c) As a senior programmer, I knew he'd say that.

3. In a recent issue of COSMOPOLITAN, Helen Gurley Brown exhorted her girl readers to become programmers and make $15,000 after 5 years. What do you think about that?

(a) O.K., if they promise to keep lipstick off the flow charts and nail polish off the tapes.

(b) Helen Gurley who?

(c) Good, I prefer working with women. Men complain a lot, thrive on gossip and are too unreliable.

(d) Ask me again in five years.

4. An exciting project to me is:

(a) A problem everybody avoids because of fear it can't be done.

(b) A problem everybody avoids because it really can't be done.

(c) Working with Helen Gurley Brown.

5. I think a professional is:

(a) One who doesn't get shook when deadlines are leaning all over his back.

(b) An expert who, together with other leaders in the field, works on nothing but his expertise.

(c) A person who works alone, makes a lot of money, but never advertises.

(d) One who picks better cities for Joint Computer Conferences.

6. You can measure the quality of a senior staff by:

(a) How long they're gone for lunch.

(b) How close they work with junior staff.

(c) The stock options.

(d) How good-looking their secretaries are.

7. Which makes you grit your teeth the most?

(a) Someone trying to get a copyright on a program that was dead two years ago.

(b) Clowns who insist on smoking in the computer room.

(c) The same guys who leave covers off tape reels.

(d) Someone who replys, "I'm 90% done" when you ask him how his program is coming.

8. What's the future of time-sharing?

(a) It will absorb the expressions "on-line," "multi-processing," "multi-programming," and "multiple access." Then we can get rid of these foggy terms.

(b) It will reach out to every home, and will probably be in a pastel colored unit with chimes and a night light.

(c) I hope it will involve everyone but authors of papers on time-sharing.

9. If I had the time, I would like to program:

(a) The orchestrations of Lawrence Welk.

(b) The behavior of a close girl friend.

(c) The paintings of Pablo Picasso.

(d) Other.

10. Lately, the information sciences has practically become synonomous with:

(a) CPU (b) CATV (c) CRT (d) CSC

Choose your answers carefully; although your first reaction is frequently correct. Mark them clearly on the card and send them in promptly. (No more of that fooling around like key-punching the reply card. And this time there's a limit of four staples per card. That's all!)

Equally prompt, we'll reply with a report on your test, a list of compelling reasons why you should be working here, and the usual application form. (If the card's gone, write your answers on anything and mail it to the attention of Joe Ward.)

While you're waiting for the return mail, take a look at what we're involved in. It's all on the next page.

Computer Sciences Corporation

AN EQUAL OPPORTUNITY EMPLOYER

This page is for programmers who enjoy packing. Or who hate packing but enjoy traveling. Or who hate packing and traveling, but enjoy meeting the best in the business.

L.A./ SAN DIEGO Financial, materiel, and production programs for banks, aerospace firms, and oil companies. Also, operation and requirements analysis, compiler and natural language research. Command and control systems for Navy. Plus — Learn to barbecue without burning you or the meat.

WASHINGTON, D.C. — Military and government agency work. Like trajectory analysis and orbit determination for NASA. A data management system for the Office of Economic Opportunity. And a lot of commercial projects for firms all the way up to New England. Plus — A new hobby. Follow the inside workings of the wisdom and folly of international politics.

HOUSTON — We first went there to support the NASA Manned Spacecraft Center. Now we're into everything. Geophysical and structural analysis projects for oil companies. Management information systems for retail stores, and conversion projects for third-generation. Plus — Cosmopolitan center of the southwest. Sports, dining, theatre, and music hold their own with the best.

BRUSSELS, BELGIUM — This one's new and growing fast. So fast, we'll soon offer just about everything we have going stateside. Plus — Four neighboring countries, each no more than two hours away.

SAN FRANCISCO — Satellite data handling for NASA, and just about the same projects as those in Los Angeles and San Diego. The three offices are pretty closely allied. Plus — Bad parking, interesting gourmets, and friendly flower children.

RICHLAND, WASH. — Headquarters for our northwest operations. We operate and maintain the A.E.C. comp center at the Hanford facility. And we operate a network of remote terminals through time-sharing on a UNIVAC 1108. This thing goes all over the northwest and up into Canada. Plus — You're right in the middle of fiber-glass country: rods, skis and boats.

HUNTSVILLE — We support the Computation Lab, develop programs for the Marshall Space Flight Center, and research advanced computer techniques. You could also work on the reduction of test data, the design of special hybrid computer systems, and the development of new mathematical and computer techniques for simulation studies. Plus — A "Who's Who in the Space Sciences" living right in your block.

HONOLULU — One of our newer operations. An extension somewhat of the L. A. office, besides the inventory work systems for the Army. Plus — You can take the money you save on clothes and buy a catamaran.

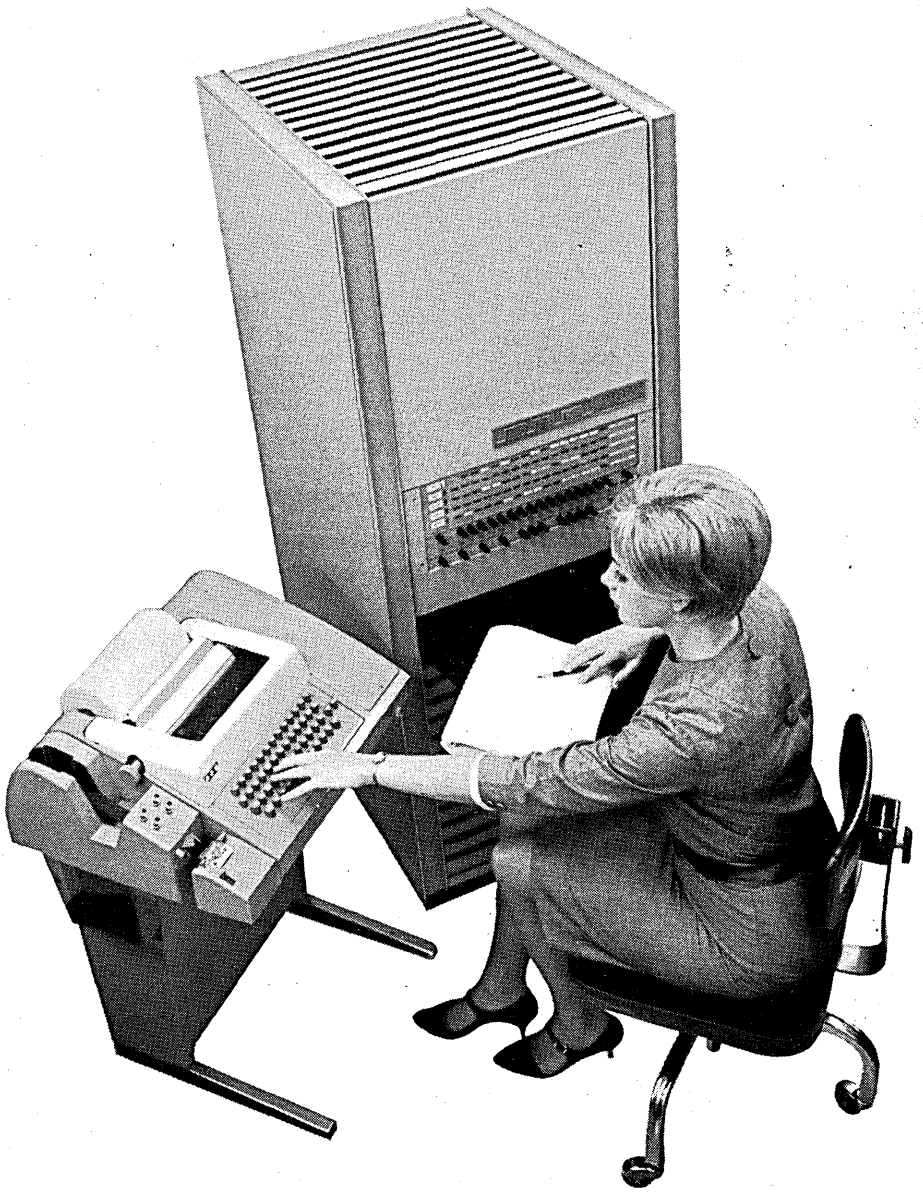
Computer Sciences Corporation

650 NORTH SEPULVEDA BOULEVARD, EL SEGUNDO, CALIFORNIA 90245 ATTENTION: JOE WARD • AN EQUAL OPPORTUNITY EMPLOYER

calendar

DATE	TITLE	LOCATION	SPONSOR/ CONTACT
Sept. 25-29	EDP Conference	Marriott Twin Bridges Washington, D.C.	Retail Research Inst. of the Nat'l. Retail Merchants Assoc., 100 W. 31st St., New York, N.Y. 10001
Oct. 1-4	Symposium: Operating Systems Principles Cost: $25-$30	Gatlinburg, Tenn.	ACM
Oct. 10-12	Users' Meeting	Hilton Hotel Pittsburgh, Pa.	VIM-7, Control Data 6000 users
Oct. 12-14	Workshop: Computer Fundamentals	Commons Bldg. North Campus Univ. of Michigan Ann Arbor	Inst. of Science & Technology
Oct. 16-18	Idea Sharing for Hospital EDP	Statler Hilton Dallas, Texas	ECHO/R.A. Crenshaw, Hillcrest Med. Ctr. Tulsa, Okla. 74104
Oct. 16-19	Users' Meeting	Statler Hilton Washington, D.C.	Users of Automatic Info. Display Equip.
Oct. 19-20	Conference	Fairmont Hotel San Francisco, Calif.	ADAPSO
Oct. 23-27	Business Equipment Exposition	Coliseum New York, New York	Business Equipment Manufacturers Assn.
Oct. 23-27	Short Course in Project Mgt. with CPM and PERT	Ga. Inst. of Tech. Atlanta, Ga. 30332	Sch. of Engineering, Dept. of Cont.
Oct. 26-27	Symposium on Purposive Systems	Nat'l. Bureau of Stds. Auditorium Gaithersburg, Md.	American Society for Cybernetics/ Dr. C. Hammer, Univac, 2121 Wisc. Ave., NW Wash., D.C. 20002
Nov. 6-8	Computer Graphics Conference	Univ. of Illinois Urbana 61801	Prof. C. W. Gear, Dept. of Comp. Sci.
Nov. 10	Symposium: Application of Computers to Problems of Urban Society	Hilton Hotel New York, New York	ACM/J.M. Spring Computer Methods Cp. 866 Third Ave. New York, N.Y.
Nov. 10-11	Users' Meeting on Computers in the Laboratory	Jolly Roger Motor Inn Anaheim, Calif.	DECUS, Maynard, Mass. 01754
Nov. 14-16	Fall Joint Computer Conference	Convention Center Anaheim, Calif.	AFIPS

This 16-bit, real-time computer is so fast you can have one in 45 days.



It's our SEL 810A, for high-speed data acquisition and control. All integrated circuits, 3 levels of priority interrupt, 4K memory, teletype, high-speed hardware multiply and divide, real-time I/O structure, and an outstanding software package. Over 50 in the field. Price: $23,950. Systems Engineering Laboratories, 6901 West Sunrise Blvd., Fort Lauderdale, Florida 33310, Area Code 305 587-2900. Offices also in Washington, D.C.; Los Angeles, California; Boston, Massachusetts; San Francisco, California; Cleveland, Ohio; Houston, Texas; Huntsville, Alabama; and Orlando, Florida.

Systems Engineering Laboratories

CIRCLE 11 ON READER CARD

"Develop," said Applied Dynamics, "a reliable and simple programming system with perfect shielding for a hybrid computer."

So we did.

Reliability: faced with the critical shielding performance demanded in the APPLIED DYNAMICS/FOUR hybrid computer, AMP designed a programming system which eliminates crosstalk and achieves a high degree of reliability.

Simplicity: the shielded 3840 position system and the unshielded 1920 position system facilitate programming and improve packaging.

Both shielded and unshielded systems were specially designed by AMP for exacting analog and hybrid computer systems. Their outstanding performance results from features such as egg-crate shielding, detent patchcords, reliable gold-plated contacts; simple back-panel connections.

The combined engineering and design abilities of AMP and AD have resulted in a hybrid computer with unique electronic packaging features, streamlined appearance and dramatic programming ease. In short, it's a general-purpose computer that's fast, versatile, and reliable. Let AMP engineers help solve *your* problems faster and better. Write or call for more data without obligation today.

AMP

PUT YOUR IDEAS INTO ACTION WITH THE HELP OF AMP ENGINEERING . . . WORLDWIDE

CIRCLE 12 ON READER CARD

AMP INCORPORATED
Harrisburg, Pa. 17105

Please send me more information on Programming Systems

NAME _____ COMPANY _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

letters

words, words, words

Sir:

Your June editorial (p. 21) concerning the USA Standards' vocabulary revealed a moot point: that there exists today a real gap in literature for the layman and apprentice about computer technology. Most publications use terms that are meaningless to the non-professional.

With a growth rate of 25-30% a year for the past three years, the computer industry is inevitably reaching more and more non-technologists: the philosophy major whose tests are computer-graded, the New York traffic violater who receives a computerized summons, and so forth. People in all walks of life want to know about these machines that are now evident in almost every aspect of their lives. A simplified vocabulary of meaningful definitions would do much to help them.

The USA Standards Institute is a voluntary organization, and the professionals contributing to it deserve much praise and commendation for their work. However, your call for help is well taken. If people in the computer field don't exercise their responsibility to help USASI in its standards work, their groans about the standards that develop . . . hardware, software and words . . . will be indefensible.

THOMAS K. CHRISTO
Newtonville, Massachusetts

voice of the turtle

Sir:

My heartiest congratulations on your Editor's Readout ("EDP's Wailing Wall," July, p. 21). Your very concise description of the problems and agonies of the third generation computers hit the nail on the head. I do not have one of the more popular computers and your article indicating that the entire industry is having the same problems was enlightening.

I would suggest that the manufacturers, besides working towards simplifying the third generation technically, should also emphasize education for their salesmen and systems people. They are not getting enough exposure to the third generation computer before it is installed in the customer's office. Going back to headquarters to solve problems is frustrating because all too often, the headquarters people do not have a feeling for a customer and try to remain remote.

J. W. MARKIN
Landrum, South Carolina

process control

Sir:

I believe that your "travel-weary editor" should either have stayed at home or sent a substitute when invited to view and report on certain of IBM's process control installations (News Briefs, July, p. 83). It appears that he (1) does not know what he saw, (2) does not understand what he saw, or (3) is not interested in what he saw.

While DATAMATION has never attemped to devote itself to computer process control with the same vigor as to the more conventional computer applications, it has done its readers—and the process control field—a disservice in presenting the item mentioned above.

You and your readers are directed to "Instrumentation at Work" in the July issue of *Instrumentation Technology* for a realistic account of the applications involved.

N. BRUCE ANGELO
South Charleston, West Virginia

police information systems

Sir:

I read with considerable interest an article by Lawrence Ragan entitled "Chicago's Police EDP System" (July, p. 52). The author discussed the progress which has been made by the Chicago Police Dept. during the tenure of Superintendent Orlando W. Wilson. He also mentioned statewide systems that have been proposed and are in various stages of development.

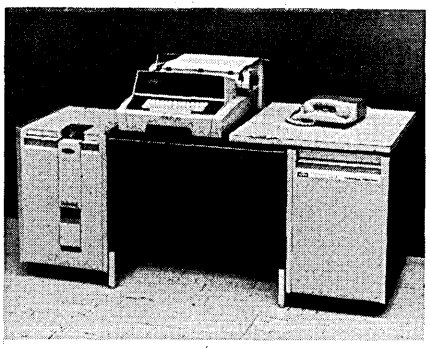
I believe that credit should also be given to the work undertaken by the State of California, Dept. of Justice. The California program, known as the Criminal Justice Information System (CJIS), involves a cooperative venture between the Dept. of Justice, State of California, the Lockheed Aircraft Corp., and participating representatives of criminal justice agencies throughout the state. This project has received OLEA support for an 18-month period. The program was officially launched on June 26, 1967, and should invoke considerable attention due to the fact that it will endeavor to identify and satisfy the needs of the several disciplines that constitute the criminal justice system. May I offer my commendation for the consistent attempt of DATAMATION to present a balance of current programs in major technical areas.

EDWARD V. COMBER
Criminal Justice Information Systems Design Study
Sacramento, California

a terminal illness?

Sir:

The article in your July issue (p. 19) still implies that the Friden 7311 terminal did not perform during the benchmark demonstration. The unit operated in an entirely satisfactory fashion during benchmark tests, but



the total system being demonstrated to the Air Force did not perform satisfactorily. It was determined, in both cases (RCA/Burroughs), that the problems were either in their interface or their programming. I am enclosing a picture of our 7311 terminal.

WILLIAM F. WELLS
Vice President & General Manager
Friden, Inc.
Rochester, New York

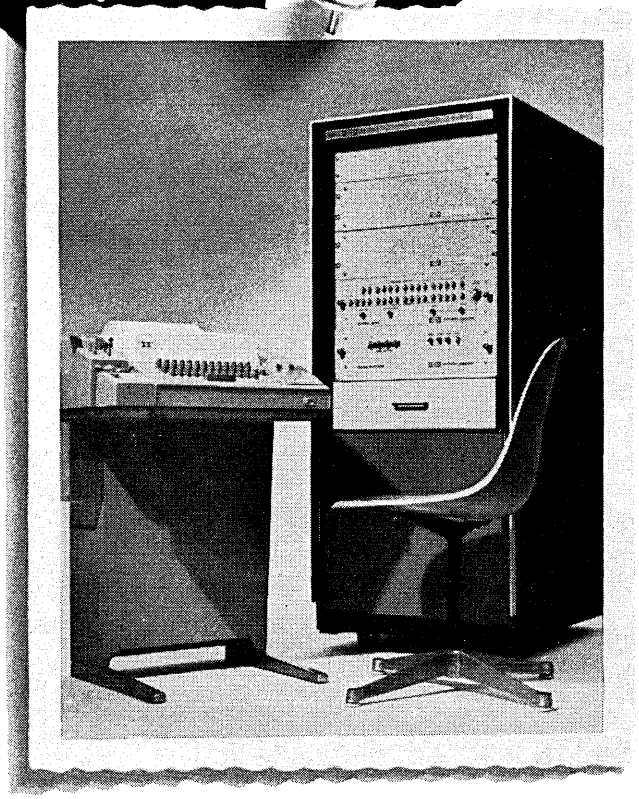
Sir:

In reference to "Fault Not Friden's" (July, p. 19): I was in charge of the Data Communications portion of the Burroughs B3500 MCP (Master Control Program) that was used for the Air Force Phase II demonstration. To blame Burroughs hardware, communications or software in this discussion is ridiculous.

We used 1050's only because Friden could not deliver to our site in Pasadena five 7311's. In fact we actually demonstrated for the Air Force that our software could talk to the 7311 via a program I wrote that communicated between the B2500 SPO (supervisory printer) and the prototype 7311 in Rochester, New York (a distance of 3000 miles).

Because of prior Burroughs B5500 simulation, we were able to debug the MCP portion that communicates with the 1050 after 20 minutes of B2500 time! The B2500 MCP

Price & Power



The new Raytheon 703 IC systems computer—$15K.

RAYTHEON

Raytheon Computer is expanding its data systems product line of Integrated Circuit modules, multiplexers and conversion equipment with a new low-cost 16-bit IC digital computer. The 703 is designed to replace core buffers and special logic as the central element in data acquisition, processing and control systems.

FOR $15,000, YOU GET:

- ASR 33 with paper-tape reader and punch
- 16-bit word length
- 2's complement arithmetic
- 71 hardware instructions
- Direct and indexed addressing
- 4K memory
- Byte and word addressing
- Byte manipulation
- Register entry and display control panel
- Programmed word transfer via 16-bit I/O bus
- 2 μsec cycle time
- software-diagnostics, assembler and executive routine

YOU CAN HAVE:

- Up to 32K memory
- Direct memory access channel
- High-speed hardware multiply/divide
- Real time clock
- Peripherals including mag tape, disk and Raytheon Computer's exclusive Multiverter®.

WE WILL SEND YOU FREE:
Bulletin SP-244 with all you need to know. Raytheon Computer, 2700 S. Fairview St., Santa Ana, Calif. 92704. (714) 546-7160.

CIRCLE 13 ON READER CARD

The Burroughs theory of evolution

From a second generation computer to third generation in a single smooth transition.

We started a revolution in 1960 when we introduced the B 5000—a second generation machine with third generation software, years ahead of its time.

From this evolved the B 5500, whose exceptional performance has been envied, imitated, but not yet duplicated. Because its hardware and software were designed together, to work together, right from the start.

NOW, THERE'S THE NEW BURROUGHS B 6500. With advanced third generation hardware. With the industry's only fully proven operating system—the Burroughs Master Control Program. With multiprocessing as its standard operating mode.

The B 6500 offers up to 5 times the processor speeds and 15 times the main memory capacity of its predecessor. It can be built as big as you need, in modules, at any time, without any reprograming. The B 6500 handles up to 255 peripherals, more than 2,000 communications lines, and billions of words of all-electronic disk file storage.

It has everything needed for multiprocessing, on-line, time sharing, and real-time operations.

This logical evolution means that B 5500 users have a direct route to even higher capacity and performance. At minimum cost. Because their current programs will run with full efficiency on the B 6500.

It means that users of other large systems need not face revolution again when they've changed over to the B 6500. And we can even help make that changeover a gentle one.

Watch this magazine next month when we will tell you about the next logical step in the Burroughs data processing evolution.

Burroughs

DETROIT, MICHIGAN 48232

CIRCLE 14 ON READER CARD

letters

worked with the Rochester 7311 the *first* time!

You are wrong when you say the 7311 is similiar to the 1050 because the 7311 is not polled or addressed (at least the prototype was not). It is, however, much easier to program.

KENT HUCKSTEP
San Diego, California

in defence of programmers

Sir:

Many programmers have probably wondered, as I have, why the occupation of programming is held in almost universal contempt by those outside it. (Many find it difficult to understand why programmers have university degrees.) These views are even more difficult to understand when the extremely challenging nature of much programming is taken into account. There is certainly scope for people of the highest ability and qualifications.

This disdain for programmers stems from the fundamental values of industrialised western society. Job status is determined primarily by whether one works with machines or people and ideas. As programmers mainly work with machines, they are naturally associated with those who "get their hands dirty." We can certainly see why there is such a large difference in status between those who merely use the computer as a tool in their professions, and those who program full-time.

It could be a long while before programmers are recognised for their true worth, especially in the more inflexible societies of Western Europe. Programmers are well paid, of course, but this is really a case of supply lagging behind demand; many capable people will not enter the programming profession because of its seemingly low status.

C. J. A.
Victoria, Australia

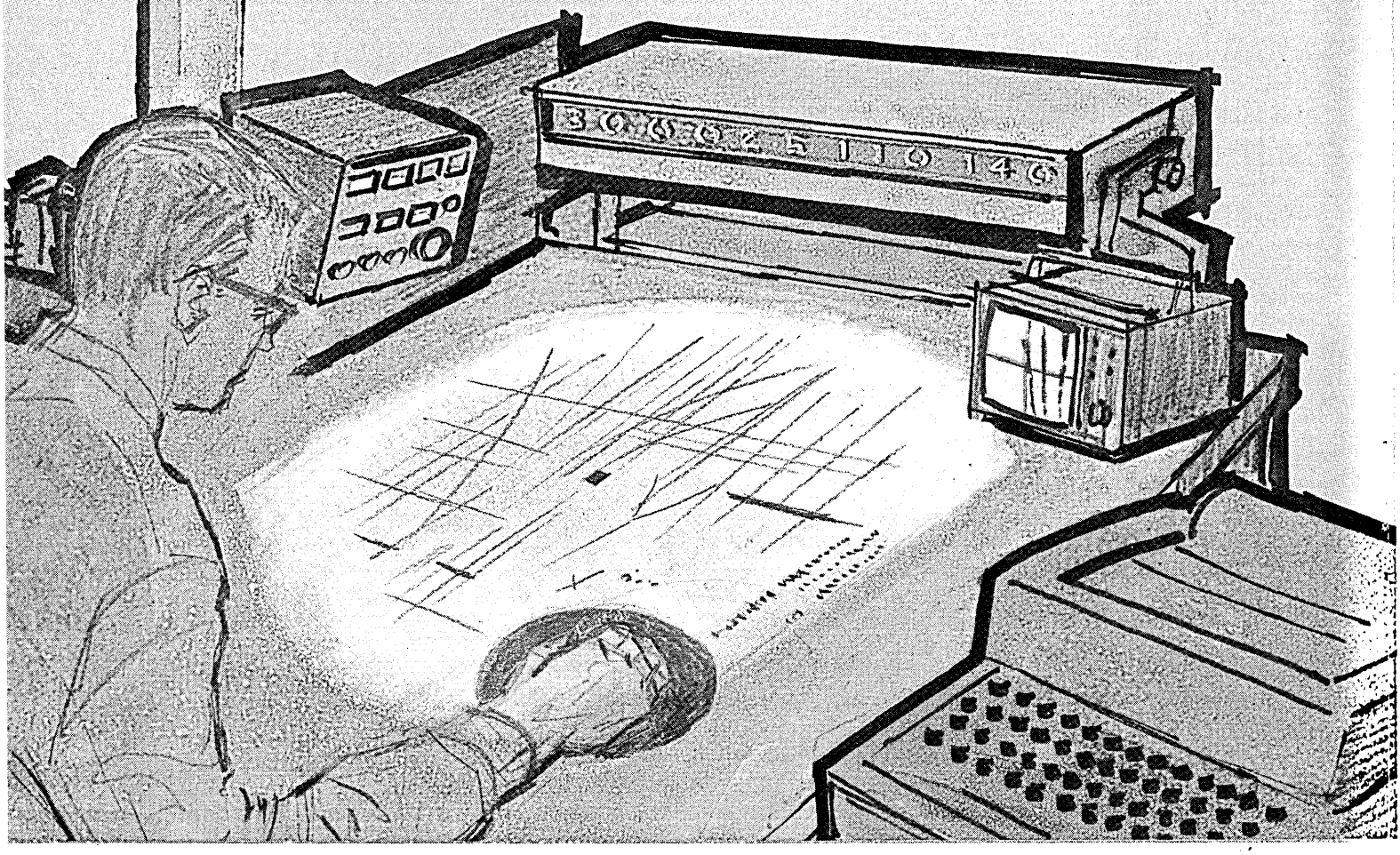
At SLAC an EMR Computer fingerprints the atom*

In Stanford's linear accelerator, energetic electrons travel a two-mile freeway bent on collision with atomic nuclei to knock sub-atomic particles loose. The free particles then pass through a bubble chamber, leaving tracks as evidence of their passage. These tracks are signatures of atomic events that are analyzed by an EMR *ADVANCE* 6020 computer at SLAC* (STANFORD LINEAR ACCELERATOR CENTER). On-line with a number of film projection measuring tables, the computer scans films of bubble-chamber data, checks and validates track position information automatically and prepares the data for final processing. With the EMR computer, bubble-chamber data is completely analyzed in greatly reduced time without human intervention or, most important, without human error.

An important reason for the choice of an EMR computer was BUCAPS, a programming system specially devised for bubble-chamber analysis by EMR. An EMR computer can control up to eight bubble-chamber measuring tables simultaneously with BUCAPS.

This is only one example of the many kinds of special programming assistance offered by EMR. Perhaps we can help you with your special computing problems, whether they are concerned with software or hardware. We'd like to help, and encourage you to write or call: Computer Division, EMR, 8001 Bloomington Freeway, Minneapolis, Minn. 55420.

COMPUTER DIVISION EMR



look ahead

STANDARD ADDS EMULATOR, NEW PRICING SCHEME

Standard Computer Corp., Santa Ana, Calif., has added another emulator to its "multi-lingual" IC-6000 series, and announced what may be a revolutionary pricing scheme based on throughput. Starting next January, Standard will base rentals on actual throughput at the customer's shop. The 6000's 7094 emulator performance ranges between 25-65% of the 94. Thus the user whose job mix permits the upper figure will pay more; lower performance will command less. IC-6000 rentals will range between $14-20K.

Next month, Standard will make available a 7040/44 emulator, which has achieved speeds of from 35-80% of the 7044 in company tests. IC-6000 users will be able to temporarily dump their 7094 emulator and load the new emulator for about an extra $500/month.

Meanwhile, at North American, the 6000-19 is reported to be exceeding performance specs, and the mod 29 is running 10% under projections. But Standard says it will demonstrate improved emulation speeds just prior to establishment of the new pricing policy, which will mean the elimination of 6000 model numbers.

LEASING FIRMS FORMING ASSOCIATION?

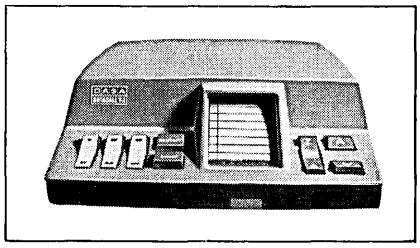
Association fever has struck. Software firms have been talking about their own group for several months, and now it's the leasing companies. Seven firms, led by John Randolph of Randolph Computer Corp., met last month to explore the idea. Among purposes of such a group would be to provide representation on common problems before manufacturers and government agencies and to exchange information on what equipment some lessors have available that others may be able to place. One common legal problem for leasing companies is taxes. For example, Illinois has recently instituted a 5% sales tax from which the manufacturer-lessor in the state is automatically exempt. But the leasing firm is not, making it a discriminatory tax.

CSC ANNOUNCES NEW COST-CUTTING COMPILER COMPILER

Following up its Exodus programming package, Computer Sciences Corp. stays on the Biblical nomenclature trail with a new offering called Genesis. It's a compiler compiler, or "...a formalized method for the semi-automatic production of compilers and other systems software."

Input to Genesis is a compiler language specification, written in analytic grammar. Genesis interprets the specs and produces a series of language- and machine-independent syntax tables describing the language to be compiled. These tables are input to a compiler skeleton that is composed of analysis phase, global optimization phase, and plug-in target-machine editing and code-generating phase which also provides local optimization. Communication between phases is in a machine-and language-independent

HAVE A WORD WITH YOUR COMPUTER



DASA's DATACALL Automatic Message Composer matches man and the machine. It fills the communications gap between human language and machine language. Because it understands both.

This all happens on DATACALL's unique magnetic tape. On the front, you type or write your descriptors — customer names, product descriptions, part numbers, etc. On the reverse side the associated machine-readable codes are stored. DATACALL can read out this stored data into its associated system — teletypewriters, automatic typewriters, or computers — at the touch of one button. You can read the front side of the tape, the computer reads the back.

DATACALL is designed to efficiently handle "fixed" data — the kind of information that has to be communicated over and over again. A Single Line Advance handles messages of up to 40 characters — ideal for the entering of headers or addresses in a computer switching system, the transmission of computer commands, etc. An Automatic Line Advance provides continuous messages of up to 40,000 characters — perfect for order entry invoicing, preparation of freight bills, payrolls, etc. And the magnetic tape cartridges are instantly replaceable, making the machine's uses virtually limitless.

DATACALL completely eliminates tub files, slow, inaccurate manual typing, and hard-to-manipulate punched paper tape and edge-punched cards that must continually be replaced. You only have to organize your information once. No need to train operators.

DATACALL cuts storage space, insures top speed and complete accuracy in data communications.

Want to have a word with your computer?

First, have a word with us.

Other DASA data communications products include:

DATABANK Message Relay Stations that can simultaneously store and transmit data. At different speeds.

DATAGUARD Scrambler/Descrambler Devices that provide the ultimate in security for classified data.

For detailed information, write to: DATACALL, DASA Corporation.

DASA

DASA CORPORATION
15 Stevens Street, Andover, Mass. 01810
(617) 475-4940

CIRCLE 17 ON READER CARD

look ahead

(Continued from page 17)

intermediate language.

Genesis is already at work at one DOD agency, where it has produced Algol compilers for six different machines: 7094, Univac 490 & 494, CDC 3600, GE 635 and SDS 910. Speeds of Genesis-produced compilers, says CSC, "are not slow." Version 2, due at year-end, will compile at 75% the speed of a "good" compiler. Version 3, due in a year, will shoot for 90-95% of hand-coded compilers' speeds. Version 2 object code will compete with the best existing compilers, and version 3 will shoot for a 50% improvement, the company says.

With Genesis, CSC provides a "cradle" which links the compiler to target machine operating system. Core requirement right now is a minimum of 32K 32-bit words, with improvements due in version 3. CSC estimates the system can reduce compiler construction costs by 1/3 to 1/2, reduce production time by 1/2 to 2/3. The only thing missing: a theme song.

ALPHANUMERIC'S TYPESETTING CENTER

Alphanumeric Inc., which made a big stock splash with a $3 million contract to provide its photocomposition system to IBM, this month opens its first typesetting service center in Lake Success, N.Y. The 65-man group, including 14 programmers, is combining a 360/30 with its APS-2 system to produce graphic arts quality text at up to several thousand cps.

Customer tapes, including those used in other photocomp systems, will be fed through the 30 to produce a tape with not only control data and text, but a coding of only those characters used in the text. (A disc on the 30 contains a digital matrix of all characters in numerous fonts and 4-18-point type sizes.) This tape is then put on APS-2 and under control of its own CPU (PDP-8) is fed through a core memory, which spews characters to the CRT in the photoprinter unit. For best quality typesetting, continuously moving film is exposed at 600-300 cps, or, say, ten 8x10" pages (8/10 point) a minute; for proof quality--2K-10K cps, or 40 such pages.

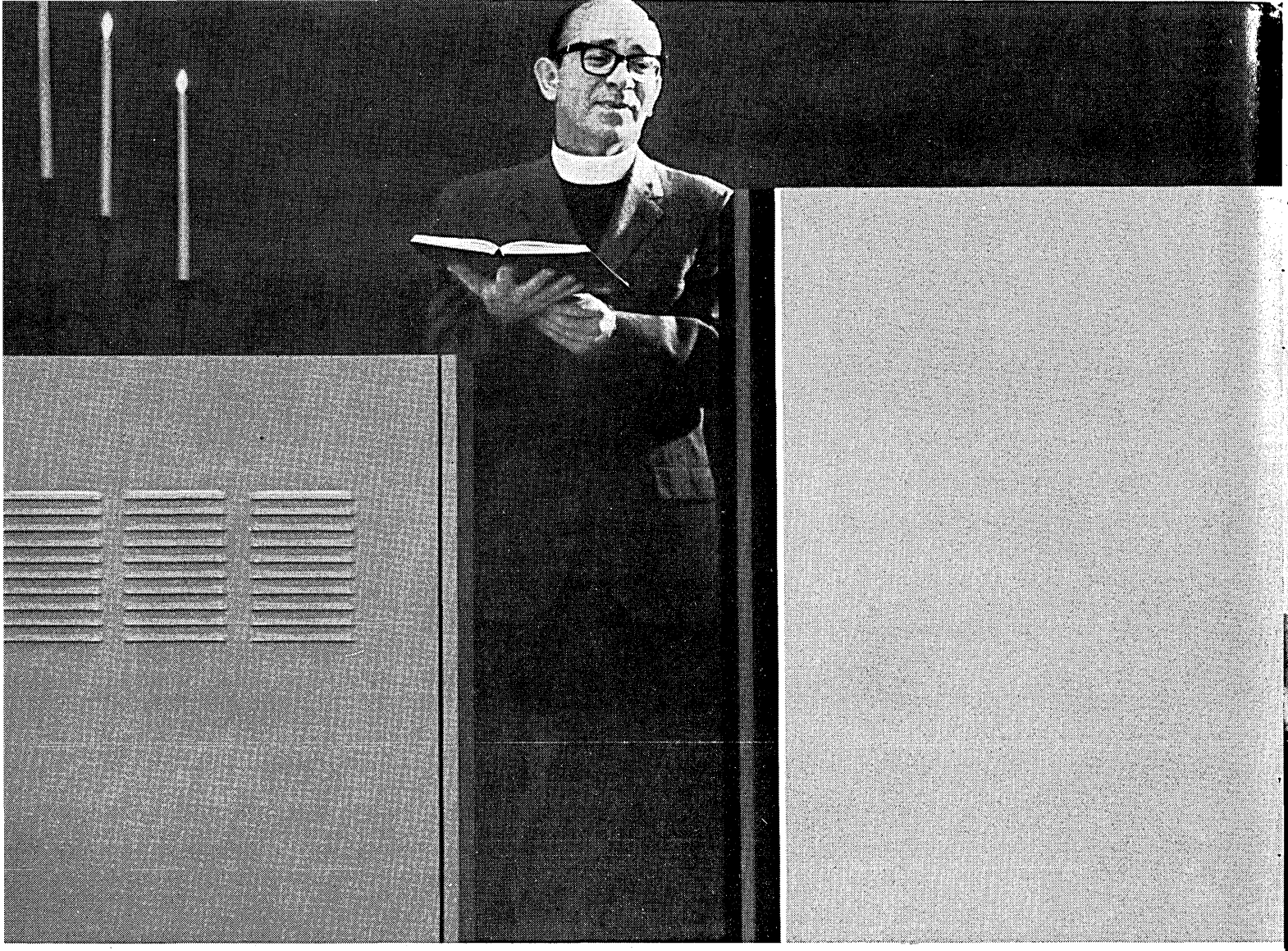
SHORTAGE CREATES NEW DISC PACK BIZ

The popularity of IBM 1316-type disc packs and their short supply is causing the entrance of several manufacturers into this field. Newest of the independents is Caelus Memories Inc., San Jose, Calif., which figures on having its first packs ready in January '68. Their goal is to ship $3 million next year, double that in '69. To facilitate this, they move into a new 25,000-sq-ft plant this month with some 30 people, will have 65 by year-end. They'll be selling packs, their first product, to the end user.

The firm was founded in September '66 as Janus Research under president Philippe Yaconelli, formerly with Ampex and Memorex. A conflict with the "Janus" caused the name change. Last June, Caelus sold $1.8 million of notes to Electronic Memories; convertible to common stocks, these notes could give EMI ownership of two-thirds of the then-outstanding stock, with subsequent options to increase this to 80%. Loaded with disc and magnetic recording experts, including ex-IBM manufacturing engineers, Caelus is so confident that they're bypassing the prototype stage. Their first pack will be assembly-line produced.

Already shipping packs to the OEM's and end users is Mac Panel Co., High Point, N.C. As with Caelus, the packs are IBM-compatible and comparably priced.

(Continued on page 143)



I, Digital, take thee, Analog...

We'll give it five years.

That's a long, happy life for a hybrid computer.

We've performed more digital-analog marriages than anybody. So many that we're able to guarantee them.

We will join an SDS digital computer to any brand of analog and guarantee to the user that the system will work and that he will know how to run it before we leave the hybrid alone in its new home.

We've hybridized all the leading brands of analogs, we've solved the interface problems, we've developed reams of hybrid software, and we make the fastest, most versatile and economical digital computers for hybrid applications.

We support analog computer manufacturers in the design and installation of hybrid systems, and we install SDS digital computers in simulation laboratories which already have analog computers, providing interface equipment, software, and system integration.

The simulation community is a small one, but it plays a vital role in science, aerospace, and the process industries. Our people are active members of this community, helping to advance the hybrid and digital state of the art.

They're also licensed to perform marriages, so if you have a lonesome analog...

SDS

Scientific Data Systems, Santa Monica, California

CIRCLE 18 ON READER CARD

editor's read*ut

THE FIRST 10 YEARS

A little over 10 years ago Frank Thompson took a big gamble. On the basis of very little information, a lot of hope and the advice and pressure of a young, shrewd, dynamic and far-sighted Benson-Lehner vice president named Don Prell, he decided to convert a newly acquired publication called *Research & Engineering* into a magazine for a fledgling avocation called information processing.

Thus DATAMATION was born. The first issue of a magazine called *Research & Engineering* ("The Magazine of Datamation") appeared in October, 1957. The editor, borrowed from another Thompson publication, was Charles R. Kluge (Honest. There is no connection, however, with this man's name and the famous "Kludge" first coined for DATAMATION by Jackson Granholm.)

After the first couple of issues, Kluge—showing extreme caution and/or foresight—fled the scene and Frank Thompson took over the editorial chair, leaving the nitty-gritty details of building a new publication for an almost equally young and confused industry to associate editor Santo Lanzarotta, a tall, thin, energetic and prematurely balding young man borrowed from still another Thompson publication.

Lanzarotta didn't know a computer from a hole in a card. But he was smart enough to realize this, and began immediately to build a staff of expert advisers to help him steer an erratic course toward professional technical coverage of the young industry. Almost single-handedly, Fred Gruenberger educated the editorial staff and helped to formulate the content of the groping publication. In that first year, Paul Armer, Dan McCracken, Herb Grosch, Bob Patrick, Earl Wilken and Dick Behm were extremely and graciously helpful in setting DATAMATION upon a proper course. (At the time Behm was ad manager of the ElectroData Division of Burroughs, where the current editor was one of his employees.)

In late 1957, editorial headquarters were moved to Los Angeles, and in 1958, a new logo and editorial layout were established with the help of artists at the advertising agency of Carson/Roberts. With the aid of a handful of courageous advertisers, DATAMATION was on its way, thanks primarily to the energy and skill of Sandy Lanzarotta, the magazine's first *real* editor.

In the Sept./Oct. 1960 issue, Hal Bergstein was made managing editor and Cleve Marie Boutell became production manager. In January of 1961 Cleve designed the first of an intriguing series of covers which have helped immeasurably to establish and develop the DATAMATION mystique. The same year the magazine converted from semi-monthly to monthly publication. In April Sandy Lanzarotta fled the editorial ratrace for the more financially rewarding public relations ratrace and was succeeded by Hal Bergstein, who with wit, verve and style helped to needle and bludgeon the industry toward maturity and a sense of responsibility. In 1963 Bergstein succumbed to the lure of stock options and turned PR man, too, giving way to the current editor. Throughout, Gardner F. Landon, the publisher who succeeded Frank Thompson, showed courageous restraint, allowing the editors to weave a sometimes wobbly path to editorial respectability, maintaining a clear separation between editorial and sales activities. Ham Styron, western vice president, showed even more courage. He lived and worked with the editors.

The rest is history. Today, Sandy Lanzarotta is a tall, not-so-young, not-so-thin, maturely balding, successful PR manager at IBM. Hal Bergstein is assistant to the president of SDS. Don Prell, who married DATAMATION production manager Bette Howe, is an independent consultant, entrepreneur and surfer. Dan McCracken is studying for the ministry. Fred Gruenberger is a college professor. Others who were instrumental in shaping DATAMATION are still with us. We haven't been able to name them all. But to all of them we offer our heartfelt thanks.

It's been a rewarding, hectic decade. We look forward to the next 10 years with confidence and curiosity, hopeful that we can continue to merit the respect of our readers and our advertisers.

DATAMATION

10TH ANNIVERSARY

TEN YEARS OF PROGRESS?

parallels and contrasts

by R. L. PATRICK

Our tenth anniversary gives time to pause and reflect. Class reunions allow old students to momentarily re-establish previous friendships and relive, for a few hours, experiences of the past with time-proven friends and acquaintances. As we attend reunions with our classmates, we notice that we are older, more mature, fatter, grayer, and have changed our interests somewhat since we last got together. Further, we usually pause for a brief moment and compare our accomplishments of today with our goals and dreams of another year. Even on such a festive occasion the reunion provides opportunity for recollection and introspection. And so it is with the computer field.

In the past 10 years, the computer field has grown enormously. There are more of us now and we are into many things. But how do our interests and accomplishments of today match those of 1957? In the fall of 1957, what we now know as the computer field was made up of five almost separate non-overlapping independent paths of endeavor. The analog computer, which in some ways predates the digital computer, and its advocates were seeking a place in the sun. The second major thrust involved practitioners of punched card accounting. In 1957 the card wallopers had almost reached their zenith. Board wiring, card design, and systems design involving externally stored information was a highly polished but rapidly waning art.

the impetus

The major thrust involved the users of computing machines for scientific and engineering support. In 1957, the scientific computers were the leaders in the field, utilizing the latest, faster equipment for the broadest spectrum of problems. The IBM 704 was the collector's mark and an active convivial society called SHARE had sprung up. However, there was a dark horse in the field.

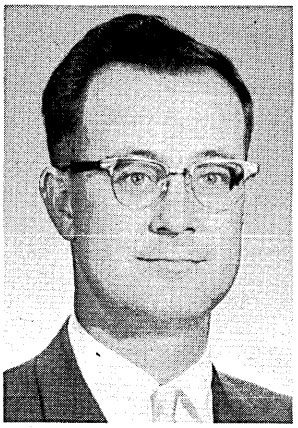
This was the more sophisticated business and commercial users, who had also adopted the general purpose computer and were busily analyzing and creating large programs and systems of programs to support management and administrative activities. In 1957, the commercial users were viewed in some quarters with disdain and treated as if they were merely neanderthal counterparts of their card walloping brothers. History has shown this view to be clearly wrong since much of the important work of the last 10 years must be credited to these neo-neanderthal types.

Last, but not least, there were a few practitioners of the black art of on-linism. Most of these were engaged in military systems which involved input, queuing, communications, processing in a time current manner, and special-purpose, on-line consoles.

There were some missing faces at our old reunion. Some of our classmates had expired; others had flourished, done well in their chosen professions, and were making significant contributions to society. Similarly, computers pass and fade. Ten years ago, IBM had several major product lines which were managed independently and appealed to given fractions of the market. To be sure, the IBM 704 was the workhorse in the scientific field: it was *the* SHARE machine. The year 1957 was the heyday of the 704, most of them with 8K words of memory, eight tapes and some primitive on-line I/O. They were supported by a set of special-purpose, fixed-wired, buffer computers which performed tape-to-print and other primary functions. The fall of 1957 also saw reports of the first two 32K memories to be installed on 704's and the initial ripple of what we now call the conversion problem, since existing 704 programs had to be modified to exploit the extra available core. The ninth meeting of SHARE was held in San Diego and 71 installations comprised the membership.

At that meeting, those who were using 704's were beginning to plan for the installation of their 709's. Several of the installations had operating systems much as we now know them: batches of unrelated jobs could be entered into the card reader and would be processed non-stop by the operating system. It was possible to compile, assemble, and load a program for execution with test or production data in one trip to the machine. In the last 10 years we have extended the functional capability of these operating systems significantly, have broadened the population of users who exploit them, and have reduced the necessary level of training for those who use simple system features.

The SHARE group had drawn up a committee to specify a new operating system for the 709. This was the sos committee under Don Shell, then of GE. The committee debated long and hard over a subject which now seems rather inconsequential. In the days of magnetic tape and small drums it seemed rather important to decide once and for all whether a computer operating system should be



A key adviser to Datamation since 1961, Mr. Patrick is a working observer of the computing scene who has participated in many of the pioneering efforts he here catalogs.

structured to have one processing phase and complete each job in a continuous series of activities, or to have several phases and to perform the same processing activity on all jobs within the batch before the next step of processing was attempted on any jobs within the batch.

That subject is still with us today. Many of our current sophisticated operating systems function in the single phase mode. With the advent of on-line disc files these jobs can be processed to completion before the next job is initiated. Other systems have a junior processor handling primary I/O and a senior processor whose complete and entire duty is to run the assigned jobs to completion. In the words of the old debate this is "three-phase in the hardware." Today many of our users are concerned with the time spent in system overhead functions. Those running time-sharing systems or using OS/360 are concerned about performance and throughput. In the last 10 years our scheduling algorithms have improved significantly so that high priority jobs need not languish behind lower priority work, but the debate about system overhead and throughput, as epitomized by one phase versus three phase, still persists.

Ten years ago the users groups were trying to establish a base of operations statistics so that they might measure, and improve, their own performance. Today the federal government is attempting the same thing. The users, while still interested in installation management, have ceased publishing statistics, and the usage meter is omnipotent. Many of our computers, now as then, are supported wholly or partially by the federal government. The federal bean-counters have seized on the usage meter as being an indicator of good management.

Ten years ago we could openly talk about idle time, setup time, re-run time, maintenance time and the time spent in useful activities such as checkout and production. Today we have groups of semi-literate ferrets who read usage meters once a month, award Brownie points for high utilization, and request further explanation for low utilization. The candid professional attitude toward installation management problems has all but disappeared. Unless a computer installation manager is simply out of capacity, it is sometimes very difficult to plan and install efficiency measures that lower the average daily utilization. Ten years ago a second shift rental hour cost 40% of the first shift cost plus all the computer room overhead. Today second shift hours are either free or charged at a nominal 10% rate, and the installation manager can tend to be slothful. What happens when the machine is fully loaded? Why, nothing; high utilization is instant justification for increased capacity, and the cycle repeats itself.

. . . and some changes

Several of our old mates are no longer in the spotlight. Ramshaw, Shell, Nutt, and Ferber are seldom heard. Others are still in the shadow . . . no longer in center stage. Bolt, Bright, Engel, and Armer still take part and contribute; similarly, some applications persist.

Ten years ago GM had some traffic simulation programs which output onto a computer-controlled CRT whose face was photographed by a computer-controlled camera: thus movies of traffic simulation solutions were made. Digital control in the process industries was a subject of active debate and some installations were actually being made. The computer had been programmed to obey the rules of chess and checkers and could be considered a worthy opponent. Today McCarthy has allowed his computer chess program to challenge its Russian equivalent. Ten years ago Fred Brooks and a group of associates published an erudite analysis, entitled "An Experiment in Musical Composition," for the IEEE. Fred is now working as a computer missionary below the Mason-Dixon line.

In 1957, the computer hardware types were concerned with analog cross-correlators, functional delay units, and analog error analyses. Similarly high-speed digital multipliers and circuit simulators occupied some of their time. The ACM had been established for some years and was firmly in control of the more academically oriented. The ACM *Journal* published "Optimum-Recurrence Formulas For A Fourth Order Parabolic Partial Differential Equation." Ten years later we have progressed to the point of "A Uniform Random Number Generator Based On The Combination Of Two Congruential Generators."

Then we were interested—as we are today—in sharing computer resources among municipal governments. Bell Tel has been working on the experimental reading of hand printed numerals for 10 years, and the fall of 1957 saw the first issue of the ACM *Communications* being prepared.

Ten years ago the Aiken Relay Calculator (Harvard Mark II) was retired from the Naval Proving Ground in Dahlgren, Virginia. IBM was actively selling 305 Ramacs, 650's, 705's, 704's, and implementing SHARE's software design for SOS on the 709. The specifications for FORTRAN II were being debated and some radical types were considering data processing on a binary machine. GE Hanford had already produced a successful output generator for the 702 and was considering a similar program for the 709. Alwac was marketing the III-E, Burroughs was pushing the 220, and Remington Rand had the 1103. The 650's were available for intermediate size calculations, and small engineering computations were being performed on Bendix G-15's, LGP-30's, and the little Burroughs E101. The Bank of America was planning a large system called ERMA and GE had the contract. RCA made a machine large enough to store wheat in called the BIZMAC. IBM produced an interesting little kludge called the 610 Auto-Point Computer which had "a unique automatic decimal point control."

Ten years ago we initiated our crusade for "magic languages" with our search for the holy grail of all source languages called UNCOL: The UNiversal Computer Oriented Language. In the interim we have been through ALGOL, JOVIAL, FACT and several others. Today we still are pursuing the same goal with COBOL, FORTRAN and PL/I.

Ten years ago we were concerned about standards, as we still are today. We were trying to devise standard for binary cards and an acceptable set of graphic symbols for a 48-character print set. Today we have at least defined the various nonstandard character sets but are no closer to an acceptable one for universal use. The demise of the 90-column card was one of the biggest strides we have made, and that was accomplished by pressures of the marketplace and not by enlightened action. We used to have trouble with the distribution of programs and we still do. We used to debate open versus closed shop operation and the debate still persists, although it has lost some of its vehemence. A FORTRAN progress report of 10 years ago reported that open-shop FORTRAN allowed programmers with less training to successfully accomplish useful work although somewhat more machine time was required; sounds like the time-sharing measurement studies being reported today.

older, not wiser

All in all many of the fundamental problems of 10 years ago are still with us today: the fight to provide operating system function while reducing the time spent in overhead activities; the terrible shortage of trained personnel which leads us to trade machine time and efficiency for software which will allow us to get the job done with the staff we have at hand; the terrific attention to detail required just to get a computing system constructed, shipped, installed and operating well in the field. We have come a long way from the days when several 704's were delivered to customers without the CAD (Copy and ADd) instruction

wired in. We have lived through the panacea of the magic language and it appears that we will live through the panacea of time-sharing while most of us still plod diligently along using the programming tools and techniques of a decade ago to accomplish today's job.

We have yet to frontally attack the problem of training masses of men in a highly complex art. We have yet to learn how to manage our affairs really well so that we can produce a computer program on a schedule and within a budget. We have allowed our applications to become more complex without developing the tools necessary for checking out on-line systems and those involving huge data files. We have made little progress towards measuring our own performance or consciously adjusting our own behavior so that the customer gets all the computing he pays for.

Ten years ago the National ACM Council adopted the following resolution:

"We, as users of diverse machines, recognizing that developments in the use of automatic computers are leading to techniques of programming which transcend the characteristics of particular machines, that communication between users of different machines is highly desirable, and further, that completed programs which are machine independent appear to be possible, recommend that the ACM take the following action:

a. Appoint a committee to study and recommend action toward a universal programming language.
b. Set up means for the rapid exchange of practical information on computer programs and programming among all computer users.
c. Appoint a committee to study and recommend areas of standardization.
d. Appoint a committee to propose means by which the ACM can foster developments in programming research.

We further recommend that the several computer users' organizations engage in a joint effort in support of these objectives."

Since the fundamental problems *still* persist, perhaps it is time to take stock and devise some new approaches. ■

DATAMATION 11TH ANNIVERSARY

and the anomaly of 1960

THE DATAMATION DECADE

by LOWELL AMDAHL

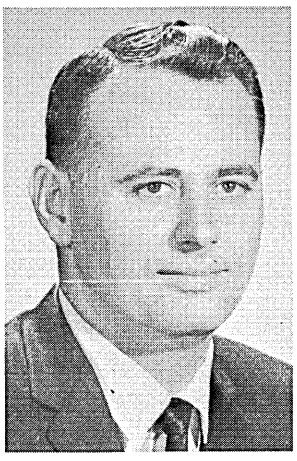
I remember a neighbor woman once explaining her rule for saving money for Christmas: "If you just put aside two dollars a week you'll be surprised how much you have at the end of a year." Despite some mathematical training, I suppressed verbalizing the thought that I would indeed be surprised if I *wouldn't* know. But it's different if one says: "Publish DATAMATION once a month, and you'll be surprised how much you have at the end of ten years." I am surprised. And this despite the fact that it was only published every two months in its early years.

Asked to write a brief article for this anniversary occasion, I took the opportunity to go through my personal library of DATAMATION. I was pleased to find that it commenced with the third issue and had relatively few omissions thereafter. Some of the evolution of the magazine is obvious—changes in cover layout, departments and quantity of material. More interesting than this is the evolution of the computer industry that can be seen as one traverses the issues. Advertisers like Telemeter Magnetics and Datamatic don't appear anymore. And one is reminded that there used to be Eastern Joint Computer Conferences held in the fall, and Western Joint Computer Conferences held in the spring.

Components and systems with catchy names like Perceptron, Magnacard and Fliden had their moments in the DATAMATION limelight. Provocative statements like "Which way is le Bull going? Up?" and "RemRand announces 'third generation' 1107" [1961] are to be found. Computer announcements had a special ring to them: "Here comes the 1604" and "Special purpose PDP has GP applications."

Grand moments in computer history were recorded, like "Bendix completes 100th G-15 computer." Personnel moves told a lot of history, too. Samples: "Heading the recently-formed Auerbach Electronics Corp., Narbeth, Pa., is I. L. Auerbach . . .", and "IBM has appointed a new assistant to the director of sales . . . Dr. Herbert R. J. Grosch, internationally known planner, organizer, and operator. . . ." [I couldn't resist the temptation to take the latter announcement slightly out of context.]

Part of the DATAMATION tradition for the better part of the past decade has been its near-psychedelic covers created by Cleve Marie Boutell. To me, they are great and are vastly to be preferred over the dullness of photographs of electronic equipment. Matching the brilliance of the cover design is the tradition of an occasional



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article of devastating wit by authorities like Granholm, Grosch and Patrick. We can especially thank Jackson Granholm for adding "Kludge," "weenie" and "Zorch" to our everyday vocabulary. (Sample articles: "How to Design a Kludge"; "How to Hire a Programmer".)

the 1960 anomaly

In leafing through past issues, I came upon what seemed to me to be a remarkable year for computer annoucements. In 1960, 10 new computers were the subject of DATAMATION articles, eight of them in the first two issues of that year. Verification of this plethora of new products was made by checking Knight's listing of computers by year[1,2]. His data for over 300 computers announced between 1944 and 1966 is shown graphically in Fig. 1, and indeed has a significant peak in 1960.

What is so unusual about 1960? One might speculate that this was a year when a lot of companies decided to really break into the computer market (only later backed away from it). In and around this time one sees several manufacturers in this category: Bendix, Librascope, Philco, Ramo-Wooldridge, Packard-Bell and General Mills. But even so, why in the immediately preceding years were there typically only one-third as many announced computers as the 35 of 1960?

An alternate theory, one to which I subscribe, is that manufacturers attach special importance to having new models to announce at the beginning of a decade. If true, we can then look forward to another peak in the year 1970. (Those looking for second-order effects might even note a tendency for peaking at half-decade points in Fig. 1.) As a part of this speculation, it may also be the case that manufacturers are inclined to introduce innovations at the beginning of a decade.

ten computers

The 10 computers discussed in the 1960 articles were examined more closely to see how they fit into their respective product lines. These 10 computers were:

RW-400	Bendix G-20	GE-225
RPC-4000	RPC-9000	General Mills
Control Data 160	PB-250	Customized
IBM 7080	Monrobot XI	Computer

In retrospect, about half of these computers were commercial successes. (Approximately two dozen GE-225s were reported to have been sold at the time of its announcement.) Most of these computers did not incorporate their major innovations, yet for their manufacturer they typically represented a substantial diversification.

For Bendix and Ramo-Wooldridge, the G-20 and RW-400 were parallel core machines rather than serial drum machines of the type already in their product lines. For Packard-Bell and General Mills, these were their first entries into the computer market. The PB-250 was developed under Max Palevsky, now president of Scientific Data Systems.

For IBM and Royal Precision (formed jointly by Royal McBee and General Precision), the 7080 and the RPC-4000/9000 computers represented moves to transistorized products. The 7080 was a near relative to its predecessor, the 705, although an order of magnitude faster. The RPC machines were new designs with respect to the LGP-30 and were aimed at a new market.

The Model 160 was an interesting second entry into the computer field by Control Data in that it was a much smaller machine than the 1604. Its 12-bit instruction without a memory address was something of a novelty for its time.

At $24,500, the Monrobot XI had the distinction of being the least costly of the 10 computers, and only 1% of the most costly, the IBM 7080. This was achieved at quite a penalty for some arithmetic operations—an approximate rate of multiplication of 30 per second. For a small machine, the Monrobot XI software had surprising emphasis, specifically its "Easy Programming" feature employing microcommands.

While not GE's first computer, the article describing the GE-225 reported that it marks General Electric's first bid for the general-purpose market. The article goes on

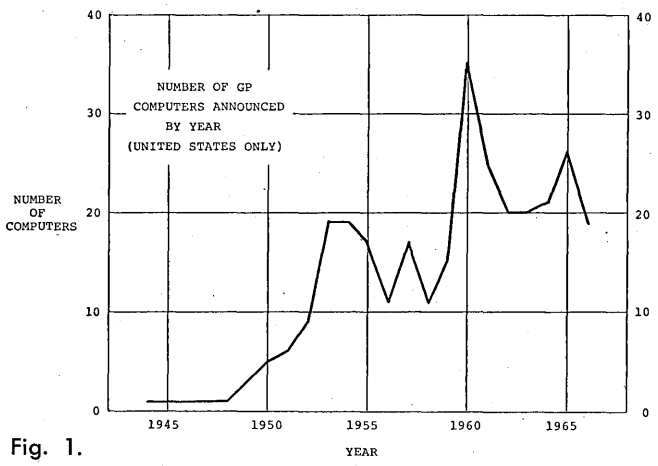

Fig. 1.

to emphasize the General Compiler System that would be provided for both algebraic and business data processing compiling.

It is interesting to note the types of memories that were employed in these 10 computers. Two—the RPC-4000 and the Monrobot XI—had drum memories. The RPC-4000 used a tapered drum that permitted the drum to be pulled away from the heads when not rotating at full speed. Magnetostrictive delay lines were used in the RPC-9000 and the PB-250. Because of its high bit transfer this type of memory permitted the PB-250 to be a surprisingly fast systems computer. The RPC-9000 utilized auxiliary magnetic tape loop storage, each tape loop being capable of storing one million characters. The remaining five computers had core memories . . . the IBM 7080 cycle time of 2.18 microseconds being a factor of three or more faster than the other core memory cycle times.

In terms of over-all organization, the RW-400 polymorphic system was the most novel. It is the only multicomputer system of the 10, employing a Central Exchange for module interconnection. Its computer modules were supplemented by core buffer modules to act as switchable I/O buffered channels. The extent to which man-machine interaction was involved in its design gives to some similarity to today's time-sharing systems.

The G-20 also had some interesting and novel design features. Notable at this time was its 32-bit word composed of four 8-bit characters, each character carrying a parity bit. The General Mills machine offered pluggable instruction cards, giving it some flexibility in its construction. Its announcement came hard on the heels of an article by Bob Patrick suggesting a "customizable computer." While Patrick's suggestion was more along the lines of a microprogrammed computer, the General Mills machine partially fulfilled his requirements.

conclusion

Fascinating history lies between the covers of the past 10 years of DATAMATION issues. The look at 10 assorted

1. K. E. Knight, "Changes in Computer Performance", *Datamation*, September, 1966.
2. K. E. Knight, "Evolving Computer Performance: 1962-1967," *Datamation*, to be published.

computers of 1960 vintage points up the progress we have made in recent years—progress perhaps not so much in basic new features as in performance, usability and dependability. The anomaly of 1960 in announced computers leads this reader to suspect that 1970 will be another bumper year.

Will the computers of 1970 be loaded with new features? Probably not. Emphasis will likely be in higher performance for less money, more software, and larger memories. At the low end of the systems computer line we may even see $5K computers. The eight-bit byte will reign supreme, a *de facto* standard. Large scale integration of computer circuits will probably not be in general commercial use by 1970, but LSI implementation of certain functions such as bus-oriented flip-flop arrays should be available at very attractive prices. Greater interest will be shown in microprogramming as a method of machine standardization. The more daring firms may even offer computers with instruction sets that vary in time by the use of electrically alterable microprogram storage.

As to who will be building computers in 1970, there may be a few surprises. Integrated circuits have to a great extent taken the performance risk out of computer design. This, coupled with competitive prices available for product support software, make machine development costs more reasonable than ever. Still, the nut to crack is marketing, and the successful small developer of computers will probably have to appeal to a specialized market. An example of considerable current interest is the activity being mustered by the electronic instrument manufacturers.

I anticipate that 1970 will be the beginning of the era of "vertical markets" in the computer industry, when systems—computers, peripherals, communications and software—are tailored to specific applications. The early evidences of such systems in airline reservations, stock quotations and cement manufacture should seem paltry indeed in comparison with the new systems to report by the end of the second DATAMATION decade. ■

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OLD MYTHS AND NEW REALITIES

in business applications

by ROBERT V. HEAD

On the occasion of this tenth anniversary issue of DATAMATION, one must resist the temptation to ruminate nostalgically over past accomplishments and the men and companies that achieved them. Certainly, the advances in business data processing during the past decade have been remarkable, but in the context of this article they will be viewed not in terms of personal reminiscence but rather in terms of historical perspective. We shall examine the changes wrought in the past only as a prelude to identifying the changes that are to come.

It is the thesis of this commentator that there are at work today, in the field of business systems, powerful forces of change—forces that bode ultimately to alter fundamentally presently established methodologies. Just as surely as symbolic programming was beginning to replace machine language a decade ago, new technological approaches to system development are now emerging that will profoundly impact tomorrow's data processing milieu.

individual company approaches

This impetus for change is coming largely from computer users rather than from the suppliers of hardware and software. For this reason, it is appropriate to look back briefly at historic systems efforts to which individual users contributed heavily. These past efforts can then serve as benchmarks against which to contrast the orientation that computer users are presently beginning to assume.

Here, then, are capsule case histories of three different

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projects, in three different industries, supported by three different equipment manufacturers.

- General Electric Appliance Division, Louisville, Kentucky, 1954, developed the first successful industrial payroll application, operational on a Univac I computer. Today, payroll is perhaps the most universally accepted computer application.
- Bank of America, San Jose, California, 1959, designed with the aid of Stanford Research Institute, a fully computerized demand deposit accounting system. More familiarly known as the ERMA system, it was implemented using GE 210 computers, a choice which did much to push GE into the computer business. Today, banks throughout the country use computers to process their checking accounts.
- American Airlines, Briarcliff Manor, New York, 1962, employed IBM 7094's to electronically store, for the first time ever, complete passenger reservation records as part of its SABRE System.

Many other milestone achievements could, of course, be cited. But those mentioned will suffice to help identify a number of the characteristics of "pioneering" in commercial applications in the past:

1. Such applications required new technology, either hardware or software, usually both. GE Louisville, for example, besides using a then new computer, wrote its own assembly language and utility routines. The ERMA work hastened the development of the E 13 B magnetic character recognition font and the development of the now ubiquitous (in banking) MICR encoders and readers. The American Airlines SABRE system embodied numerous hardware and software innovations, including the first program "paging" system for the 7094, a sophisticated real-time control program, dual arm disc files, and other features.
2. These projects demanded an enormous investment of developmental resources by both manufacturer and user. Though company PR men may deny it, both vendor and customer typically "took a bath" in producing such new systems, in the sense that more resources had to be expended than originally envisioned, or more calendar time elapsed before completion, or both.
3. Most significant of all, perhaps, these systems set a pattern for other companies in their industries. There is today, for instance, no more common "garden variety" business application than payroll. Today, more than 1,000 bank computers routinely process customer checking accounts. And today, the airline companies have accepted computerized passenger name records as an industry standard.

the elements of change

If these early systems were successful, despite all the problems, why change the development formula? After all, they must be doing something right!

There are compelling reasons why a single company—even an industry leader like those mentioned—can no longer join forces with an enlightened manufacturer to achieve the kinds of breakthroughs such partnerships have produced in the past. The fact of the matter is that there is now available a *better* way of achieving progress—better from both an economic and a technological standpoint.

In terms of the economics of system development, there is emerging a pattern of *industry* rather than individual company interest in advanced business systems. As we shall discuss later in this paper, many industries have arrived at the point where there is no longer merely one company ready to underwrite the costs of systems progress but instead a whole peer group of companies, often united under the aegis of an industry association.

Another important economic factor is that contemporary systems tend to cost more, for both hardware and software, than in the past. Despite reductions in the relative cost per character stored or computation performed, the individual company price tag for data processing has steadily escalated as new and more ambitious applications are undertaken. Even if these costs were not increasing, many industries have reached a sufficient level of systems maturity to appreciate the economic benefits of sharing the cost burden of system development. Continually rising costs simply underscore an existing industry motivation to proceed along cooperative lines.

But if an economic rationale is present, why has such sharing of development costs not come about before? Why have companies chosen to "go it alone" and forfeit the benefits of jointly funded systems broadly applicable to the needs of many users? Essentially, the missing ingredient has been technological, in that there has not been until fairly recently sufficient standardization at the machine level to warrant serious pursuit of the subject of industry-wide systems.

Although a single manufacturer has possessed a large share of the computer market, this share was, until 1965 or so, fragmented among several machine classes, i.e., the 1400, 7070, 7080, and 7090 series. The introduction of a unifying influence in the form of 360 (and 360-like) equipment for the first time permitted a "hardware consensus" among computer users. In parallel with this phenomenon, there has arisen a "software consensus" on the part of commercial installations, which by and large agree that COBOL is the programming language to use, at least for the present. These two events have coalesced to provide an unprecedented technological climate for standardization.

the emerging dominance of industry systems

Along with this tendency toward hardware and software standardization, and stimulated by it, there is evolving a different pattern of user organization. Heretofore, companies had little choice but to gravitate into user groups such as GUIDE and SHARE where they clustered, herd-like, around particular machine configurations. Within these large and heterogeneous groupings, companies found little in common beyond the fact, often strictly accidental, that they happened to possess a particular machine model.

The new pattern of user organization is *industry-oriented*, not machine-oriented. This is strongly reflected in the increasing scope of the automation activities of numerous industry associations, among them the Air Transport Association, American Bankers Association, Associated Credit Bureaus of America, Association of American Railroads, National Association for Bank Audit and Control, National Retail Merchants Association, National Supermarket Institute, Railway Management Association, and the U.S. Savings and Loan League. It is not without significance for the future that the automation interests of the thousands of computer users in these and other industries are beginning to align behind trade association leadership.

What is behind this shift toward integration of user interests along industry rather than machine lines? Why *are* companies looking for, and finding, technological guidance within their industry association and relying less on the equipment suppliers? Several reasons can be identified.

Manufacturer priorities. With the advent of third-generation computers, the manufacturers' technical resources have become severely over-extended. Because of the emphasis that must be placed on the systems software, such as compilers and operating systems, so vital to to-

day's machines, there are few hands left over to assign to specific industry problems. Coupled with this is an ingrained tendency to regard applications software as on a secondary level, to view it more as a marketing tool than an integral part of an overall system configuration. As a consequence, applications software has been relegated to a back seat position, with systems software receiving the bulk of the manufacturers' attention.

Systems software experience. To say that the systems software being delivered with third-generation gear falls short of being an unqualified success would perhaps be the understatement of the decade. The manufacturers' difficulties in providing flexible and efficient operating systems, file management systems, and other software aids are causing users to ponder whether software that purports to be "all things to all men" can ever be truly satisfactory for anyone. Attempts to produce systems software that will work on many machine configurations, while at the same time satisfying the needs of diverse classes of users, are coming dangerously close to being self-defeating, in the opinion of knowledgeable users. Has the time not come, they wonder, to design software with particular industries in mind, so that instead of, say a general business query language, there is a bank-oriented language, a retailer-oriented language, and so on.

User sophistication. Users are discovering that the articulation of equipment and software requirements on an industry basis strengthens their position markedly. Consider two examples.

- One association has set up a committee to establish specifications for industry-oriented terminal devices. The chairman of this committee asserts that "Before, when I talked to the vendors about terminals, I spoke only for my own company, a potential user of no more than twelve devices. Now I speak for a group of companies that will eventually purchase several thousand of these machines." Needless to say, the committee has succeeded in attracting the attention of the manufacturers. This same committee, incidentally, is considering the preparation of software specifications as a preferable alternative to waiting passively to discover what application packages the vendors may deign to supply with their gear.
- Another industry association is jointly sponsoring, with an equipment manufacturer, the design and programming of a standardized information retrieval and reporting package. This package can be purchased by individual members of the association at a price estimated to be approximately one-tenth the original development cost.

Thus, more and more users, in numerous industries, are questioning the necessity of "reinventing the wheel" time after time in company after company. Is utility billing, they ask, *really* all that different in electric companies throughout the country? Or patient accounting in the nation's hospitals? Or interest accrual in thousands of banks and S and L's? Of course not. Granted there are differences, but these can frequently be accommodated by a trade association member who can, by virtue of his membership, obtain operational software packages either free or at a fraction of his own potential development cost.

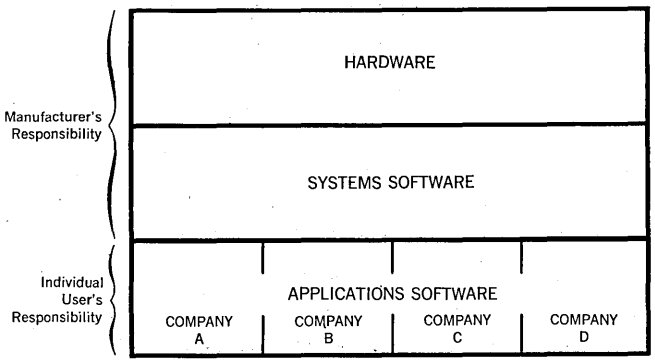


Fig. 1 Traditional Hardware/Software Relationships

two views of system development

The differences between the old and the new perspectives in business data processing can be delineated by conceptual schematics. Fig. 1 shows the world of edp as it has traditionally been structured. It is a *horizontal* universe with the two uppermost layers—hardware and systems software—being largely the province of the manufacturers. These vendors looked out—or down—on a conglomeration of "users" who were responsible for producing their own applications software on an individual company basis. True, the manufacturers did make some desultory efforts to supply certain application packages and did, on occasion, go "all the way" in supporting ventures like those described at the beginning of this article. But by and large, it has been every man for himself when it comes to developing operational systems.

The new pattern for industry systems is indicated in Fig. 2. Here, a *vertical* specialization along industry lines can be seen to knife upward, bisecting the no man's land of systems software and penetrating the hardware area as well. This suggests not only an industry approach to applications software but a *total* industry approach, encompassing applications software, systems software, and even hardware, the latter perhaps being dictated by means of specifications similar to the terminal specifications mentioned previously.

It takes but little reflection to discern that this new pattern implies a significantly different relationship between user and supplier than that which has heretofore prevailed, as the user becomes increasingly adept at exercising the leverage provided by his industry association. Two new approaches to the user-vendor interface can, under the new scheme of things, be expected to gain adherence.

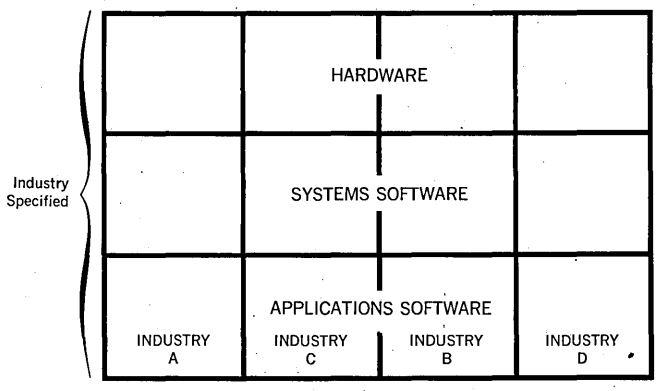


Fig. 2 Industry System Development Pattern

- The issuance of *performance* type specifications for contemplated new systems, whereby an overall level of hardware and software performance is required. Sometimes referred to as a "turnkey" or "lock" systems approach, this would mean, in effect, that a supplier (not necessarily a hardware manufacturer) would be called upon to provide *all* the system elements represented within one of the vertical segments of Fig. 2.
- The adoption of a building block or erector set approach, whereby a company—or an industry group—obtains separate bids on the hardware, systems software, and applications software needed for a system. This procedure

is certainly consistent with increasingly voiced user demands for separate pricing of hardware and software.

conclusions

Although prognostications in an area as spongy as that of software for business applications are laden with peril, there are indicators which seem to point to the following conclusions:

1. The "industry leader" method of achieving systems innovation is no longer the only, or the best, route to future progress.
2. User groups organized along machine lines will dwindle in significance, to be succeeded by industry groupings.
3. These industry associations will take the initiative in specifying, and in many instances developing, industry software, including industry-tailored languages and other systems software as well as applications software. (Actually, the line between systems and applications software will tend to become somewhat blurred as such tailoring progresses.)
4. A new pattern of equipment and software acquisition will emerge as a result of increasing industry activity, giving impetus to separate procurement of hardware and software.
5. In an edp universe in which the computer manufacturer is no longer at the center, the rôle of the independent software companies will be enhanced to the point where they will be delivering generalized software, not just to the manufacturers as is presently the case, but directly to the end users.

These emerging new realities are bound to have a disruptive effect on presently established relationships. But the weight of logic and of economic necessity is on the side of change. Though some suppliers may suffer from these dislocations, the ultimate result should be better systems at lower cost for the stoical and long-suffering user. ■

DATAMATION 10TH ANNIVERSARY

spanning the generations

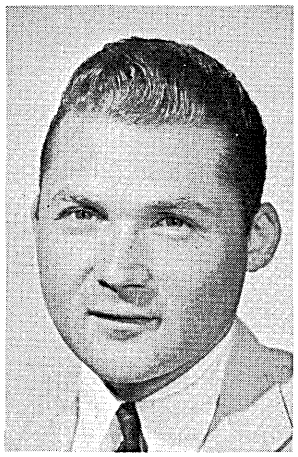
THE CHANGING ROLE OF CONSULTANTS

by HOWARD BROMBERG

When asked to comment on the past 10 years in the computer field for DATAMATION's 10th anniversary issue, I thought it would be interesting to discuss a profession which was made possible by the progress of the last 10 years. By "profession" I mean all of those activities which today are categorized under the term of computer consulting. The activities of hand-tailoring, reformatting, streamlining, reducing the "hidden" costs of data processing, analysis, producing a lower throughput cost and many others fall into the province of the computer consultant. In addition, the consultant is often called upon to supplement a user's technical staff by providing a specific talent, performing a turn-key operation or by offering more warm bodies for the purpose of overwhelming the application. Here is an avocation which has grown with the computer field itself and one which probably never would have developed had not the technology associated with computing machinery design been further advanced than the technology of computing machinery use.

It is, of course, obvious why this occurred. Computer engineers had a tradition upon which to base their activities. Similar work had been done in other fields. Theories had been developed and experience had been gained. Even up to very recently it was necessary to have a new computer built and running before one could develop any experience with its programming. Nevertheless, whatever the reason, there are many of us who are grateful for these last 10 years.

There are no doubt other fields where consultants are used. Engineering, education, medicine and management are those that come to mind immediately. However, even in these fields the consultants are more specialists who act as advisors in a pure sense of the word. This is not meant to imply that computer consultants do not provide their fair share of lip-service. Probably the major difference between



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computer and other kinds of consultants is their degree of importance with respect to their particular environment. Without consultants, engineers would still engineer, teachers would still teach, doctors would still doctor, and managers would still manage. But would the computer user derive the same benefits, realize the same advantages and exist at the same level of accomplishment without the existence of the computer consultant?

Unfortunately for most computer users, their vendors are primarily sales motivated and most considerations of specialized requirements or efficient utilization are subordinate to the major goal. Thus the responsibility for specific, prudent and economically sound employment of computing machinery becomes the sole responsibility of the individual user. Contrary to popular belief, the computer user operates with limited resources and is motivated by the urgent requirement for computer processing of his bread and butter applications. More often than not, this practice exhausts his technical resources. In the past, the consultant was used primarily to help the user "get on the air." Today his role is changing.

the changing role

To see how the consulting business has exploded over the past decade, I scanned a 1957 issue of a Brand-X magazine which published a list of organizations under the title of Consulting Services. Forty-two such organizations were listed. Ten years later the same magazine listed similar organizations under the category of Programming Services. In 1967 there were 226 companies who appear to gain the majority of their income from the pursuit of consulting services. This shows greater than a five-time growth in this past decade. Indeed, California alone has more consulting services organizations than the 1957 issue showed the entire country to have. Of the original 42, only four were repeated a short 10 years later.

It is interesting to note that in 1957 only three listed organizations had a variation of the word "computer" in their name. In 1967, 22 had. In 1957, two had a variation of the word "data." In 1967, 16 had. In 1957, none of the organizations shown had the word "information" in their name. In 1967, 11 used this.

To give you a better idea of how young our computing field really was in 1957, this same issue had a section that dealt with a pictorial introduction to computers. One of the items shown was a photograph of a magnetic tape reel and another photo had the caption, "What Programming Looks Like." (Today, instead of showing a photograph of instructions to demonstrate programming methodology, one would probably display a picture of Fort Knox.) In 1967, the issue contained lists of ideas in the computing field, applications, programming languages, and machine characteristics.

As the computing field developed in the last 10 years from the "what" state, to the "how" state, the requirements for consultants increased. Hardly a single organization today, especially those heavily engaged in computer activity, has not had the need for outside consulting services.

There are many reasons why an organization should employ outside consulting services. While I do not intend to describe them, it is obvious that there are economic as well as technological justifications. However, as it is with any activity within our field, there is a continuing requirement and striving for excellence. To accomplish this with outside consultants depends upon how one prepares for the consultant, how one selects the consultant, how the job is defined, how the responsibilites are defined, how one works with the consultant and, finally, how one measures the results.

There is no hard and fast rule which governs the decision to use a consultant. Aside from the infrequent obvious cases, no formula exists which easily decides the proper trade-offs between in-house and outside design and implementation. It is a highly subjective and complex situation. Each organization is motivated by different goals—speed to some, cost to others, efficiency, etc. Even though corporate politics and financial conditions affect the decision to use consultants, this decision must be based on the individual considerations of the particular organization. As mentioned above, there are general guidelines to follow in order to gain maximum advantage from the working relationship with the consultant, but none exists to decide whether to establish the relationship. And there is little worse than a relationship between client and consultant based on a flimsy foundation of uncertainty.

continuing demand

Judging from the size of the list of consulting organizations and the new ones popping up every month, there appears to be an increasing and continuous demand for their various services. Hopefully, others than those starting the services have this feeling. It is obvious to me, however, that the number of consulting firms in the computer business will continue to increase over the next decade at least. I make this statement primarily based upon two beliefs. First, a consulting business is about the easiest business to start. The reason for this is that there is no inventory and such a business can be operated with a relatively low overhead. The second reason is the complexity of the computer business itself. As the field becomes more encompassing and more difficult, organizations will find that they have a lack of knowledge for a significant specialty. Indeed, we have seen consulting business start up based upon talent in a single specialty item. Some examples are time-sharing and operating systems.

It takes a single contract or just an ability to sustain oneself until the first contract is signed in order to start a consulting business. Many persons with recognized talents in a highly specialized area are sought to moonlight or to take on full-time projects as consultants. People in universities have been undertaking such assignments for years and there is a trend developing for commercial technicians to do likewise. In the past, it has been the case that the senior member of the consulting team called in by the management of a company ends up as an important full-time member of that company. Today, the reverse is happening. Senior members of an organization who have been successful in their computer activities leave to establish their own consulting outfits. Using their previous company as a training ground, they assimilate their experiences into a generalized technique only to particularize them for sale to similar companies.

On the other side are those with "greener" motives. To the entrepreneur in the computer field, neither real estate nor the stock market represent the maximum opportunity for professional and monetary satisfaction. I would not be surprised to learn that some consider the establishment of a consulting firm in terms of future acquisition or merger and secondarily in terms of a fair profit for services rendered. Nevertheless, regardless of motivation, consulting companies are on the rise. Rarely does one hear of such a company folding up its tents and slipping away into the night.

new requirements

The past decade in the computer field has been particularly interesting because it spanned all generations; that is, it started within the first generation and concluded

at the beginning of the third. From the standpoint of a consultant, it has shown the complexities underlying each of these generations. In the extreme, it has shown the significant differences between the first generation technology and that required to be practiced in the third. More important, it has demonstrated that the successful achievement of third generation excellence, much less that of the subsequent generations, will require an amount of advice and specialization not normally associated with those capabilities of the average user of information processing equipment. Thus, the role of the consultant will change in this coming third generation decade. The expansion of technological capabilities is accompanied by a large group of new problems demanding solution. As it was at the beginning of the first generation, so it is at the onset of the third. Interpreting the state of the art and placing its characteristics into operational environments remain a major responsibility of the consultant. The difference with the current consultant lies in the depth of training required to exploit the new technology.

As we get further into the third generation, the consultant will paticipate in other activities. Some of these will include development of industry or application oriented, machine-independent languages; specifying, implementing, marketing and maintaining general and special purpose packages; extending the vendor's capabilities; and playing a larger role in hardware evaluation, acquisition, operation and financial control. I think this third generation might be sub-titled, "The Consultant Generation." At any rate, I hope it will be. ■

DATAMATION
II TH
ANNIVERSARY

time out

THE RECEDING FUTURE

by ASCHER OPLER

Few technical fields can match the computer world in its obsession with *time*. Our vocabulary is replete with terms like access time, nanosecond, latency, time slice, asynchronous activity, interrupt, time-sharing, simultaneity, overlap time, release date, clock pulse, scheduling algorithm, cycles, start-stop time, purge date, etc.

Computer people are experts in dealing with time. Computer engineers analyze the status of each circuit on a clock pulse-by-pulse basis. Some programmers count timing cycles within tight inner loops, determine the number of milliseconds available to process an interrupt, etc. Schedulers plan computer operations so that waste time is minimized and high priority schedules are met.

However, when the computer specialist leaves the domain of computer time (picoseconds to hours) and enters the realm of human activity time (hours to years), he becomes a bumbling amateur. In the relatively brief history of electronic computers, an incredibly poor record for estimating time duration has been made. Although flagrantly bad estimates have drawn attention from time to time, not everyone realizes the breadth and depth of our errors in projecting the time required to achieve certain goals.

Serious failures have occurred in predicting both general and specific achievements.

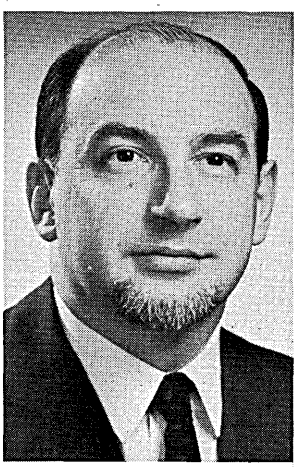
predictions that failed

In mentioning some statements that went wide of the mark, this writer can plead guilty to a few of his own. In 1961, for example, after stating that a "software crisis was at hand" he concluded with the hope that "some of the solutions currently proffered will bring the chaotic situation in automatic programming under control by 1963 or 1964."

When the first programming languages were announced (1954), over-zealous manufacturers' announcements predicted the immediate demise of all other programming methods.

The development of the Perceptron (1958) evoked many predictions of early replacement of programming with self-organizing systems.

Photographic (1953) and cryotron (1959) memories



Mr. Opler is contributing editor of Datamation, an author and long-time observer of the computing scene. His experience in the computing field began at the Dow Chemical Co. in 1947.

were projected as playing a major part in computer storage systems "within a few years."

At a 1961 meeting, an early enthusiast for time-sharing predicted the disappearance of all but interactive console programming in two or three years.

The widely reported demonstration of Russian to English translation in 1953 led to predictions of quick complete mastery of language translation by computer.

Predictions about widespread use of optical devices that read typewritten and printed pages have also been wide of the mark.

systems that were late

The history of the development of computer hardware, software and applications has been characterized by (1) lateness, (2) rescheduling, (3) cliffhanging finales, (4) substitution of interim versions for the promised ones, (5) the substitution of a "Phase 1" goal for the full goal, or (6) the on-time delivery of the promised system in a version whose quality and reliability were too poor to allow system usage.

This sweeping condemnation has many well-known examples. It primarily applies more to the large, new and complex system than to the small, simple system that breaks no new ground. Acceptable operation of systems has frequently lagged six months behind schedule and occasionally three to four years.

Among the systems whose lateness embarrassed their sponsors were large business language compilers, command and control systems, real-time telecommunication systems, ultra-high speed computers, government-wide data processing systems, ultra-high capacity storage systems and large operating systems.

why are we so myopic?

We understand what happens in one second of computer time; we do not understand what happens in one month of a man's time; we do not understand what happens in one year's time of technical development. If we are ever to leave the era of delayed fulfillment, we must improve our understanding of the true metric of time. Our vision of time is poor for a variety of reasons:

1. The time scale of the entire computer development is such that distortion arises easily. The technology of five years ago seems relatively primitive; that of 10 years ahead, "way out." In this environment, it is difficult to see two years ahead without distortion.
2. Marketing pressures in a highly competitive market are felt by everyone in the field. Under such pressure, one naturally makes claims for the earliest delivery of the most advanced system. Constant emphasis on *soonest, earliest, availability, delivery, installation* cannot help but prejudice all who estimate actual completion dates.
3. Lack of reliable industry experience on which to base our projecting. Chemical, automotive, steel and petroleum industries can make better projections based on many more years of experience. Experience in building computers, implementing software and real-time systems is diluted by the thousands of new people in the field and is rapidly made obsolescent by fast-changing technology.
4. So far we have failed to develop fully satisfactory methods for controlling the implementation of very large programs and, as a consequence, we have failed to develop accurate methods for predicting completion dates.
5. Underestimating the extent of development required to take a promising technical innovation and make it into a low-cost item usable with high reliability on an everyday basis. In other industries, a lag of at least five years is expected; in many fields, 10 years is normal.

There are two general solutions to the late-delivery problem for specific systems: learn how to meet tight deadlines or learn to make more realistic schedules and live with them. For years, we have strived to do the former; perhaps it is time to give attention to the latter. Invariably, when a fiasco is viewed in hindsight, everyone agrees that the schedule was unrealistic. Where are the men who can brand such a schedule as unrealistic when it is proposed?

This practice of setting schedules as tight instead of as realistic as possible applies all the way down the line. Large systems fail to meet their target dates not only because of delay in the whole, but also in the delay of many of the smaller parts. PERT charts with unrealistic activity times lead to much paperwork but not to on-schedule completion.

One hopeful trend is the gradual disillusionment with the products of crash programs and with accelerated early release versions. Bad experience after bad experience is hammering the lesson home . . . the reasonable user must wait a reasonable time to get a reasonable product. One installation manager states that he has switched from the vanguard of users to the rearguard—with a smoother running introduction of new systems that more than counterbalances the delay. He shudders when he recalls the frenzied days in the vanguard.

The industry is still too young to have amassed both experience and data about its own developments, costs and schedules. Eventually, there must arise a stable supply of "old hands" at production of systems who will be equipped with good data about past experience.

Computer manufacturers have moved ahead with design and production automation systems for hardware with a consequently improved record of meeting predicted schedules. The software producers have experimented with equivalent tools for years, but with far less success. The construction of large integrated user systems is faring little better than the construction of system programs.

As far as technical innovations are concerned, perhaps we can minimize disappointments by instituting the following practices: delaying announcement until the technical validity and utility of an innovation have been demonstrated; presenting before your peers a paper devoid of claims of vast potentialities; distinguishing sketches, models and mock-ups from the real thing; making extremely conservative estimates of the time needed to develop and introduce a product, carefully considering if it has *all* the attributes needed to replace the current, corresponding product.

In addition, we might follow these commonsense rules:

1. Try to re-capture facts concerning the resources and times required to produce past accomplishments, or start gathering them for current ones. Use of historical data could prove useful in more accurately estimating the time, manpower and other resources required of future projects.
2. Let's start exchanging information on such data. Papers describing particular projects could include information on just what it took to get the job done.
3. Make sure that in estimating for a new project we enumerate *all* of the tasks to be accomplished in order to deliver a product or system. Too often we ignore such items as training, documentation and conversion.

Perhaps we should begin to allow in our deadline planning time to reflect on our total performance with respect to time. Sooner or later the breathless years must give way to experience and stability. I am not predicting when. ■

CONFIDENTIAL

Inter-Office Memorandum

TO: Sales Representatives for Kludge Model 97

FROM: Kludge Komputer Korp.--Marketing Headquarters

SUBJECT: Superkomputer Delays

Shortly after the announcement of the Kludge Model 97 Super Time Sharing System, research was begun into its feasibility. That research, begun in May of 1958 and recently completed, indicates that several changes are needed in our marketing strategy.

Time estimates for paging and other system overhead indicate that users who are planning on having more than two remote terminals may experience lost data. When both typewriter terminals are being used simultaneously, it is important the operators try not to enter data at the same time. Moderate success has been achieved in entering data at rates approaching four characters per minute. Therefore, in all proposals use the figure 80,696 cpf (characters per fortnight). Future software may increase the maximum number of terminals but it is doubtful that the advertised 4,096 maximum can be met.

Unfortunately from a marketing standpoint, adding more CPU's to the system further degrades performance. It is also unfortunate that production volume has reached the point where it will not be possible to cancel the orders for multiprocessing systems. The sales force should also note that, due to a misunderstanding with our subsidiary doing the actual component assembly, the printers will be delivered with Japanese characters on the print chain. Should this cause any problems with your users, write directly to Marketing Headquarters. This problem is not as serious as it would seem at first glance. Because of communications problems with another supplier, our optical character reader accepts only Japanese characters. KKK has anticipated your needs for special help in these areas and several Japanese system engineers are in training. Courses in written Japanese will also be offered in the Customer Education Seminars.

A more serious problem is software. It will not be possible to actually deliver any with the machines. While software development has been under way for some time, the staff has been plagued with management indecision and communication bottlenecks. Therefore, after the forthcoming release of our 200K card-to-print package (FORTRAN compiler--phase 1), further software releases will be delayed until the fourth quarter of 1969. It should be understood that a definite decision to release the software at that time has not actually been made and sales representatives should go no further than vague implications and faked coughing spells.

The PL/I compiler is definitely "out," as storage requirements proved to be an order of magnitude greater than the maximum permissable core size. Because of this it was not possible to get actual compile time estimates but it looks as though they would have been competitive with other manufacturers. The FORTRAN subset compiler has had many of the same problems and another try will be made with an even smaller subset. Most notable among the deletions necessary to implement this subset will be all I/O statements. It is also possible that the DO statement may have to go.

Due to the constant quibbling between the COBOL and ALGOL groups,

(see next page)

— CONFIDENTIAL —

not much is to be expected in these areas.

SORT/MERGE packages were completed and sent to software testing where it was discovered that the card sorter was an off-line device. The resultant hard feelings have clouded the future of this effort.

An RPG package was lifted from a competitor who had lifted it from another competitor, but our version is not working either.

Our best marketing strategy would now appear to be playing up our soon-to-be-announced fifth-generation system. The advantage of fifth-generation equipment is that no customer programming is needed. Programs will be distributed to users on pre-loaded cores. Thus, the money saved by reducing the customers' programming overhead can be spent on core memories, which are presently showing a better profit margin. This equipment will have complete, direct program compatibility (subject to certain conditions, etc.) with fourth-generation equipment--should it be announced. If questioned closely on the programming aspects, it might be wise to stage a fainting spell.

In conclusion, it is important that we keep our communication channels open. Remember, marketing does more machine design than engineering. Please see that prescribed channels are used in all communications--namely that all requests for information, especially price quotes, are submitted first to the account manager, who will forward a copy of it (after approval) to the branch manager, who will forward a copy of it (after approval) to the district manager, who will forward a copy of it (after approval) to the regional manager, who will forward a copy of it (after approval) to the national manager, who in turn must send copies to the numerous individuals involved via their supervisors. All persons involved should keep copies of the correspondence should it ever become necessary to affix blame. No deviations from these standards are permitted. A complete discussion of these procedures may be found in the branch managers' manual (X97-43862-43,961) volumes 4-16.

T. J. BAUD
Marketing Director

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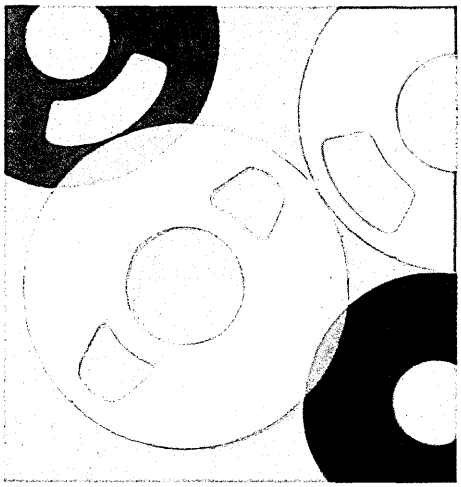

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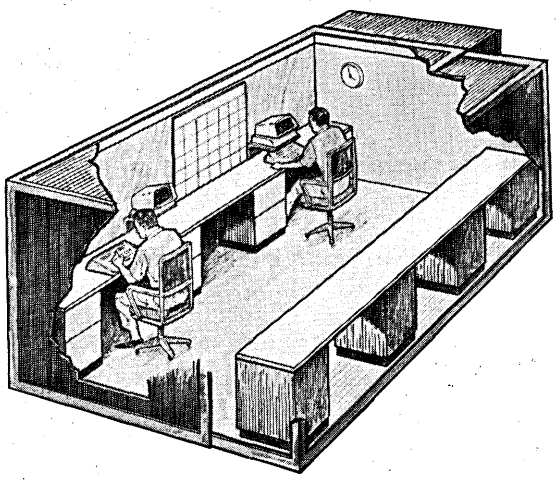

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CIRCLE 21 ON READER CARD

PROGRAM BUDGETING

by CHARLES J. HITCH

This article is based on a speech given by Mr. Hitch to the Thirteenth Regular Meeting of The Diebold Research Program in Phoenix, Ariz., Feb. 1, 1967, sponsored by The Diebold Group, Inc.

I should like to do two things here: sketch the development of what is now usually called program budgeting—strangely enough, we never called it program budgeting in the Department of Defense, we called it the Planning-Programming-Budgeting System—and outline some of the problems and risks as well as the opportunities in extending program budgeting to other areas, such as civilian government, education, and industry.

Nearly two years ago, President Johnson directed all federal government departments to introduce program budgeting systems similar to that of the Department of Defense. It is my impression that most of these departments are still struggling manfully to learn just what this means and how to comply. What is program budgeting or the planning-programming-budgeting system? In my lexicon, it is a combination of two management techniques which are related and mutually supporting, but distinct; in fact, they are so distinct that it is possible to use either without the other.

the techniques

One of these management techniques is called program budgeting or, more simply, as in the Defense Department, programming. Since program budgeting is also used more broadly to mean the whole planning-programming-budgeting system, I will use the simpler term "programming" (in its non-computer sense) to describe this part of the system. Programming as an activity produces a program which has the following characteristics: first, it is organized by programs rather than by objects of expenditure as traditional budgets are. Or, if you prefer, it is classified by outputs which are objective-oriented rather than by inputs. The resource requirements and the financial or budget implications are linked to these program outputs. I know that to many people this is just about all that the term program budgeting conveys. In my opinion, this by itself is not a very significant change in traditional budget procedures. But there is a second characteristic of programming, namely, that the program extends far enough into the future to show to the extent practical and necessary the full resource requirements and financial implications of the programmed outputs. In the Department of Defense, the programmed outputs are usually shown for eight years and financial implications for five years.

The second of the two management techniques in planning-programming-budgeting is called systems analysis, cost effectiveness analysis, or cost benefit analysis, as well as various other names, including operations or operational research. The whole system seems to be singularly plagued by terminological confusion. I hope that, as someone said of the music of Wagner, it is better than it sounds. Let me call the second technique systems analysis, since that is its official name in the Department of Defense. I know that this is very confusing, because the term is used in quite different ways. Systems analysis in this sense is explicit, quantitative analysis, which is designed to maximize or at least increase the value of the objectives achieved by an organization, minus the value of the resources it uses.

These two techniques, programming and systems analysis, were introduced into the Department of Defense by Secretary Robert S. McNamara for one purpose: to improve the high-level planning of the department—that is, planning at the level of the Department of Defense headquarters, service headquarters, and headquarters of the unified commands. Other management functions in the Department of Defense such as control and operations were not affected, except indirectly, by these particular McNamara innovations. Even the format of the annual operating budget as appropriated by Congress and accounted for by the department's accounting staff was unaffected, at least initially. Instead, we developed a "torque converter" for translating the five-year program into the budget format and vice versa. I emphasize the exclusive relation of these techniques to the planning function for clarity in explaining their rationale, certainly not to disparage them, for I consider planning and its various aspects to be the important function of top management in any large organization, whether government, business, or education.

Before saying more about the techniques, let me make some general remarks about the nature of planning. The planning function can be analyzed in a number of different ways; first, of course, by the distance of the future time period with which it is concerned. We have short-range planning—planning for the use of existing facilities and resources; intermediate-range planning—planning for procurement or construction of new facilities; and we have long-range planning—the planning of new developments with very long lead times, like new major weapon systems in the Defense Department or new campuses for the University of California. In defense, we generally found a ten-year planning cycle long enough

Mr. Hitch is vice president for administration, the Univ. of California. A former assistant secretary of defense (1961-65), he has also been chairman of the research council at The RAND Corp. He has a masters degree from Oxford Univ., and is the author of three books. The most recent,* Decision-Making for Defense, *was published in 1965.

for most of our developments. At the University of California, the lead times are longer. New campuses require that we look about 35 years ahead to the year 2000, and we attempt to do so.

planning

Another distinction which is critical is that between substantive planning and fiscal planning. Fiscal planning is the planning of future budgets, how much money and how to spend it. Substantive planning is the planning of objectives: ultimate objectives and intermediate objectives. In the Department of Defense, substantive planning is called military planning. In the university, it is called academic planning. The fiscal and substantive planning can be short, intermediate, or long range.

I repeat, the reason we introduced the two techniques of programming and systems analysis in the Department of Defense in 1961 was to improve the exercise of the planning function, which we found in disarray. We introduced programming to make the military planning of the department more realistic, to make it face up to the hard choices by linking it to the fiscal planning, from which it had been divorced. And we introduced systems analysis to provide a criterion or standard for making the hard choices, to achieve some rationality and optimality in the planning.

When I point out that planning was in disarray at the beginning of 1961, I mean just that. There was plenty of planning activity of all sorts in the department, short, intermediate, and long range, military, and fiscal. The key to the disarray was the almost complete separation of substantive or military planning and fiscal planning. These two types of planning, in the first place, were performed by two different groups, the military planning by the Joint Chiefs of Staff and the military planners in the services and the fiscal planning by the civilian Secretary and the comptroller organization throughout the department. Secondly, the two types of planning were couched in different terms, not readily translatable and, in general, not translated. Military planning was in terms of Army divisions, Navy ships, fighter aircraft squadrons, and so forth: military units or weapon systems—the outputs of the department. Fiscal planning was in terms of budget categories, which were military personnel, operations and maintenance, procurement, research and development, military construction—input categories. In practice, the long-range and intermediate-range military plans of the Joint Chiefs of Staff and the services were either not costed out in terms of their budget requirements, or this was done so roughly and unreliably as to be unusable. Thirdly, the two types of planning were for different time periods. There were intermediate/-and long-range military plans, but no fiscal plans extending beyond the next budget year.

objectives

In consequence, the intermediate- and long-range military planning was largely ineffective. The Department of Defense, one of the world's largest organizations by any standard, had no approved plans extending more than one year into the future. Each year the Joint Chiefs of Staff would produce its massive intermediate-range military plan called the Joint Strategic Objectives Plan, the JSOP, with recommended forces extending five to ten years into the future and would send it to the Secretary of Defense, who would note it and file it. Before McNamara, no JSOP was ever approved. Then in the budget season, in October and November, the real-life decisions were made by civilian secretaries advised in the main by the comptroller organization.

Why was the JSOP ignored? Primarily because it was financially infeasible. It was more or less a pasting together of the wish-lists of the four military services. If costed out, the budgets it required would be far in excess of what any Secretary of Defense or President or Congress would approve. The system, in short, did not require the military planners to face up to the hard choices that are part of responsible management. Let me emphasize that this was not the fault of the military planners, but a fault of the system. In organizations with similar systems, academic planners and business planners act just like the military planners.

But since the military planners didn't make the hard choices, the civilian Secretary had to make these choices as best he could in his budget review, and without much help from intermediate- or long-range military plans. The method which he used in his budget review, lacking any other, might be described generically as the budget-ceiling approach. The president would indicate the general level of Defense budget he felt was appropriate to the international situation and to his over-all economic and fiscal policies. The Secretary of Defense, by one means or another, would allocate this figure among the three military departments. Each military department would, in turn, prepare its basic budget submittal allocating its ceiling among its own functions, units, and activities.

It was recognized long ago that this was a rather inefficient way to go about preparing the Defense budget. For one thing, the budget submittal didn't provide the right kind of information for programmed decisions. It wasn't organized by programs and it extended only one year into the future. Secondly, the decisions were too decentralized to achieve a balanced over-all program. Each service naturally tended to exercise its own priorities favoring its own unique missions to the detriment of joint missions, striving to lay the framework for an increased share of the budget in future years by concentrating on alluring new weapon systems and protecting the over-all size of its force structure. Moreover, because attention was focused only on the next fiscal year, the services had every incentive to propose large numbers of new starts, the full cost-dimensions of which would only become apparent in subsequent years. This is the foot-in-the-door or thin-edge-of-the-wedge technique which one-year-at-a-time approaches at budgeting greatly encourage. So every year the programs of each of the services had to be cut back to fit the budget ceiling by program cancellations, stretch-outs, or postponements, but only for that year. Beyond the budget year, unrealistic plans continued to burgeon. Perhaps next year the budget would be higher.

program elements

We introduced the Five Year Force Structure and Financial Program to correct the basic flaw in the system, namely, the separation of planning and budgeting. The program is organized by outputs, like the military plans, which can be related to national military and foreign policy objectives far more readily than the traditional budget categories. The basic elements of the program are force units, like Army infantry divisions, or weapon systems, like Minuteman missiles, or development projects, like the Nike-X. The sum total of the program elements, of which there are about 1,000 when one includes the overhead elements, is the total program of the department.

Each program element has with it its full resource and financial costs year by year, five years into the future, for all the men, equipment, supplies, and installations required to make it effective. The total dollars required for the

program each year are within limits which the Secretary of Defense considers appropriate and feasible. The program shifts the emphasis from cost in next year's budget to cost to complete and operate a weapon systems program.

The program, established in 1961, is continuously in being. There is always a program of the department, an approved program extending from five to eight years into the future, but program changes may result in several billion dollars' worth of changes in the over-all program each year. Any office of the Department of Defense may propose a change in the program at any time. All major changes have to be approved by the Secretary after review and recommendations by the Joint Chiefs. So we end up with a flexible planning-programming-budgeting system with the new program linking the military plans on the one side and the budget on the other.

The function of the planning in the planning-programming-budgeting system is to develop better alternatives to those which are in the current, approved program. The planning is carried out at all levels of the department and it takes three forms. One of these is the more or less traditional military planning, like that which was embodied in the JSOP and which continues. The second is systems analysis, about which I will say more shortly. The third consists of blends of the two. The budget in the system has become, in effect, the first annual slice of the five-year program. The annual budget review continues, but it has become an intensive final analysis of the financial requirements of the program for the next fiscal year rather than a review of the program itself.

systems analysis

The second of the management techniques which comprise the planning-programming-budgeting system will be called systems analysis here. Perhaps I should explain that it has nothing in particular to do with computers. Everyone knows two things about Robert McNamara. First, they know about McNamara and his whiz kids. They know that he is a strong believer in analysis to supplement judgment and experience, which is true. Second, they know about McNamara and his computers, that he is enthusiastic about the use of high-speed computers, which to the best of my observation is quite false. My feelings toward computers are a little more kindly. I believe that they are here to stay, although there are times when I have a few elements of doubt. About two months after leaving the Pentagon in 1965, I received a notice in the mail from my old bank in Washington, where I had closed my account, that it had received a check from the Army for $650 to deposit to my account. My pleasant surprise was allayed by the suspicion that I would not be permitted to keep it. Being experienced in the ways of computers, you can guess what happened. When I left the Pentagon, I was signed to a consulting agreement, mainly to keep my security clearance alive. Each month, the Army Finance Department, which gets out the payroll for the Department of Defense, is supposed to be advised that I spent 00 days consulting. Somehow this got transcribed erroneously as 10 days. The computer calculated my gross pay as $860, made appropriate deductions to get it down to $650, searched its memory to determine what to do with it, and mailed a check to my old bank. My old bank, also thoroughly computerized, detected nothing wrong and deposited the check in my closed account. In the next chapter, I received a demand from the Army Finance Department that I return not only the net amount of $650, but the gross amount of $860. If you are concerned, I did not comply. Someone has to stand up to this kind of bullying. I let the computer find its own deductions.

Systems analysis, in the sense in which I am using

the term, has nothing in particular to do with computers. You can do it with or without computers. You can do good analyses without or you can do bad ones with, or vice versa. Systems analysis in the sense of cost effectiveness analysis is nothing more nor less than economic analysis applied to the public sector of the economy, or, indeed, to the private sector. Economic analysis is concerned with the allocation of resources. Its basic tenet is to maximize the value of the objectives achieved minus the value of the resources used. In business, this reduces itself to maximizing profits, because both income and outgo are measured in dollars. In Defense, and generally in the public sector, we lack a common valuation for objectives and resources. Therefore, we have to use one of two weaker maxims: maximize objectives for given resources, or minimize resources for given objectives. Systems analysis attempts to assist the decision-maker to choose weapon systems and modes of operating them which maximize some military objective or objectives (for example, the number of attacking bombers or missiles shot down) for given resources (for example, budget dollars available).

The function of the program is to cost out the plans to keep them feasible and realistic, to make the planners face up to the hard choices. The function of systems analysis is to get dollars into the calculations at an earlier stage, into the planning process, into the calculations at an earlier stage, into the planning process, into the evaluation of alternative ways of achieving a military objective. You can't choose the optimal way or even a good way without knowing about the alternatives, what the alternatives might achieve and what they would cost.

From small beginnings which long antedate McNamara —in fact, they date back at least to World War II—the use of systems analysis has been rapidly expanded since 1961 until it has become a vital part of the planning and decision-making process in the Department of Defense. Since September, 1965, it has become the sole function of an Assistant Secretary of Defense.

So, in summary, the program provides the link between planning and budgeting, relating forces and their costs to national security objectives, while systems analysis provides the quantitative analytical foundation in many areas—but by no means all—for making sound choices among alternative means of achieving the objectives. Between them, they give the Secretary of Defense the tools which are necessary for planning a program with balance and some rationale and, therefore, for the unified management of his $70-billion-a-year department. For the first time, the Secretary of Defense is capable of exercising the authority given him in the National Security Act of 1947, which attempted to unify the military services.

future

Let me speculate briefly now about the future. First, all large organizations, whether government, business, or mixed, have many problems in common. I am very impressed by some of the similarities, having recently moved from one large organization to another which sounds very different, but which has equally interesting problems. Among these is the problem of achieving realistic, balanced, rational plans. I found academic planning in the University of California in exactly the same kind of disarray we found military planning was in the Department of Defense and for essentially the same reason. And I am sure that similar techniques do have applications in other organizations. In fact, these techniques already have widespread application. The Department of Defense is not the first organization to develop a financial plan or program which extends more than one year into the future and which has evolved budget categories more suitable for planning—for intermediate- and long-range planning—than objects of expenditure. Other organizations have confronted and more or less satisfactorily solved the problems of unrealistic and too-decentralized planning. Similarly, many well-managed businesses make explicit quantitative economic analyses, such as alternative equipment and facility plans, which are indistinguishable from what is called systems analysis in the Department of Defense. Operations researchers have assisted military, other governmental, and business planners with varying degrees of success for the past 25 years. What is different in the Department of Defense is that systems analysis there has become a generally accepted way of life, perhaps for the first time in any large public organization.

However, there are risks and dangers as well as opportunities in the application of new management techniques —including the risk of discrediting the techniques, if one tries to move too far too fast. Although it did not appear easy at the time, there is no doubt in my mind that the Department of Defense, or much of it, is easier to program and to analyze quantitatively than many areas of civilian government. For example, it is certainly easier than the foreign affairs area. Quite apart from these difficulties, the substantive problems in other areas are different and new. In Defense, we had several hundred analysts at the RAND Corporation and elsewhere developing programs and systems analysis techniques for a decade before the department attempted any large-scale general application. No remotely similar preparatory effort has gone into any other governmental area and the number of trained and skilled people is so limited that they are inevitably spread far thinner in other departments of government than they were and are in Defense.

conclusion

But finally, if I may end on an encouraging note, although these techniques are mutually supporting, we are not dealing here with the question of either/or. There is an infinity of degrees. Not only may one introduce a program budget without systems analysis, or vice versa, but each may be used in limited areas or ways, and sometimes quite productively. For example, in foreign affairs, where quantification of objectives and therefore full systems analysis is so difficult, one can, I think, organize the budget more meaningfully for planning purposes. In many areas, a systems cost analysis is possible and useful, although a full systems analysis, including measurement of objectives, is not yet.

I am convinced that there are many institutions which are quite ripe for the application of some efficiency-inducing management techniques and for basically the same reason that the military was ripe. Hospitals, for example, have, like the Army and Navy, traditionally and proudly operated on a not-for-profit basis. Just as the generals and admirals asked "what do dollars matter when national security is at stake?", doctors and hospital administrators ask "what do dollars matter when life is at stake?", and I have heard educators ask "what do dollars matter when the quality of the next generation is at stake?" Well, the dollars do matter. Granted that these are all high priority claimants on the national purse and that there is a kernel of truth in each protesting cry, the importance of objectives does not justify ignoring the canons of economy and efficiency, which are to achieve the most from whatever limited resources the nation, in its wisdom or unwisdom, places at our disposal. ■

VIRTUAL MEMORY AND PAGING

part two: dynamic relocation

by IVAN FLORES

In Part I we saw that paging makes the computer memory appear to the programmer to be a different size from what it actually is: in the small computer the memory looks smaller than it really is; in the large system the large core memory appears even larger, and takes on the size of the auxiliary memory.

In large machines, we find paging associated with multiprogramming where we wish to: 1) quickly switch between one program and another; 2) locate a new program or data segment as quickly as possible; and 3) relocate programs "on the fly." This last need is now discussed.

When several programs are using the computer simultaneously—when parts of them reside in main memory at the same time—there is a problem of allocating memory to provide for efficient use of the processor. An effective solution is to re-allocate memory as required without moving the entire program.

Suppose memory were crammed with data and three programs, A, B and C. Suppose, also, that A has requested an I/O operation which disables it for a period. The *supervisor* chooses B as the next program to operate as A uses I/O. Some time after B takes over, it makes a request for a segment not currently in memory. Something must give—there is no room. The *spacemaker* is called in to find a marginally used block. It happens to be one from A. This block is *pushed* and the segment requested by B is *pulled* to replace it. B continues when it gets the chance.

Now suppose, when A returns, it finds that it needs the segment pushed to make space for the segment requested by B. After the spacemaker chooses a block to retire, the old segment is returned by the auxiliary memory (*AM*)) *monitor* for A. Generally the segment will not appear at its old location in A, but the dynamic relocation feature permits A to reference this segment regardless of which block it has been placed in by the monitor.

The point is to keep the computer from doing a lot of wasteful push/pull operations. Suppose in the example that when A returns, it finds very soon that it needs the segment which had been pushed for B. To get it returned, the spacemaker is called in. It pushes a segment of B to replace with the old one required by A.

When B comes back, it soon needs the most recently pushed segment and makes a request for it. And so it goes: more time is spent pushing and pulling than in problem solving. What really happens depends on how well the spacemaker is designed.

As one would expect, the demand for new pages is directly proportional to the fraction of the program absent from memory. These were essentially the findings of Fine and Jackson.[1] When a small fraction of the program is present they found that "for 59% of the cases less than 20 instructions were executed . . ." before another request for a page was made.

This bodes ill for the swap problem. Time will tell

The research for this article was supported under Grant No. At(30-1)-370A to Stevens Institute by the Atomic Energy Commission.

[1] Fine, G.H., and Jackson, C.W., "Dynamic Program Behavior Under Paging," *Proc. ACM Nat. Conf. 1966, ACM Pub. P-66*, Thompson Book Co., Wash., D.C., 1966, pp. 223-8.

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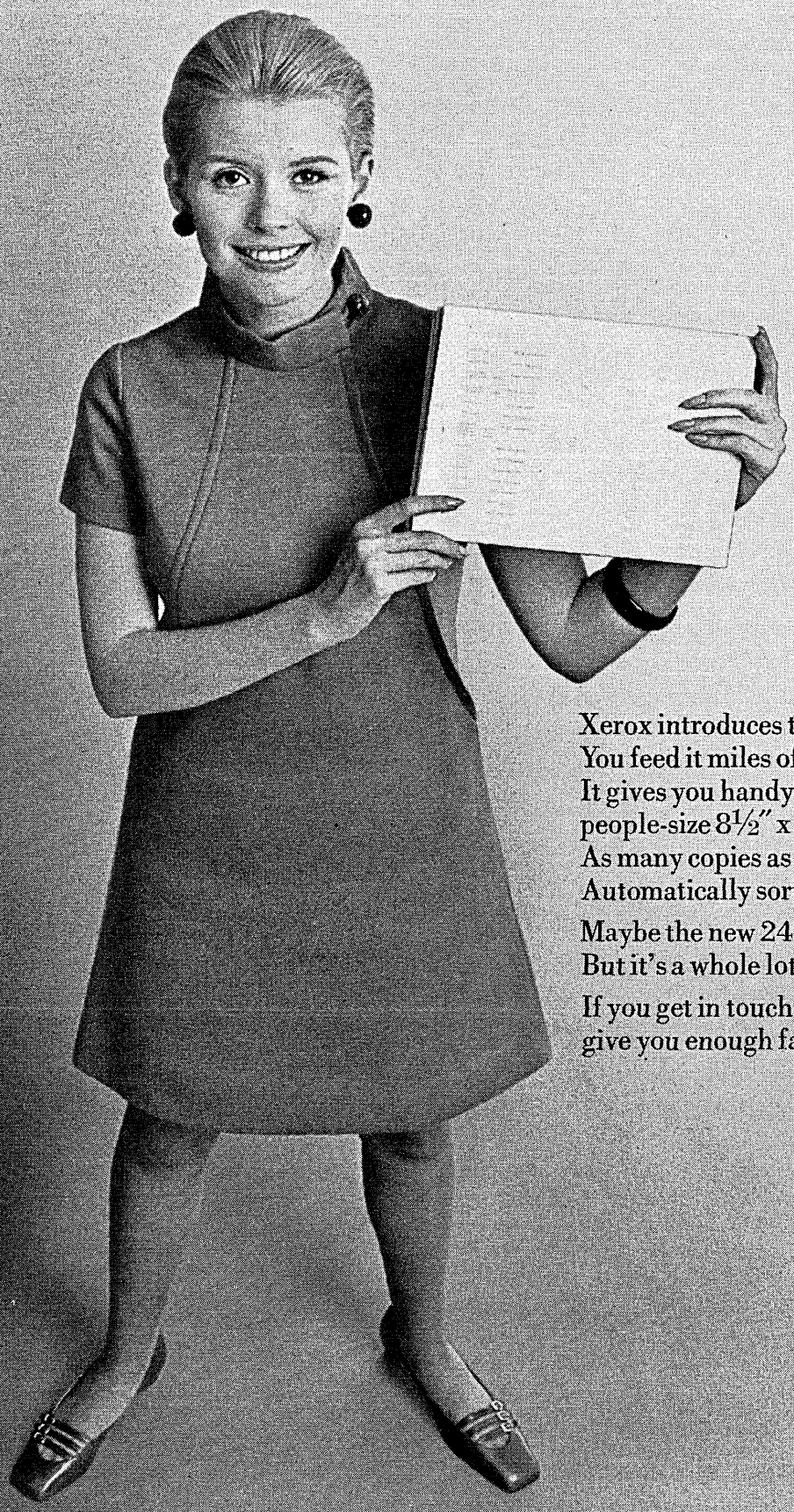

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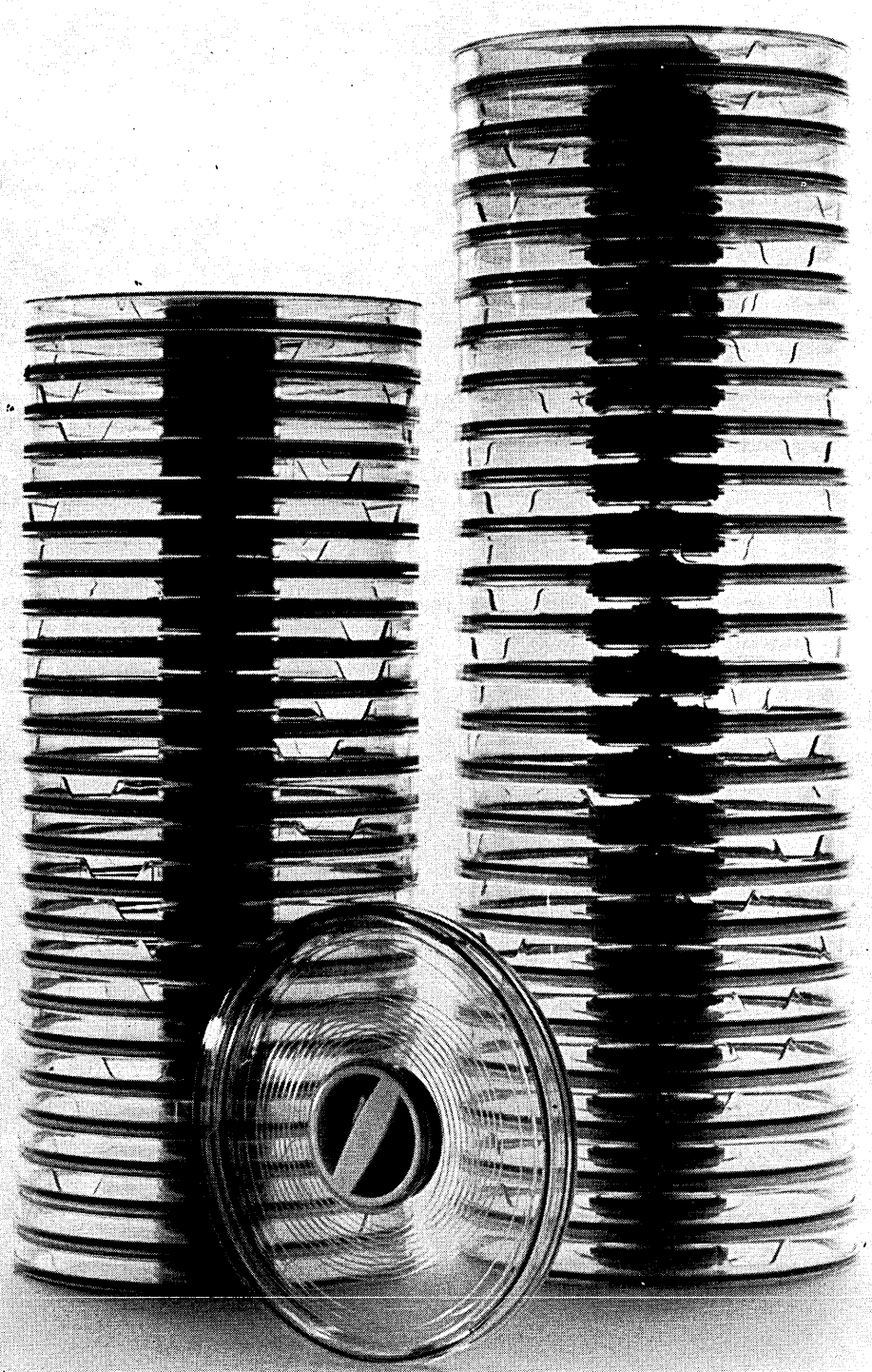

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whether dynamic relocation has been over-rated. Semi-total occupancy may be the answer.

Hardware systems have been designed to provide automatic paging. When dynamic relocation is also required this increases the complexity of the hardware. We next examine the hardware of the CDC 3300 which provides automatic paging but no dynamic relocation. Then we shall see how the IBM 360/67 provides both features, mostly in hardware.

purpose of paging hardware

The CDC 3300 paging system[2] extends the apparent size of memory accessed. It is the same principle used by the small computer where a larger operand address is required than is actually available in the command word. This is not a simple extension of core memory; it is used to make every cell of memory addressable from the operand address in the command.

The other aims of the paging system are relevant multiprogramming demands: 1) setting up specific regions in each program inviolate to other programs; 2) providing for interchange of control between programs; and 3) protecting areas mandated to given programs.

It is also stressed that the CDC 3300 does not provide for dynamic relocatability because, among other reasons, a fixed table size is provided for each program, no room is provided in the table for page use statistics, and the programmer's addressing space is smaller than main memory.

implementation

The system provided by CDC is completely hardware implemented. In this presentation some liberties are taken to facilitate the explanation. Fig. 1 illustrates the hardware provided to run as many as eight programs simultaneously. Only one program is in control of the machine at any one time. The multiprogramming supervisor provides for progression from one program to another. As it does so, it resets the *program register* to indicate the program now in control.

The heart of the hardware system is a *page file* which provides 16 registers for each of eight different programs. Each register provides a translation entry between the segment number found in a program and the block number for that segment within the memory as presently set up. The segment number in the command ranges from 1 to 16—the number of blocks that may be translatable by the page file—and 128 pages of about 2000 words each are addressable by the system. However, blocks are addressable in units of quarter pages (there are 516 or 1008 quarter pages addressable).

In Fig. 1 we see in the Instruction Register a request for a load of segment 04 word 361. Program 5 is now in control. Since the program register contains 5, we look up the information for this program in area 5 of the page file. On the fifth line pertaining to program 5 (04) we find the entry, 403. This is placed in the memory address register along with the word number, 361. The memory will access block 408, word 361.

When we look up the desired segment from the instruction register in the page file, we may find that the corresponding entry is tagged to indicate that the desired block is absent. This causes an interrupt to the *multiprogram monitor* which can obtain the information from main memory (MM).

[2]CDC 3300 Reference Manual Pub. Number 601 57000 Rev 01.

Without virtual memory the problem of push/pull does not exist. If more program or data is required than can be stored in the allocated number of blocks, the supervisory system can often handle this by assigning more than one program area to a given program. Other non-automatic techniques are also available.

software requirements

Let us briefly examine the program system requirements for this type of computer in a multiprogramming environment.

An interrupt can occur from many sources. Among them are these two: 1) the program makes an I/O delegation, which causes a holdup in that program; 2) an I/O activity has reached completion and interrupts the control subsystem.

Control goes to the multiprogramming supervisor, which uses a program selection algorithm to determine what's next. This algorithm may be based on priority, activity or some other criterion. It may cause the same program to be returned to or select a new program for performance.

For a new program, some changes must be made. The interrupt places the *saved* instruction register and other register information somewhere in memory so that job is out of the way. Next, the program register must be set to indicate the number of the new program. Then the registers for the new program must be *unsaved*; that is, they must be brought back from memory locations at which they were saved. Among these is the instruction register information which must be unsaved as the next instruction to be performed in this program. This probably will require reference to the page file, depending upon whether instruction register information was stored in absolute form.

Setup software is necessary to evict a program when it is completed and to pull in a new nonresident program for initiation. Eviction consists mainly of resetting pointers. It is up to the loader to get new program information, which is then stored in blocks set free by the evicted program. Empty blocks were posted to an available block list where they are now available to the loader for the new program.

As new segments are brought in, they are assigned block numbers from the available block list by the loader. These are entered in the page file for the number assigned to the incoming program. The loader continues until the program or a working portion of it has been loaded. It then turns control over to the new programs (or a different resident program).

A segment addressed which is not in the memory is determined by finding 0's in the page file for that program. The situation envisioned here is where all the possible blocks have not been assigned to a given program. The program requests a segment which is not present in memory, although there is room for it in memory. It is up to the monitor to go to the available space list and pull out a block assignment for the new segment. This is posted onto the page file. Later the page file may be entered normally when this segment is addressed.

Since the pull of the new page requires the AM monitor, it is highly probable that the requesting program is released and another program initiated. When a new turn comes up for the requesting program, hopefully the new page has been entered into main memory by the AM monitor. In that case, a search of the page file gets us to the proper page, and the requesting program continues.

360/67 philosophy

The IBM 360/67[3] has virtual memory hardware to facilitate multiprogramming. The design provides both

software and hardware for easy swapping between AM and MM. The hardware provides for facilitation in several facets of the accessing problem.

Multiple tables are used. These are arranged in the hierarchy presented in Fig. 2 and discussed below. Since table organization is emphasized in this machine, table design, size and location will be discussed. Only as many tables as required are allocated and the space for each table can be lengthened by link list techniques so that memory space can be used more effectively. This permits variability in program size. Few or many segments can be allotted to a given program and this may be done dynamically according to need.

Model 67 handles several programs at once. An assignment for the machine may consist of one or many programs, the number limited primarily by software specifications.

Each program is divided into segments; each segment consists of a number of pages; each page has one instruction per line. We use line because the machine uses variable length instructions consisting of a variable number of bytes.

The hierarchy of program organization is then: 1) program; 2) segment; 3) page; 4) line. The last three comprise a virtual address within a program. Table organization parallels program organization.

In Fig. 2 a program directory or program table lists the programs which the *loader* has loaded into the computer. This means that they reside now either in AM or both AM and MM. There is one pointer in the program table for each program. It points to a segment table which lists all the segments which comprise the program with pointers to all page tables for that segment.

A page table lists the starting location for each page in a given segment. Generally, pages are not contiguous. The need for a page table arises *because* pages are spread throughout memory.

[3]IBM Sys. Ref. Lib., System/360 Model 67, Time Sharing System, Preliminary Tech Summary Form (20-164).

address translation hardware

Assume we have an effective virtual address stored in the address portion of the instruction register (Fig. 3), divided into three parts—segment, page and line.

The table register stores the starting point of the table for the program currently in control and points to the beginning of the segment table. When offset by the segment portion of the address in the instruction register (IR) we get a pointer to the starting address of the desired block in memory. It is inserted in the lefthand portion of the memory address register (MAR). The righthand portion will be filled with the line number L from the instruction register; the MAR now contains the absolute address of the correct type.

As described above the IR contains, among other things, an operation code and a virtual address consisting of segment, page and line. Actually when an instruction is procured from memory the operand address may have to be augmented by a relative base and by indexing to get the effective virtual address. This is done conventionally by passing quantities through adders and returning them either to a special register or to the proper portion of the IR.

As described, the computer must use both tables each time an operand is required. By conventional programming at least two complete accesses of memory would be required to reach each table (and two accesses for the commands). Further, some masking and extracting are essential to form the proper addresses (and commands are needed to request the masking and extracting).

Table lookup above is simply multiple indirect addressing. The difference between the indirection required here and normal indirect addressing is that the indirection address field changes with each table use. This is not difficult to implement in the hardware.

Assume the *table register* has been loaded by the multiprogramming monitor with the address of the start of the segment table, Fig. 3. The first memory access uses an effective address formed by adding the contents of the table register and the segment field of the IR. Addition can be performed as the information is sent to the MAR. The result of this access is an entry in the segment table which appears in the memory data register (MDR).

Next we find the page table. The starting address

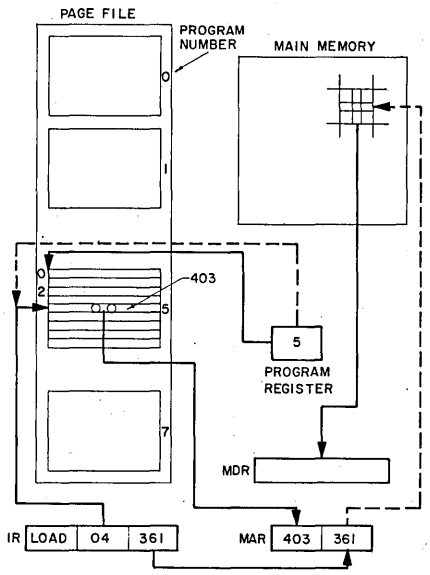

Fig. 1 Paging Activity, CDC 3300.

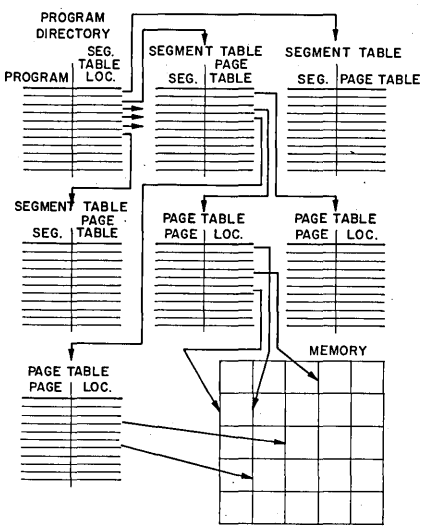

Fig. 2 Hierarchy of Tables.

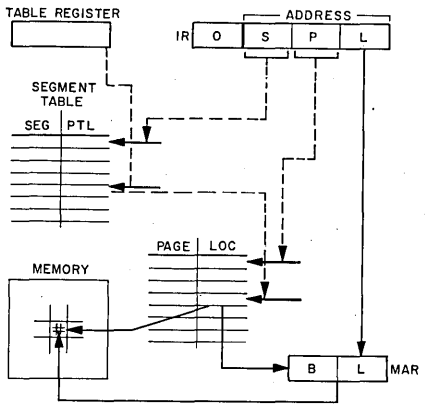

Fig. 3 Translation from Virtual Address to Absolute Address.

of the page table is a field of the word now in the MDR. It's offset by the page quantity P stored in the IR. The contents of the MDR properly masked is one entry to an adder; the other entry is the page field from the IR; the adder output is sent to the MAR which points to an entry in the page table. This is procured by the memory hardware and placed in the MDR.

One last indirection is performed. The starting address of the block (or the page address) is one field of the work in the MDR. The desired byte is a distance, *L*, away from this starting position. The MDR properly masked is one input to an adder; the L field from the IR is the other input; the result is passed over to the MAR to end up there as shown in Fig. 4. MAR now points to the desired operand.

look behind

The automatic indirection hardware has reduced the number of extra memory accesses for automatic paging to a mere two. Even so, this means that *every* operand acquired requires a total of three accesses or two more than might ordinarily be necessary. To reduce this number in a majority of the cases, *look behind* registers are furnished in the Model 67. These comprise a bank of associative registers whose purpose is to hold translation information for the most recent pages accessed.

Fig. 4 shows how the look behind registers work normally—that is, if the page to be accessed is listed in the look behind registers. Assume a command in the IR and the effective virtual address is currently in the operand

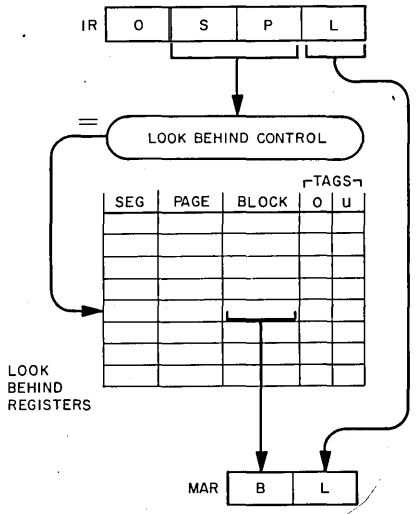

Fig. 4 Normal Use of Look Behind Registers When Desired Entry is Present.

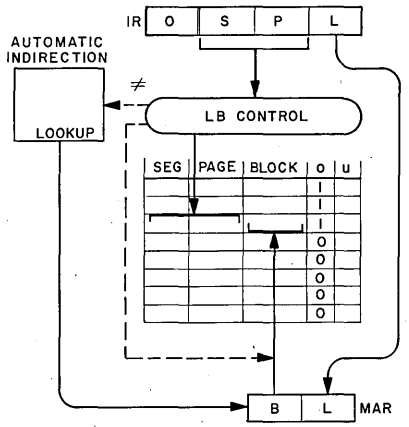

Fig. 5 Making a VM Entry in the Look Behind Registers When There is Still Space There (at Least One 0 Bit = 0).

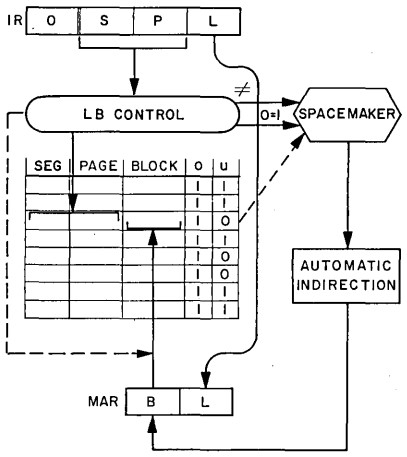

Fig. 6 Making a VM Entry in the LB Registers When They are Full (All 0's = 1).

portion of the register. Before automatic indirection is performed the look behind registers are examined as shown. The segment and page are sent over to the look behind control unit, which performs an automatic content search. This is described in "Computer Programming."[4]

When associative memory is provided in the hardware registers, lookup can be performed in a fraction of a microsecond. The control unit searches all the registers simultaneously, looking for one for which the proper portion is identical with the segment and page furnished—here, S and P. This is done by examining all entries simultaneously; if there is a correspondence, an indication is made.

In the example the segment and page label contained in the instruction register is also found in the sixth look behind register. Therefore, the block number of the required operand is the same as that found in this entry.

The next step for the look behind registers control unit places this block number into the MDR. The control subsystem (overall computer control) transfers the line number from the R to the MAR which now holds the absolute address of the operand.

lookup activity

Starting with the same condition—a command with an effective virtual address in the instruction register—let us examine another situation, presented in Fig. 5. The look behind unit examines segment and page contents of each register and finds that the desired entry is missing. This calls for a lookup activity. Control is turned over to the indirection hardware, which makes a trip through the two tables to determine the location of the desired block in memory. This is placed in the MAR and we are ready to access the operand.

Before we do, however, we wish to set up the look behind registers in case a nearby operand address is accessed in the near future. The block field of the contents of the MAR should be placed in one of the look behind registers. To determine which one, the two tags *O* and *U* are examined. O stands for occupancy and U for use. In this situation only two of the look behind registers are occupied. This is probably because this program has been started recently.

Although there are six vacant registers, the first of these is chosen to enter the location information: segment and page fields are transferred from the IR by the control unit into the third look behind register; block information is transferred from the MAR to the fourth look behind register; the occupancy bit for register 3 is changed from 0 to 1. Now the operand is accessed and the control subsystem executes the command.

Fig. 6 shows a somewhat different situation. Again the segment and page information is turned over to the control unit of the look behind registers. An entry is not found and so the automatic indirection hardware will be called in to load the MAR as before.

The occupancy bits are examined; they are all 1. All eight look behind entries are full. One of these must be eliminated. (It is more likely that *this* entry will be

[4] Ivan Flores, "Computer Programming," Prentice-Hall, Englewood Cliffs, N.J., 1966, Section 3.7.

referred to than *one* of the eight presently occupying the registers.)

The use bits determine which entry to replace. The list of use bits is examined; the first one found, which is 0, indicates an entry which has not been used as recently as other entries and hence most eligible for replacement; this is the destination of the new entry. In the figure, segment and page information is transferred from the IR to the third look behind register.

Now that the look behind registers have been updated the command can proceed with a memory access for the operand. Notice that the previous resident of look behind register three has been expunged.

Each time an entry in the look behind registers is used, its use bit is changed from 0 to 1; if it is already 1 it remains so. This takes place only if at least one of the other use bits is set to 0.

Thus after the use bits are all set to 0, one after another, one of the use bits is set to 1. There is always at least one bit which is 0. As soon as we try to set the last use bit to 1, this causes all the use bits to be reset to 0 assuring that there is always one look behind register as the next one to be loaded.

software intervention

Software intervenes as far as virtual memory is concerned in at least three instances: 1) set up, 2) certain table accesses, and 3) push/pull.

Software manages the set up and satisfactory operation of all the tables and directories required for multiprogramming. This is initiated when a program has been completed, satisfactorily or otherwise. All segment tables and page tables belonging to that program are cleared, and locations returned to the available space list, since they are now free.

Generally a new program is brought into AM to take the place of the old one. The origin of the segment table for the new program is set up and at least the first segment assignment in the segment table is provided. A pull operation as described below is required to get new segments and pages into memory.

We have described what happens as long as a page addressed by the program is present in core. Suppose there is space in core but the page desired is missing because the entire segment is unlisted in the segment table, or the new page for this segment has not been added? In the first case a new page table is necessary; in the second, a new entry for one page table is required. The philosophy is similar and we examine only the latter case.

Automatic indirection takes us from the table register through the segment table to the page table. When the page entry is sought, it is found to be missing. At the spot where the page entry should be, the residency bit is 0. The indirection hardware turns control over to the software, which must now obtain the page and update the page table. The software consults an available space list of unoccupied blocks in memory. For this case there are entries in the space list. All that is required is a pull. An available block location is obtained from this list and control is turned over to the push/pull software.

A block transfer from AM is now required. This will generally cause an interrupt of the program now in control. A disc or drum access takes a long time compared to normal program sequencing, and so another program will probably be brought in while the block transfer takes place.

How long the new program remains in control depends upon the software monitoring system and the time slice allotted to the program. Eventually control will go back to this program. At that time the command which caused the interrupt because of the missing page will be brought into the IR and the look behind registers cleared. Now when the segment and page tables are consulted, the desired block is found to be in memory.

The page table is updated at the time that the AM monitor interrupts indicating that its task is complete. The push/pull monitor takes over momentarily, updates the page table and turns to the other program that was in control.

Once the original requesting program regains control, IR is processed in a normal command since its operand is listed in all the proper tables and the look behind registers are clear.

In the case above, space for a new block was obtained by looking in the available space list which contained the address of at least one empty block. Suppose now that there is no space available in core, a likely situation. How does the push/pull monitor choose a block for the page desired by this program? This is done by the spacemaker using some relation strategy. A contrast of these strategies is a paper in itself.

The spacemaker chooses a block for expiration and determines if it has been altered during use. If so, a push is delegated to the AM monitor. Next, the supervisor selects a program and turns control over to it.

When a push completion interrupt occurs, a pull is immediately initiated via the AM monitor. When a pull completion interrupt occurs, the tables for that program are updated and control returned to the current program. Eventually the original program regains control and finds its required page thru the updated tables.

new commands

The foregoing has described how data referenced within a command word is obtained in a paging system. But how does one sequence from one command to another? Remember, program information is paged too.

As long as a complete instruction counter is provided it may operate independently of the look behind registers. It should contain segment, page and block information.

The next instruction is the one right after this one—just advance the instruction counter. As long as the same segment and page are indicated, the same block is used. Only the byte is different.

If the line indicator overflows to indicate a new page, automatic indirection is called for. The new page is looked up in the same way as was described for a new data page. The block number is placed in the block portion of the instruction counter and a fetch initiated.

For a jump, the new sequence and page is filled into the instruction counter from the operand address. Then the automatic indirection hardware takes over to get the block. Finally a fetch is done.

summary

Paging and virtual memory is a technique which has been incorporated via both hardware and software to facilitate multiprogramming and to some extent multiprocessing. This is done by automatic fragmentation of programs and data without the awareness of the programmer. Dynamic relocation, which is facilitated by paging, permits quick restoration of idle programs in a multi-access environment.

Whether paging, in spite of its high software overhead, can compete with complete program swapping is a matter for conjecture. ■

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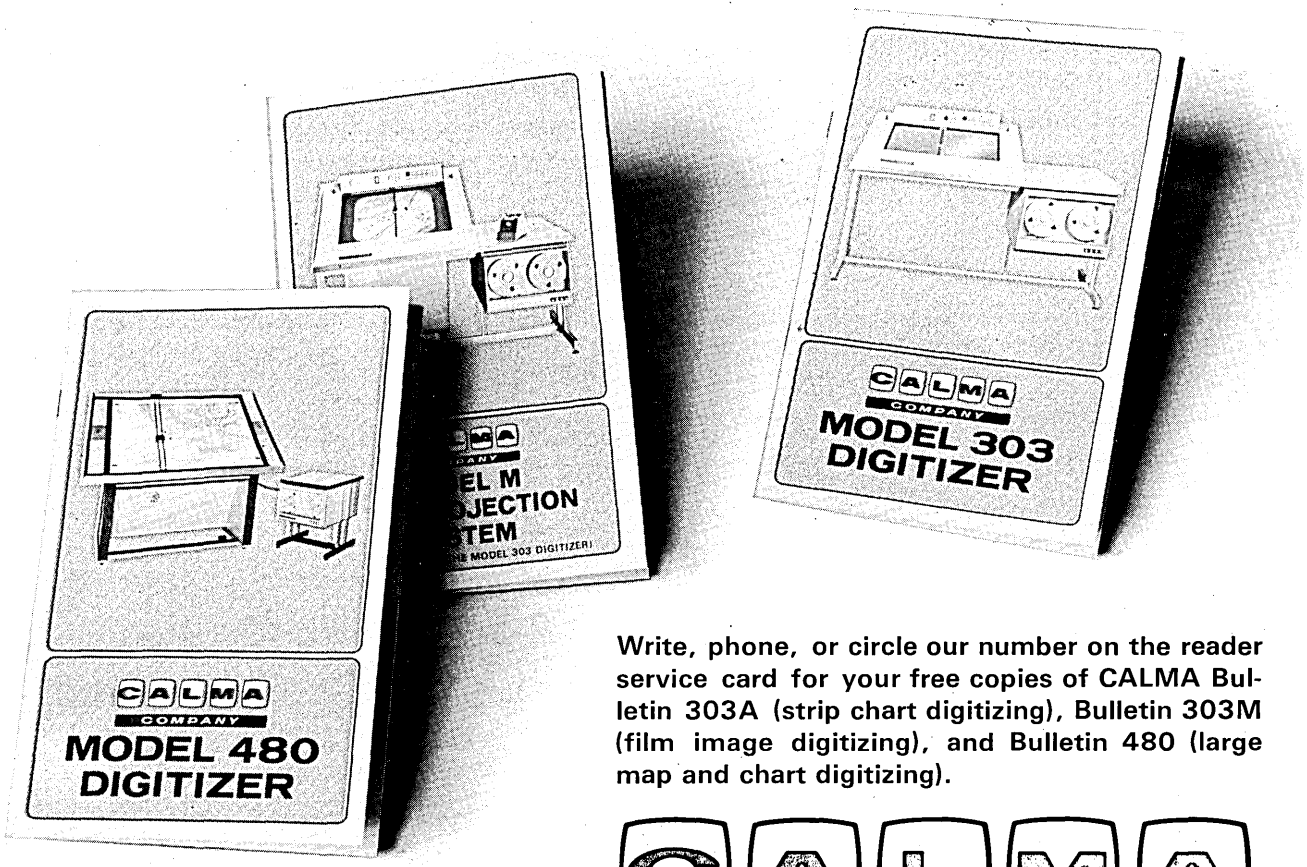

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CIRCLE 26 ON READER CARD

THE WRINKLED RED CARPET

can trip you up

by JOHN WILLETT

The programmer is perhaps the hottest commodity on the job market today. This fact is alarmingly documented by a recent magazine article which estimates that while we now have 120,000 programmers in this country, we are still short by 55,000.

Evidence of the programmer shortage confronts us every day. The help-wanted pages of almost every daily newspaper are awash with ads for programmers, and the inducements are almost as numerous as the ads: opportunity, advancement, challenge, pioneering activity, professional atmosphere, excitement, creative independence, intellectual sanctuary and countless others. Behind the scenes, meanwhile, company personnel officers and advertising men join heads to come up with new approaches, new catchwords that they desperately hope will strike the programmer's "hot button."

Unfortunately, many companies continue to spend thousands, even hundreds of thousands of dollars, trying to attract programmers, only to fumble the ball during the critical interview or "red carpet" phase of the hiring process. In some cases, they lose the applicant at the outset. In others, they hire him only to lose him a short time later because of job dissatisfaction. In both instances, poor communication may be playing a large role.

This article sets forth some common but often violated interview procedures. Their objective: a clear understanding of each other by both the applicant and the company. While primarily directed to those doing the hiring, it may benefit the job applicant himself by alerting him to certain practices that work to his disadvantage.

the rules

Resumes before the interview. Job hunters often are reluctant to send resumes to a company because they feel that this puts them out on a limb. And some companies, afraid of letting precious talent slip through their fingers, will settle for just a few facts over the phone before setting up an interview. In doing so, the company and the applicant suffer. While one of the reasons for resumes is to filter out the qualified applicants, the most important purpose they serve is to enable the interviewers—personnel people and department managers—to prepare for an informative interview. They permit the interviewers to think at length about the applicant's background in order to prepare more penetrating questions that will evoke more revealing answers.

Relying solely on the interview to produce a clear image of the candidate is risky. Without sufficient direction, conversation may deteriorate into irrelevant discussion just for the need of having something to say. Such discussions, of course, prevent more useful information from coming forth and more interviews are necessary than might have been otherwise. Or worse, if the right questions and answers don't emerge, a good candidate might be rejected, or the company might not put its best points forward, or the candidate might be hired only to leave the company a few months later because of a misunderstanding.

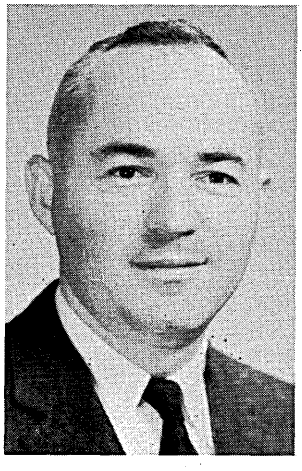
Just as important as the need for a resume is the resume's content. The resume should be concise and factual. All too frequently however, resumes are long and windy and more of a credit to the applicant's creative genius than to his programming talent.

I once received a remarkable three-page resume from a programming novice in which every aspect of his life was draped in ornate prose and embellished beyond credibility. The account of his Boy Scout activities resembled a Silver Star citation while his listing of professional and social memberships included everything but AA. When asked what he did in the Air Force as an "administrative aide for automotive activities," he said that he was a motor pool clerk. Somewhat chagrined, I asked if he had considered sales. "No," he said, "but I might if you have any good openings."

Knowledgeable recruiting staff. A recruiting or personnel staff need not be staffed with math PhD's, but its members should have at least a basic knowledge of the job and the work involved. An applicant seeking more information of a fairly general nature before making an appointment does not like to be told: "Well, this is a program design job for a program designer who will be engaged in the design of programs for our program design group." Or, "I don't have that information, but I can get it for you." In addition to being annoying, this type of remark conveys indifference on the part of the company in both the job and the work involved.

Occasionally, a personnel man will try to snow his way through an interview, dropping a few "in" terms throughout the discussion and ending up with egg on his face. I recall one recruiter's response when told by an applicant that he had designed an assembly system. "Well, you'll be right at home here. We have an assembly line too."

Delegate departmental interviews. The department manager should allow some of his people to question and talk with the candidate. Such a procedure provides the applicant with a better view of the department, people, organization and attitudes. Moreover, collective judgment concerning the applicant is likely to be more valid than that of the department manager alone. Incidentally, this is also a good way to develop interviewing



Mr. Willett is supervisor of technical recruiting at The Foxboro Co., Foxboro, Mass. Originally an engineer, he has been technical recruiter for Raytheon, employment manager at Northrop-Nortronics, and manager of Scientific and Professional Employment, Inc.

ability and a feeling of responsibility among various members of the department.

Don't waste time. Interviews should go off like clockwork. Needless delays have a tendency to disturb and even anger the applicant. Put yourself in his shoes. He may have taken a couple of hours off from his job. He may even be in the offices of the competition. He may feel edgy, guilty and vulnerable. He may have a lot of work back on his desk and he won't appreciate being put even further behind. Unless he's really sold on what the company has to offer, avoidable delays may make him think twice before returning for more of the same. You can speed up the first interview by avoiding prolonged excursions into company history, philosophy or benefits at this time. It's much too premature for such discussion.

Stick to the facts. Personnel and recruiting people like to hyperbolize. "Dynamic," "tremendous" and "great" are three of their favorite standbys and sometimes, to really make an impression, they'll parlay all three: "It's a great company with dynamic people and tremendous potential." To anyone half as perceptive as programmers, exaggeration completely destroys credibility and attentiveness. After delivering just such a spiel on one occasion, a personnel manager concluded with: "But I'm sure you've heard about us before today." "I sure have," the applicant said, "but I thought I had to die to get here!"

There's nothing wrong with the use of superlatives when they're backed up with facts. However, even here, a "tremendous" growth of 10% is not so tremendous if

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"Think of it not so much as losing a daughter but as gaining a logical designer."

every other company in the industry is doing as well or better. How much more effective to say, "We had a 5% increase in sales three years ago, 8% the next year and 10% last year." Such a statement carries its own impact and needs no rhetorical accompaniment.

Draw the man out. The purpose of an interview is an exchange of information between the applicant and the company. Yet, more often than not, the interviewer does most of the talking. Often, the applicant is guarded, perhaps even fearful of making the wrong responses, hence he may volunteer nothing and his answers will be short and to the point. After a few brief and fruitless exchanges of this sort, many interviewers revert to a monologue and the company learns nothing about the applicant. If the interviewer is patient enough, persistent enough, the applicant will open up. Everyone likes to talk about himself.

No promises. A promise is a bad practice under nearly all circumstances. But promises are made, sometimes with good intentions, other times accidentally and still other times deceitfully. A department head may be faced with a real hot programming applicant and, hating to lose him, knowingly fail to curb some far-reaching implications ("I didn't come right out and say that; can I help it if that's what he infers?"). Or he might say something like, "In time, I'll need an assistant manager and the job is wide open," knowing that the job is virtually sewed up by another man in the department. The manager might convince himself that no deceit was intended, that anything could happen if the new man's performance is outstanding enough. In reality, however, the man would have to be outstanding indeed to overcome such obstacles as seniority and the reactions of other department members.

Nothing will spur a man to seek greener pastures more than the feeling that his company reneged on a promise.

Follow-up. I make it a rule to talk to the applicant and the department manager after the first interview. Perhaps I can salvage a situation. But, more importantly, some information may turn up that will give me a much sharper picture of the position involved and the type of person that we want to fill it.

It also may happen that the follow-up will produce some valuable feedback concerning the department manager's handling of interviews. For example, I was told of a department manager in one company who frequently interviewed candidates educated at one of our better colleges, yet never hired one of them. As it turned out, he apparently delighted in calling them in for interviews and keeping them waiting, then deprecating their backgrounds and, in particular, their education. The applicants were reluctant to report his behavior because they felt it might be his interviewing style and they didn't want to risk losing the job. Fortunately, one applicant cared little for the job and far less for the manager and brought the situation to the attention of personnel.

conclusion

Many recruiters and personnel managers will view some of the foregoing practices with an arched brow. "Insist on a resume, and blow the deal before we even have a chance to talk to the man?"

"In view of today's job market conditions, it's unrealistic to tell anyone to stick to the facts; salesmanship is a must."

"We don't make promises, but we do use inducements, and so does everyone else."

Comments such as these reflect a common attitude in the recruiting of programmers: hire the man and worry later about losing him. I can understand the attitude—in view of the programmer shortage and the highly competitive nature of the programmer market—but I certainly don't agree with it. Failure of the company and the applicant to arrive at a clear understanding of each other will almost invariably lead to an earlier termination of employment than might be the case otherwise.

If not corrected, failure to observe proper and proven interviewing procedures will continue to add to the fortune now being spent by the industry in recruiting expenses. I think, therefore, that every company would do itself a service by taking a good look into its own red carpet. As for the programmer who may now be contemplating another job, I would advise that, before he makes a change, he make sure that the grass *is* actually greener. ■

JOB-SHOP SIMULATOR

small but effective

by RICHARD B. BLACK

One of the major obstacles to more effective use of the computer as a business tool is the widely held view that sophisticated applications require large systems beyond the resources of small and medium-sized companies.

Here at Warner Electric Brake & Clutch Company, with net sales of $33 million, we have been disproving this viewpoint for three years by using an IBM 1440 system at the end of the application spectrum generally considered the most sophisticated: long-range planning. Around this equipment, we have built an integrated manufacturing planning and control system whose main element is a computer-simulation model of a job-shop production facility consisting of 400 machines, some 10,000 part numbers, and 4-5,000 different production routings, each of which averages seven operations.

One of the most dramatic measures of the system's utility has been the ability to negotiate an unsecured bank credit for capital expansion that amounts to almost two-thirds of our net worth. The fact that this is almost twice as good as the normal credit-to-net-worth ratio can be directly attributed to the type of advanced planning the model and the rest of the system has made possible.

planning orientation

Unlike most companies, we have always considered data processing primarily as a tool for sophisticated long-range planning rather than for accounting or short-term control. In 1960, when we began mechanizing data processing operations with punched-card equipment, the first application we undertook was the development of a five-year financial plan, which proved to be accurate to within 5%.

The reason for this particular application approach is that planning has always been the key factor in the profitability of our business. We produce approximately 1,000 different types of electric clutches, brakes, controls, and precision ball-screw actuators for automatic, aerospace, computer, food processing, farm, textile, packaging, lumber, printing, and electrical industries. Not only are our markets expanding rapidly, but the nature of the products needed to serve them is continuously changing. While net sales have almost doubled in the past three years, the demand in one product category has grown almost five times faster than the demand in another.

Since 50% of our production is job-shop work, this rapid and uneven change in requirements creates the dangers of long lead times, inventory build-ups and shortages, high unit costs, manpower shortages, and late deliveries. These problems can be alleviated to a degree with a highly sophisticated computer-based production and inventory control system that reduces the time needed to respond to significant changes. However, this is not as effective as a system that defines requirements far enough in advance to provide the time needed to plan the optimum response to changes. Consequently, we chose to emphasize long-range planning over short-term control.

a different kind of simulator

This decision led us to develop a system built around a job-shop simulator that is different from most. The typical job-shop simulator is designed to provide the detailed operational data—such as queue lengths, lead times, and work-in-process flows—that will help supervisory shop management make better control decisions in a particular cost center. We weren't concerned with that. What we were concerned with was providing middle and top management with the data needed to make better planning decisions for an entire profit center.

Consequently, our model does not look at the details of work in process within a single cost center, but at the machine, manpower, and inventory requirements, a given volume and mix of business will pose in all seven of the cost centers in our job shop operation.

The main elements in this model are bills of material, production routings (including pertinent data per operation, such as tools and materials required, set-up time, output rate, etc.), and standard costs. Stored on three 2-million-character 1311 disc packs, this data enables the model to convert a sales forecast into the production-hour load and labor costs per machine or machine center.

This simulator output is the basis for a comprehensive manufacturing plan that shows machine, inventory, and manpower requirements by the month for one year into the future and by the quarter for another two years. All

Mr. Black is vice president, finance, of Warner Electric Brake & Clutch Co. Before joining Warner Electric, he was a management analyst and systems manager at Vulcan Materials Co. He has a BSCE from Texas A & M and an MBA from Harvard.

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three aspects of the plan are audited with monthly reports on inventory and production performance. The model, itself, is continually updated with current data on bills of material, routings, and standard costs.

The forecasts that are used as the simulator inputs are a composite of historical projections and sales department estimates. The historical projections are generated by the system from data on past sales patterns. They provide a basis for three sales department forecasts: one of these is a hard forecast, while the other two are high and low estimates with appropriately lower probabilities.

Forecasting is done in terms of 25 basic product categories. The three-year forecasts are generated monthly to see whether there are any gross changes in product demand patterns that may require a change in plan. Normally, no change is necessary from month to

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PART NUMBER / SU HR	POL CODES OPR# / SU HR/C	STD HR/C		I51	I25	I53	CMB	CTB	SPN	HI	525	475	TOTAL
535E0007	3M613	212	QTY				92						
10.0	2.50S	5.01P	HRS				8.9						
CX10030	2M5J1 1	211	QTY										
10.0	3.23A	2.97P	HRS										
700E0009	52M51449	214	QTY		527	13							
10.0	.50S	2.63P	HRS		16.5	.4							
750E0002	52M613	212	QTY		1								
10.0	8.00A	2.88M	HRS		.9								
750E0003	52M513	212	QTY		1								
10.0	8.00A	2.18M	HRS		.1								
800E0012	51M41591	212	QTY	2902									
10.0	.20S	2.99P	HRS	92.6									
800E0013	52M51481	214	QTY		404	13							
10.0	.50S	2.18P	HRS		10.8	.3							
800E0026	52M51459	215	QTY		110								
10.0	4.00S	2.18P	HRS		6.8								
800E0042	55M51399	213	QTY		24								
10.0	2.00S	10.94P	HRS		3.1								

Fig. 1. Machine Planning Report

month, so the forecast is processed through the model to update the plans on only a quarterly basis.

The planning cycle begins with the generation of a machine and manpower planning report, which shows management the load forecasted requirements will create for key machine centers. Two of these reports are generated: one from the hard forecasts for all 25 product categories, the other from a mix of high and low forecasts. Management defines the mix by selecting the forecast it thinks is most consistent with the sales trends in each product category.

Generating a machine and manpower planning report is a four to five hour simulation run. First, the bill-of-materials data is used to explode the forecasts into the parts mix for each product group. Then, using routing data, the simulator determines what parts will be run on what machines and in what quantities. This data is then combined with the data on standard machine performance and labor hours to generate a report that shows the forecast, by product category, in terms of the production-hour and labor dollars requirements for key machine groups.

Part of a typical machine and manpower planning report is shown in Fig. 1. The top two-thirds of the report shows production-hour requirements in parts-number detail. The parts are identified in the left hand columns, along with estimated set-up times for the quantities required, the standard set-up times used to compute the estimates, the standard run times, and the operator numbers. The quantities of the parts required and the number of machine hours needed to produce them are listed to the right under the appropriate product categories.

The bottom third of the report (not illustrated) shows the total standard labor dollars, standard hours, and actual hours (standard hours adjusted by machine efficiency) needed to produce the forecasted requirements of each product category. To show how the load will be distributed over the three-year forecast period, actual hours are also shown in quarterly totals.

This type of report on all key machine centers provides management with the information needed to analyze the adequacy of existing capacity for future requirements. From this analysis, a machine plan (Fig. 2) is developed that shows the target production and utilization levels for key machine groups, forecasted requirements, and planned capacity increases for three years into the future.

The development of inventory and manpower plans is essentially a manual decision-making process. The forecast is exploded in the model to determine the parts quantities and mix per cost center. Using its knowledge of production, labor, and vendor conditions, management

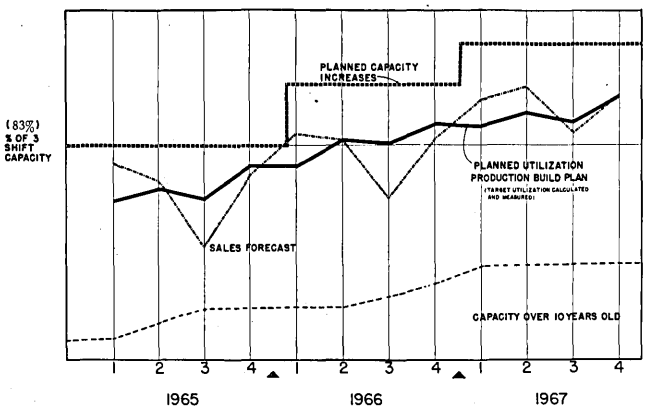


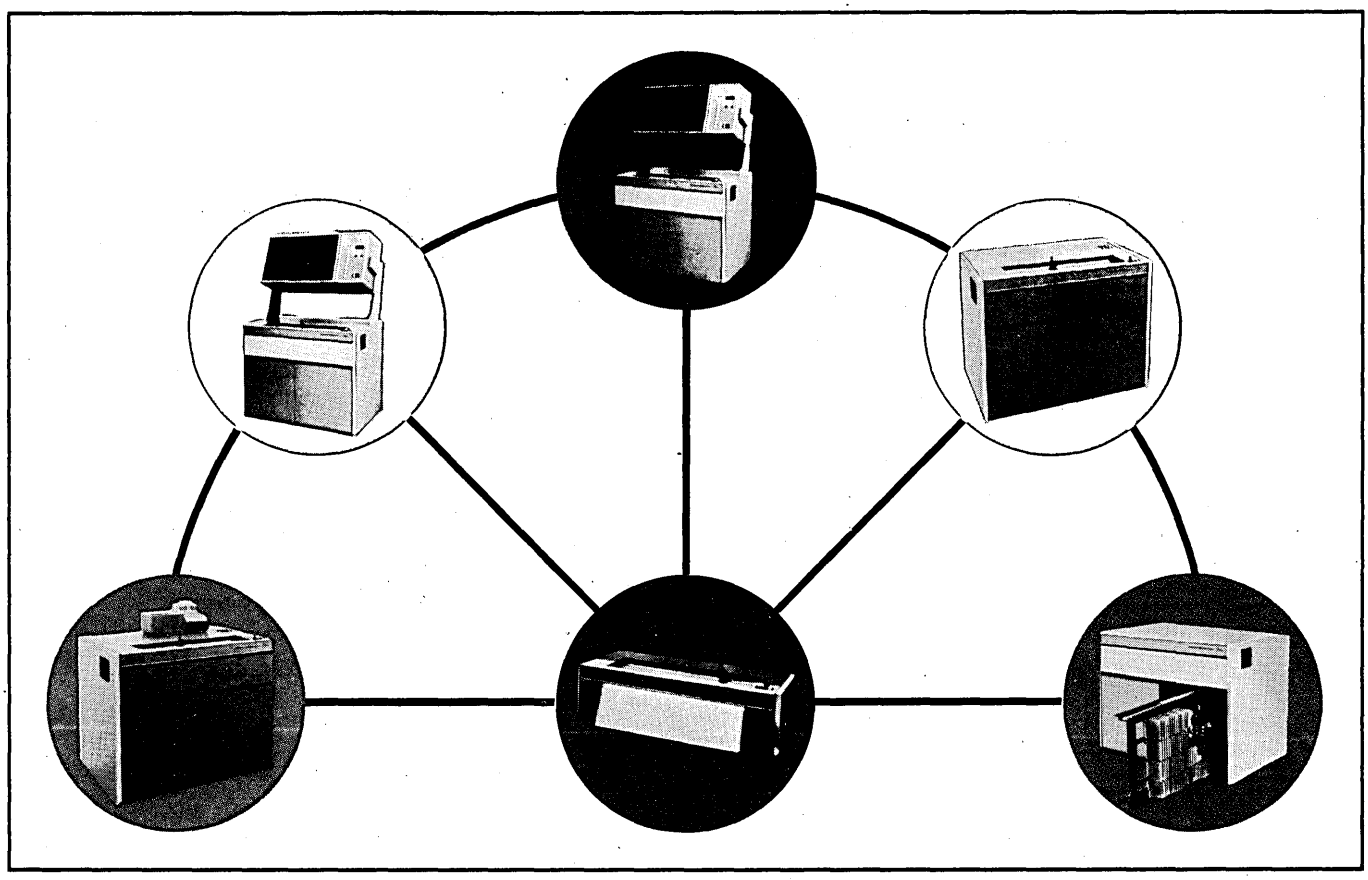
Fig. 2. Machine Planning and Utilization—Key Machine Groups

then develops a master production schedule which represents the optimum way of meeting the forecasted requirements within normal manufacturing constraints.

The inventory plan is the difference between the forecasted requirements and the master production plan. Inventory is designed to act as a buffer between requirements and capacity. During peak-demand periods, it supplements production capacity; during low-demand periods, when there is a need to build up inventory, it provides work to keep production capacity fully utilized.

The inventory plan is expressed in production-manpower units. To develop these for each cost center, management applies current data on average productivity per cost center to the inventory plan. This data is provided by the control part of the system.

The formal manpower plan is generated by the system



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planning benefits

This type of planning capability has a number of advantages. The most obvious are the ability to define requirements, machinery, manpower, materials, and funds far enough in advance for us to respond to changes in requirements when they occur. During three successive 25% increases in net sales and a radical shift in product demand patterns, we have kept lead times stable, held inventory within strict limits, and managed to raise machine utilization rates to the 60-80% range, despite the installation of some $5 million worth of new equipment.

Another advantage is the time cushion we have against the lengthening of vendor lead times. Because we can order against requirements in advance, we were able to absorb a three-month increase in the lead time for forgings without changing our own lead times.

In addition, the simulator enables us to experiment with a wide range of production strategies by running forecasts against alternative routings and machine mixes. The comparative effect of the different strategies is shown in both production hours and labor costs. Even product design changes can be tested by inserting alternative bills of materials into the model and examining the effect they have upon machine hours and costs.

These things would be impossible to do without a computer simulation model. Lacking this tool, even the staffs of the largest corporations can't consider more than two or three different strategies before making a decision, because of the huge amount of computation involved.

Then too, there is the by-product advantage of faster management decision-making. Equipment acquisition decisions aimed at providing us with the ability to meet forecasted requirements, as opposed to those aimed at improving our manufacturing cost performance, are fully justified and documented by the simulator output. Consequently, these decisions are made promptly once a quarter. There is no need to develop elaborate presentations to management, and decisions do not remain pending for lack of sufficient information.

An additional benefit that is both real and important, although it can't be measured, consists of being able to better exploit marketing opportunities at reasonable profit levels. Because the simulator can show us the extent of the inventory and machine utilization risk involved in gearing production capacity to high forecasts in given areas, we are in a good position to make the difficult trade-off between the possibilities of under-utilized capacity and full exploitation of a rapidly expanding market. As a result, we have been able to minimize the amount of business lost because of inadequate capacity. This is one of the primary reasons sales growth in each of our major markets has consistently exceeded the growth of the market itself in recent years.

integration of planning and control

The emphasis on planning doesn't mean our system ignores the problem of controlling the work flow into and through the shop. Since no planning techniques can anticipate transient fluctuations and no plan is any better than the ability to control daily performance within the gross planning parameters, the system incorporates reports for monitoring manpower, inventory, work-in-process, and machine performance on a daily, weekly, and monthly basis.

An inventory subsystem generates daily lists of parts to be ordered, weekly reports on the status of open shop and purchase orders, and monthly analyses of both part re-order points and actual inventory performance versus planned performance. In addition, the subsystem supplies the normal monthly reports on inventory status and transactions.

A shop subsystem provides the reports needed to control work in process and machine and manpower performance. These consist of daily reports on job schedules and status, machine loads, and labor performance. In addition, weekly reports are generated on machine load and utilization and labor costs.

These inventory and shop control reports not only provide the information needed to manage inventory and production, they also provide the operating data needed to keep the simulator valid and to enable management to analyze the simulation outputs realistically.

system development

The planning orientation of the system reflects the way we have fit data processing into our organization. Data processing is a corporate function, reporting to the financial vice president. At this level, we are concerned more with the development of techniques that will enable us to improve the over-all management of the company than we are with reducing expenses in individual cost centers. From this viewpoint, the single most important function that a computer could perform was to help us define requirements far enough in advance for us to keep capacity in a profitable balance with demand.

Once this objective was established and the concept of the simulator was developed, the most difficult job was developing an accurate data base for the simulator. We had developed basic data on routings and standard costs for the unit-record equipment that preceded the computer. However, for the simulator we had to develop additional data on machine rates, set-up times, bills of materials, and everything else needed to completely define our manufacturing procedures.

Accuracy was very hard to achieve in the data area. It took us three months to develop accurate bills of materials. In all, it took approximately a year to develop and organize the data base.

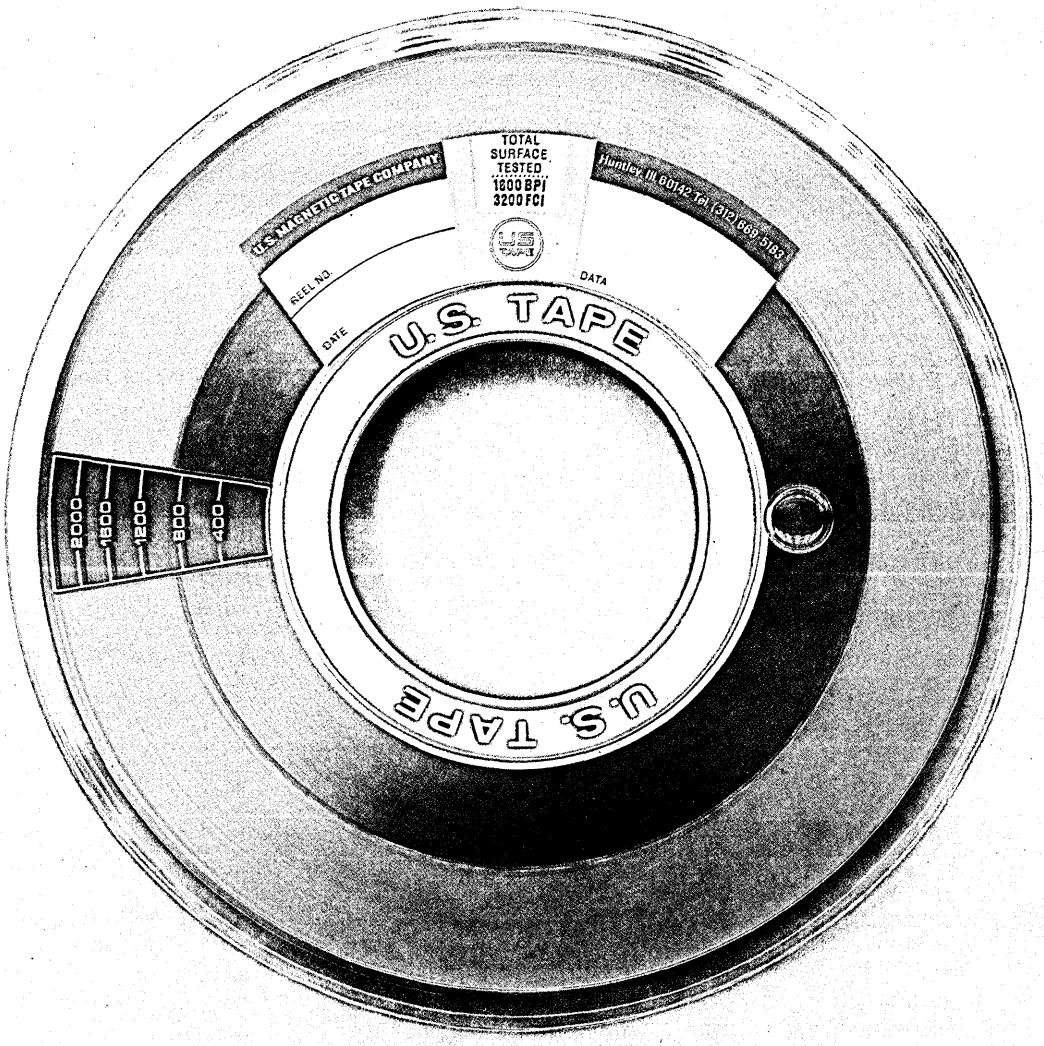
The design and programming of the system was relatively straightforward. The simulator, which is programmed in Autocoder, was developed in four months. The entire project, from the time the system plan was completed in September, 1963, to the time the system went into operation early in 1965, required approximately 18 months.

next steps

We recently installed an IBM System/360 Model 30 which we intend to use to further refine the existing system and to take advantage of more advanced simulation techniques.

Refinements of the existing system will be limited to the shop-control area, where we intend to add data-communications equipment to monitor work in process more closely and capture the information needed to reschedule on a daily basis.

However, as before, the main emphasis in our system-development program will be on corporate long-range planning. This will take the form of developing a model of the company that will show us what effect proposed marketing, financial, and manufacturing strategies will have upon the financial performance of our various profit centers. ■



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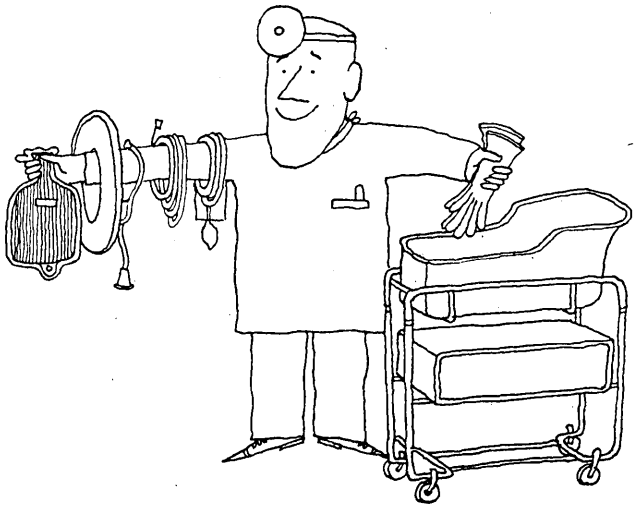

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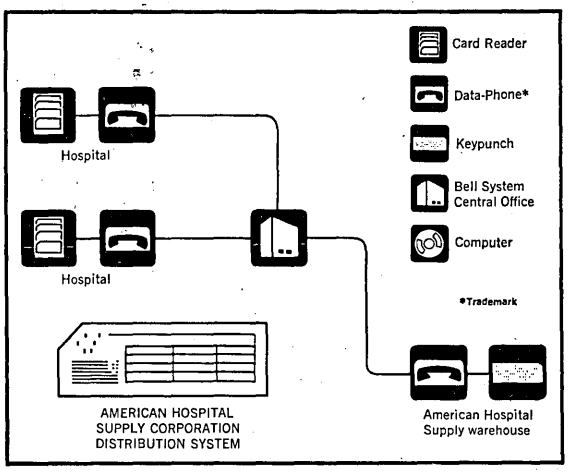

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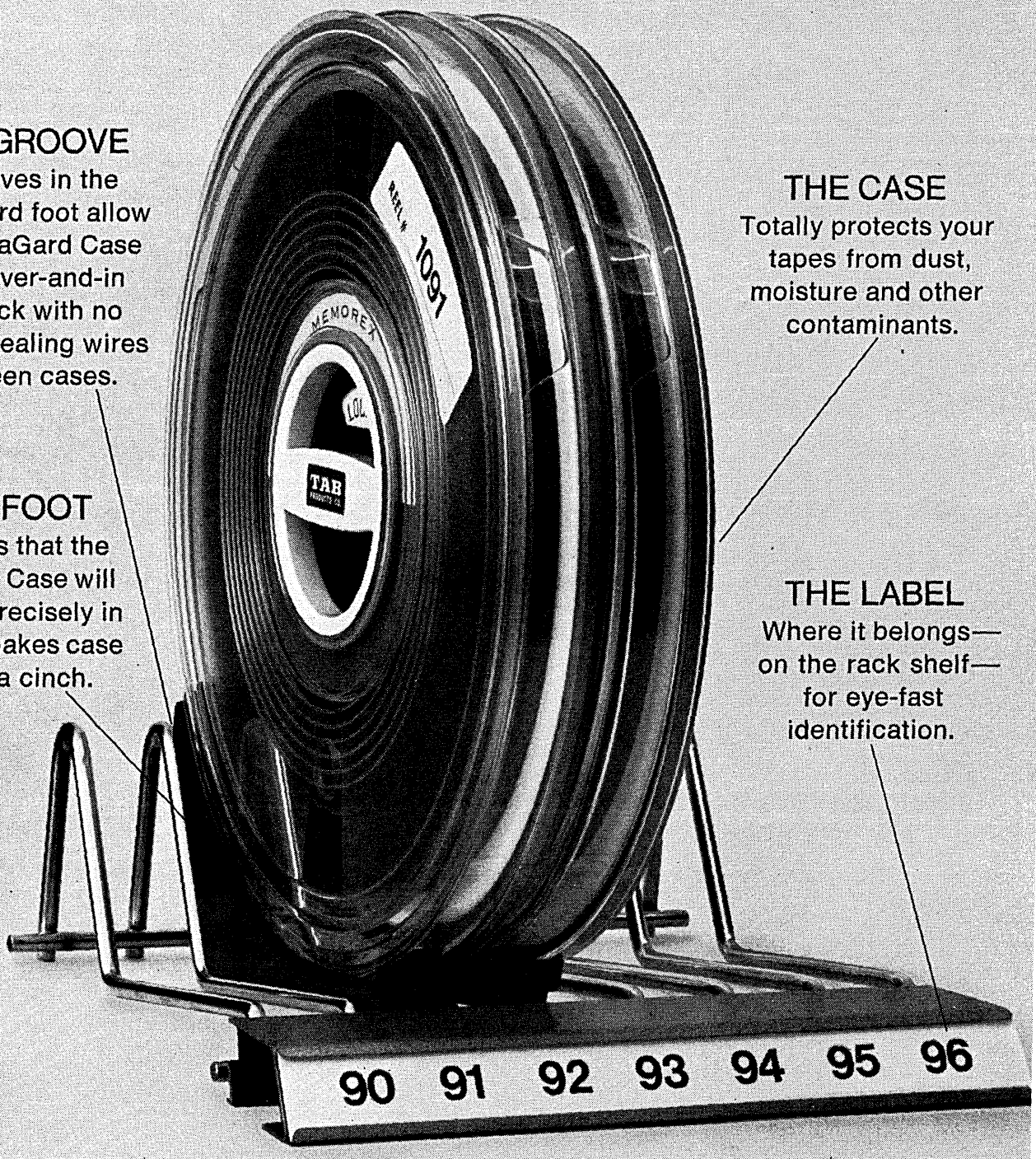

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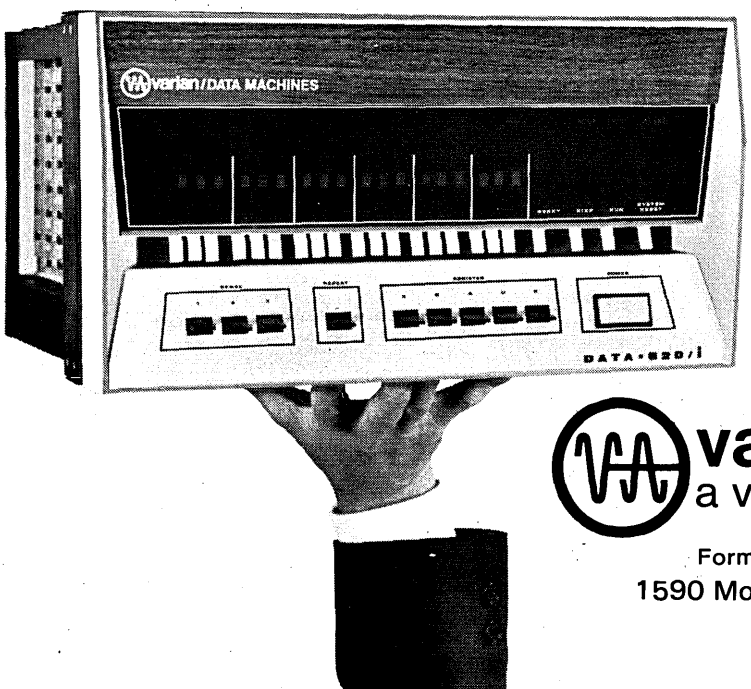

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CIRCLE 31 ON READER CARD

conference report

LARGE SCIENTIFIC DATA FILES

"You might get a baby elephant into a Volkswagen, but what do you do when it grows up?" This seems to be the dilemma confronting many of the scientific professions today, according to comments made at a recent meeting in Dallas. The question: "Is the capability to store and manipulate very large files growing fast enough to keep ahead of expanding file size?"

Under the sponsorship of International Science Information Services in cooperation with Texas Technological Univ., the Council of Scientific Societies, and the U.S. Geological Survey, 110 scientists from the U.S. and Canada gathered in Dallas July 24-26 to develop ideas on the efficient handling of very large scientific data files. There was obvious awareness of the problem of handling massive files that are growing rapidly and already tax even the larger computer; that scientists of many disciplines are experiencing similar problems; that there is potential value in developing some organization that could store and interrelate data from different data sources; and that the solution of effective file handling was essential but not yet definable. One of the participants, Peter Stark of Mobil Oil in Denver, observed that a positive result of the meeting was the "revelation of the common lack of confident foresight among most users of large data files." Someone else observed that this was significant progress because "the first step in solving a problem was to realize that a problem existed."

Welcoming addresses by W. Dow Hamm of Atlantic Richfield, and Paul Barth of the Geotech Div. of Teledyne and president of the Council of Scientific Societies, stressed that the meeting was called at the request of the scientists themselves. Hamm observed that the workshop sessions would help determine the direction and feasibility of the ISIS data bank concept. Barth noted that the seminar represented a truly multi-disciplinary approach to a common problem, and that the cooperation of the Council of Scientific Societies was natural since the council was composed of 52 societies of scientists from different disciplines. The 110 scientists were from 59 different companies, agencies, and organizations, with home offices in 13 states, the District of Columbia, and Canada.

The problems confronting the seminar delegates were outlined by Dr. John W. Harbaugh, professor of geology at Stanford Univ. and a consultant in education and research for International Science Information Services (ISIS). "The actual objective in setting up large data files is to produce a totally integrated information system," stated Harbaugh. "Some of the problems to be overcome are the means of recording interpretive data, redundancy or repetition of information, consistency in recording data, security including the need to incorporate proprietary data, and education to upgrade the scientists and other professional employees. The problems of education in both the university and company are similar in that both tend to be behind the times."

keynote speakers

In one of three keynote addresses, Dr. Grover E. Murray, president of Texas Tech, emphasized the importance of accessible information to the university scientist. He observed that a university is really an organization of people involved in the development, storage, retrieval, analysis, and display of information. "All too frequently universities fail in their function by serving as repositories of information without producing interpretations of the

data or the dissemination of results so that others can use it."

Dr. B. Warren Beebe, president of the American Geologic Institute, based the second keynote address on the bibliographic data file experiences of the AGI, which is primarily interested in manpower, education, and documentation.

In the third keynote address, Dr. Mark L. Lemmon, a well-known surgeon and chairman of the board of the Council of Scientific Societies, said that "the physician today is in dire need of more information more quickly and with greater accuracy." The reasons for this need: increase in services due to insurance; increased knowledge of services available to persons seeking medical aid; and increased services available through research and development. He divided the information requirements of the medical profession into three categories: management, clinical information, and research and education. Proper use of the computer might reduce the manual handling of information, which accounts for 30% of hospitalization costs.

The session next turned to the discussion of examples of large data files. Paul Eimon of Kennecott Copper, reviewed the mining industry information, files in the areas of exploration, mine development and production, milling operations, smelting and refining, and commodity and sales forecast. Dr. A. T. Miesch, acting chief of the Geochemical Census Branch, U.S. Geological Survey, summarized the status of data processing in the USGS as ranging from conceptual in the fields of paleontology and stratigraphy to advanced in the fields of physics, hydrology, and crystallography.

Considerable attention was devoted to ICASALS (International Center for Arid and Semi-Arid Land Studies), an ambitious project at Texas Tech. Dr. Thadis Box, director of the project, said that the effort will involve the storage and retrieval of data in 86 languages originating from some 2000 agencies involving some 56,000 people.

An information retrieval service tailored to the needs of one industry was described by Roy W. Graves, director of the Petroleum Abstract Service at Tulsa Univ. The system allows retrieval of abstracts from some 600 publications in 20 languages.

well data systems

The problems of developing, updating and maintaining a file of up to 10^{12} bits of scientific data were highlighted by a discussion of the various

well data systems by John L. Stout, manager of geosciences for ISIS, and C. G. Cooper, consultant, who was formerly the technical monitor for the Permian Basin Well Data System. Operating requirements of the users of these systems require response times of a few hours on an irregular schedule and with search parameters which are not known until the retrieval request is received.

A real challenge was presented by H. N. Rhodes, chairman of the Interstate Oil Compact Commission Committee on Geodetic Control, and chief engineer for the Utility Data Corp. in Kansas City, Missouri. Rhodes stressed that any total data system requires a standard location and consistent index among systems and nations. Despite the fact that the geographic location of a point is one of the most fundamental bits of information that is required for proper use of data, the condition of available maps in this country is rather pathetic. They were constructed primarily from uncontrolled aerial mosaics. To produce accurate and machine processable map information over the entire U.S. is a large and challenging project.

Dr. H. B. Renfro, a consultant from Dallas, reported on the results of a feasibility study aimed at determining the interest and possible need for a national data bank which could store vast quantities of scientific data and interrelate the information obtained from one data source with that from others whenever necessary. He reported that a national data bank was now feasible from a hardware viewpoint and nearly possible from a software point.

requirements for success

Dr. Harold W. Dubach, deputy director of the National Oceanographic Data Center, pointed out that the requirements for a successful data center such as the NODC are: prompt and accurate responses to inquiries; output which suits the requirements of the customer; efficient economic recall; and effective and complete acquisition in processing of data. Because of the wide variety of inquiries faced by a specialized data center, some inquiries can best be handled by a specialist with only a cursory familiarity with the specific scientific field.

"Can we develop an effective data bank within the foreseeable future that can store, retrieve, and interrelate large quantities of data from different sources, in different formats, for many different customer computer centers?" was the provocative question posed by Ed L. Dillon, executive director of ISIS. He explained that the concept of the ISIS group was that this was pos-

sible. "The proper handling of a mixture of data of different degrees of security is one of the more sensitive parts of the problem."

Following a full day of workshop sessions, the seminar participants pitched in with enthusiasm for five panel discussions. The first dealt with the security and quality control of data, serving on this panel were Roy Graves, John Stout and Ralph Tenny from ISIS, W. E. Quirk from AT&T, and Robert Hodgson from IBM. The panel's conclusions stressed the following factors on security:

1. The security of the data base itself can best be maintained through the use of a read-only system.
2. To guarantee the security of output, it is necessary that the data be available only on an output device in the hands of the customer.
3. To maintain security of inquiry, means must be taken to prevent other users from learning the question addressed to the data file by that user.
4. Confidential file protection is a particularly difficult subject although it is possible to have reasonable safeguards. In addition to protection within the data bank, additional protection must be instituted by the customer, such as assigning false coordinates to information where the customer is the only one with the information to correct the false coordinates, using codes and other unique words in the data file, and limiting access to only a few selected individuals within the customer's organization.
5. The use of a restricted area in either the data center or at the customer's output terminal is one means of guaranteeing that only selected individuals would have access to the information or would have the ability to make certain inquiries of a data file. This was considered to be very important.

communications

The panel on communication requirements between data centers and users was composed of Les Millison from Bell Telephone, John Elvig from Computer Usage, W. E. Quirk, and Robert Sone from Western Union. The opinion of the panel was summed up by stating the need for a wide variety of types of communications. An organization such as the data bank under consideration by ISIS will have varying requests. Some customers will request small amounts of data and the communication link between ISIS, the computer center and the requesting user may be low capacity. Other customers may request data through large computer centers which will require a high capacity data link, such as broad band. The computer center and the customers may then require a variety of links, depending upon individual preferences, equipment available, and funds for a specific project.

The panel on data reduction problems, procedures, and coding standards was a large one and particularly interesting to most of the group. It consisted of John Harbaugh, Joe Cosgrove from Control Data, Al Miesch, Paul Eimon, C. G. Cooper, Tom Cayless from American Geological Institute, R. C. Janeway and Thadis Box from Texas Tech, C. F. Burk, Jr., and Harold Dubach from the NODC. The committee stressed the need for a dictionary of standard codes to permit language interchange and the fact that people-oriented codes are more desirable than machine-oriented codes. The predominate thought throughout the panel seemed to be that the data file might be user-oriented and that we were well beyond the point where files should be oriented to serve the machine.

The panel on software requirements of large data files was composed of Bill Gant of Atlantic Richfield and also a member of the ISIS staff, Joe Cosgrove, and J. A. Whatley of American Systems, Inc. The consensus was that the technical ability to develop needed software was adequate to meet the job at hand even in the case of the larger data files. In fact, much software in its present form could be used but it would need some rearrangement. The problem in developing the necessary software seems to be primarily one of economics. It was also felt that software would play a very important role in equipment choice. Again, the most important point seemed to be the emphasis placed on a user-oriented system.

The panel on hardware requirements was composed of Ralph Tenny, Bob Wylie of University Computing, and Joe Cosgrove. This panel observed that the presently available memory units would be adequate for the immediate needs of the larger data files, although it is realized that these files are growing rapidly and that their ultimate size may be underestimated by perhaps three orders of magnitude.

The seminar ended on a note of "well done." A questionnaire circulated among the participants revealed that only 3% failed to find material of significant interest to their work somewhere in the sessions. A continuing series of seminars to expand on specific points now seems probable.

—ED L. DILLON

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CIRCLE 36 ON READER CARD

CAI in Chicago

INSTRUCTIONAL SYSTEM SEMINAR

In Chicago, on August 2-4, representatives of 25 educational organizations met to talk about or hear about computer-assisted instruction (CAI). The host was IBM's subsidiary Science Research Associates. The common attribute of the participants—with minor exceptions—was their association with IBM's 1500 computer system.

Although they were gathered for the purpose of considering technical matters—agenda items bore the following names: Organization, Installation and Operation of a CAI Center; Course Models and Item Pedagogy; Course Layout Procedures and Documentation; Techniques for Evaluation—the participants were much exercised over the same kinds of problems that move the founders of computer users' groups everywhere. "Functions of a Users' Group" was allocated only one hour on the agenda but probably consumed more manhours and evoked more participation than any other topic. It was not surprising, therefore, to witness the formation of an *ad hoc* committee (Chairman: Donald Reynolds, Director, Instructional Systems Institute, Texas Christian Univ.) instructed to make recommendations to the participants concerning the proposed activities and organizational structure of an "association."

If the preceding sentence seems vague it is because of the difficulty of reporting fairly the differences of opinion that arose during discussion of the subject of association. There were vocal advocates of organization strictly along machine lines; they would seek the cover of an existing users' group for administrative purposes (say, COMMON, the organization that was the 1620 Users' Group, but now admits 1130 and non-SHARE 360 "owners"). A second, but smaller, group argued that the *main* concerns of the participants transcended machine lines—especially those of a sin-

INSTRUCTIONAL SYSTEM SEMINAR

gle manufacturer—and that, hence, provision must be made for an association at least national in scope. Such an association should seek the aegis of ACM, say, or AEDS. These are problems with which the *ad hoc* committee will have to contend.

The *ad hoc* committee will have to act rapidly because within ACM there is already activity to create—out of the ashes of the SIG on Programmer Training—a SIC or SIG on CAI. This activity, pressed by Gloria Silvern (who was not present in Chicago), will culminate on Aug. 28 in authorization, by ACM's Executive Council, to proceed. The "SIGCAI," I infer from conversations with Dr. Silvern and my observation of the Chicago conference, will not be concerned with matters that seemed of primary interest in Chicago. It will be more than a pity—in my opinion, it will be more than deplorable—if SIGCAI is allowed to develop tunnel vision and the Chicago participants do not become active in its affairs.

Another major dichotomy appeared during the first technical session in Chicago. On the one hand are those—the majority of those present—who insist that CAI is just for research now. Borrowing from the methodology of those who advocate programmed instruction, they would not involve the teacher—the subject-matter or content expert—too much; rather he would describe to an instructional programmer the educational objectives of a given learning unit. The latter would devise a strategy, choose media, accomplish the programming and coding and the debugging, arrange for, if not carry out, the evaluation (although, of course, the latter necessarily involves students of whom, it could be hoped, at least some would be students of the subject-matter expert). If the result of this effort is a "course"—a collection of learning units—that can and will be used in the classroom, as distinguished from the laboratory, that is not yet a matter of much importance to the researcher.

On the other hand are the minority who view CAI as an instrument for teaching *now*. These "empiricists" have as a primary goal the development and use of computer-assisted instructional sequences *now*, to supplement or complement, if not to replace, conventional classroom instruction. The empiricists seek the involvement of the teacher: it is he who sets objectives; devises and revises teaching strategies; chooses media; accomplishes or supervises programming, coding, debugging; and validates the effort. The views and practices of the empiricists seemed to be more learner oriented (than teacher oriented); the converse is a more apposite description of the researchers.

Economics made its sharp-edged presence known to all who were present. Time and again the subject intruded itself, even though it was not on the agenda.

The first kind of intrusion merely gave voice to the traditional plaint of lack of funds to do whatever it was that wanted doing. The second kind of intrusion, it was clear from the remarks of the participants, disclosed how little is known of the operational costs of current educational means or of their effectiveness; one result is to prevent rational, justifiable statements from being made about costs or prices of conventional educational means. In addition, everyone agreed that not enough is now known about CAI to estimate its costs, now or in the future. And nearly everyone deplored the lack of effort to obtain the requi-

site knowledge. Without it there will be no way to answer those who say, "It now costs 36 cents per student per classroom hour to educate our elementary school students; don't talk to me about CAI until you're able to fit it in that framework."

On balance, it was a good meeting, a beginning. Hopefully, we can all look forward to increased cooperative activity of a kind from which students, teachers, administrators, trustees, parents (and taxpayers) will all reap benefit. ■

ROBERT M. GORDON

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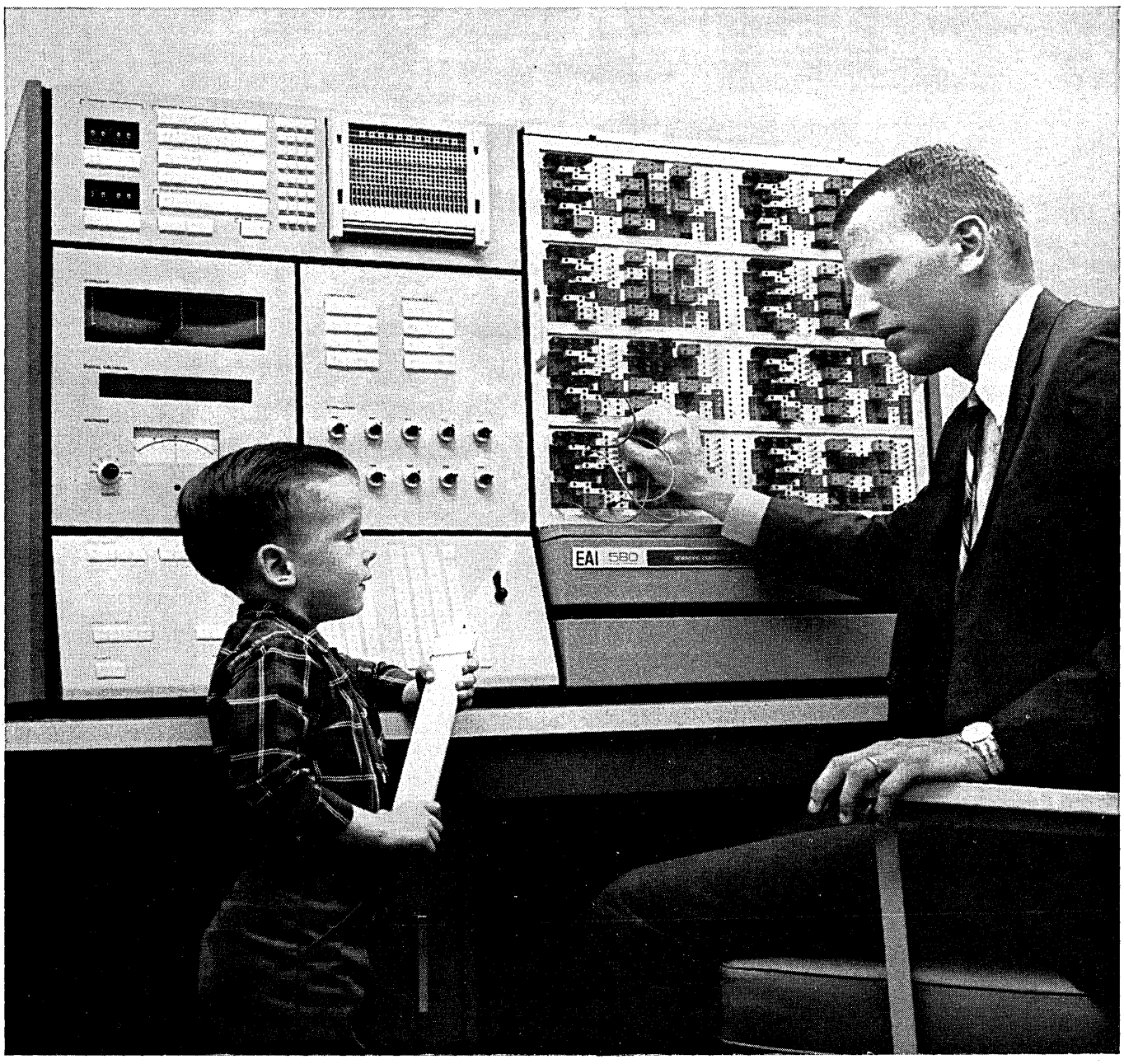

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CIRCLE 40 ON READER CARD

PL/I IN THE U.K.

yes and no

Let's not be fooled. The slightly desperate air with which Big Organizations inform themselves about the far-flung corners of their empires by means of quizzes and questionnaires is splendid gamesmanship. It is meant to impress. It does. The case in point—a quiz on PL/I carried out in Imperial Chemical Industries and the results of which were presented to the delegates at a one-day symposium on PL/I organized by the British Computer Society.

ICI is not only an international industrial giant, but also an eight times 360 user and the possessor of a technical computing centre (based on an English-Electric KDF9) which has developed its own standard computing language—K Autocode.

Respondents were divided into two classes, commercial and technical, and the table below expresses their answers in percentage form.

	Commercial			Technical		
Is PL/I Easy	Yes	Qualified Yes	No	Yes	Qualified Yes	No
to Learn:	35	55	10	21	22	57
to Write:	57	42	0	30	20	50
to Debug:	31	42	27	0	27	73

J. M. Sykes of ICI disclosed these opinions, held by their programmers, as an informative supplement to the ICI official party line on PL/I. In April 1965, an ICI working party, chaired by R. A. Brooker of Manchester Univ., had endorsed the candidature of PL/I as a single language to cater for commercial and technical computing. Two years later this was still their view. Originally, the teachability of the language had been in doubt. Experience had hardened this criticism of PL/I and Mr. Sykes had "a sneaky feeling that there's too much of PL/I." Subsets were a useful way of solving the teaching problem, but "when it comes to implementing the language, I firmly believe that the number of subsets must be kept to the minimum. An attempt should be made to follow the pattern that has been applied to FORTRAN, which provides a full standard and a basic standard. Failing that, we might have a small number of packages of features, each well defined, so that an implemented subset can be unambiguously specified in a few words. We must at all costs avoid the mess that FORTRAN was in before standardisation and even the idea of a host of elective features as found in COBOL-61. It is, perhaps, inevitable that a language which attempts to be as comprehensive as PL/I, should fall far short of the stark elegance of ALGOL, but it should at least do its damnedest not to."

Apart from the obvious need expressed many times during the day for efficient implementations, Sykes added, "some features of the language are obviously difficult to implement efficiently while others are, I suspect, virtually impossible." Outside of Sykes' own division of ICI there was only a limited acceptance of PL/I. For the future, he thought "PL/I will become an acceptable proposition to IBM users." This stance was confirmed by J. W. Lewis of BOAC, where most of the programming for their triple central processor 360 system went through the PL/I mill. Only the O.R. people at BOAC were anguished at the missing features of the language. BOAC's first priority call to IBM was to

fill in those missing facilities and then, secondly, to make PL/I less profligate.

Delegates and paper presenters alike were keyed up to hear the U.K. manufacturers' views on PL/I as a standard language. For International Computers and Tabulators, Ltd. (largest U.K. computer house) a spokesman made a clear statement that they "are not really convinced that PL/I is a major step forward." ICT has its own candidate for a comprehensive data processing language in NEBULA and although this was not mentioned, reference was made to their users' satisfaction with current compilers and languages. ICT could not see standardisation getting much further whilst "specification of the language is under the control of a single manufacturer." Confirmation of this point of view came from Phil Scull of English-Electric. "Anyone who thinks that any settled standard is going to come out of ECMA or any other standardisation body in less than probably three years from now, is being extremely optimistic." Nevertheless, E-E "is currently engaged in the first design stages of a subset PL/I implementation on System 4."

a national policy

The U.K. manufacturers' attitudes may have been news to many of the delegates but they must have been wearisomely familiar to the chair, occupied as it was by Professor Gordon Black, Director of the National Computing Centre. The NCC, the Ministry of Technology, ICT, English-Electric and Elliott Automation are jointly attempting to thrash out a national language policy. Publication of this policy is expected before the end of 1967. The role of the NCC can be visualised by quoting Gordon Black on this occasion: "We are forming groups of companies—one of them is ICI, Shell, Unilever and Dunlop; we are talking to the hotels and catering industry. So it looks as if in the NCC we can go a good way towards standardisation and compatibility in various groups of industry—and I think this is the way it will go, but there won't be any standard British language. I am sure of this. I keep telling the Government that it won't occur."

Earlier in the day some two-thirds of the 300 delegates had indicated that they expected to be using ALGOL, FORTRAN and COBOL in April, 1970. The show of hands was a response to the probing of Marjorie Barritt from the Edinburgh Regional Computing Centre. The centre is planned to provide multi-access in the future. Naturally they were interested in the suitability of PL/I in this role and particularly in the training of systems analysts from small organisations to be fully appreciative of PL/I.

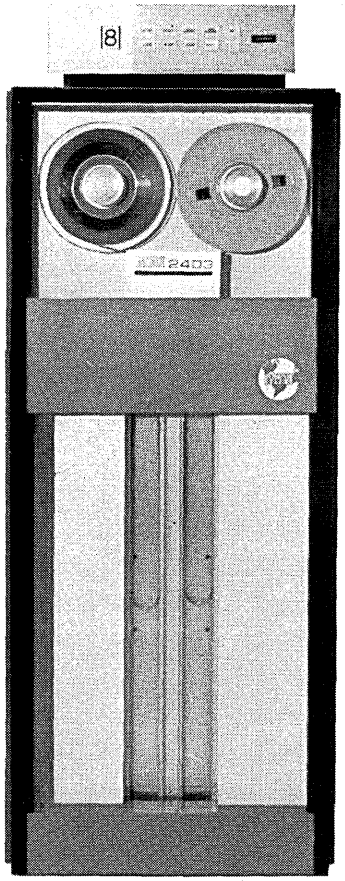
The crucial effect on systems work of a standard language was the main reason behind the Institute of Computing Science activity in creating BCL—a Business Computing Language. David Hendry from the institute did not see in PL/I the data structure facilities that met general needs and had created a working compiler for BCL in less than 10 man-years of effort and with an incredible compactness—less than 6K, 48-bit Altas words, in total. Over coffee anyone who cared could discover that a Czech group, with three ICT medium-scale machines on order, were itching to develop BCL. Nobody would suggest that Eastern collaboration is an effective counterweight to IBM domination—at least nobody would admit to suggesting . . .

More coffee talk disclosed that Mrs. Barritt was not alone in thinking PL/I was three years too late for research and about three years too soon for the U.K.'s normal small commercial outfit. One ex-ICI computer man thought that if you could get good basic software then the best course was to head in the direction of developing your own super facilities. Funny thing, that's just what attracted those Czechs to BCL . . .

Prof. Black joined the ranks of the Unbelievable Believers for long enough to provide an insight into the myth of how things are done in the U.S. On the problem of agreeing to standardise he said: "In the United States if there is any difficulty of this sort, they call a massive great conference, something like this one only about five times larger, in some giant hotel somewhere, and they stay there for 10 days; but after 10 days they will have decided what it is they want to do and they will all get on planes and trains and go to their various homes and they'll do what they've said they are going to do."

Unreservedly the best anecdote of the day came from the absence of Reserved Words in PL/I; only, when a variable called NOT was used "the compiler climbed out of the machine and hit me over the head with this lot of paper." ■

—HEDLEY VOYSEY



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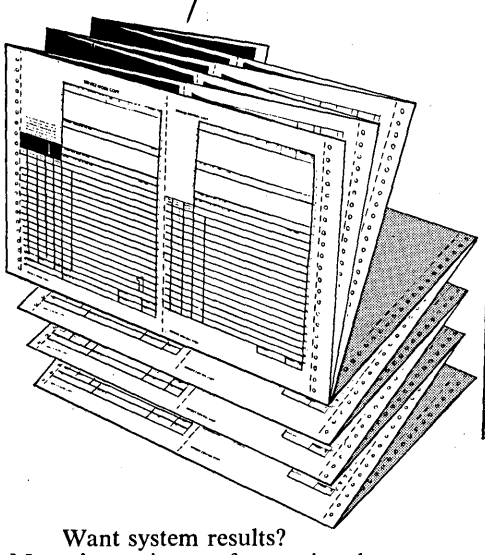

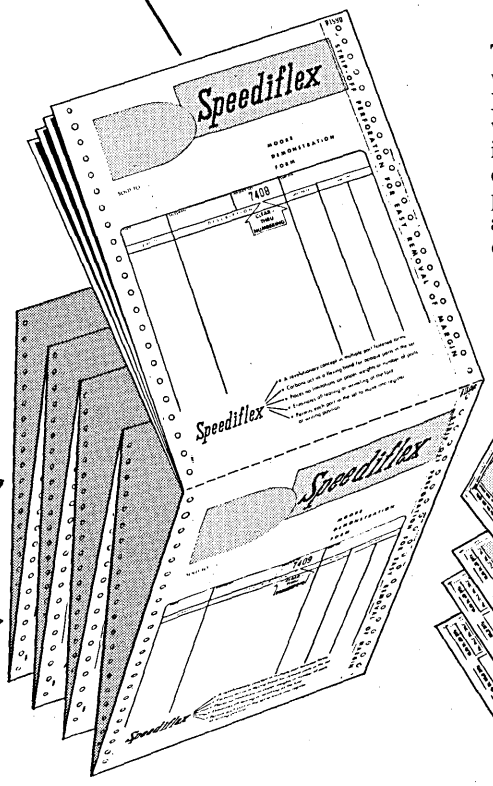

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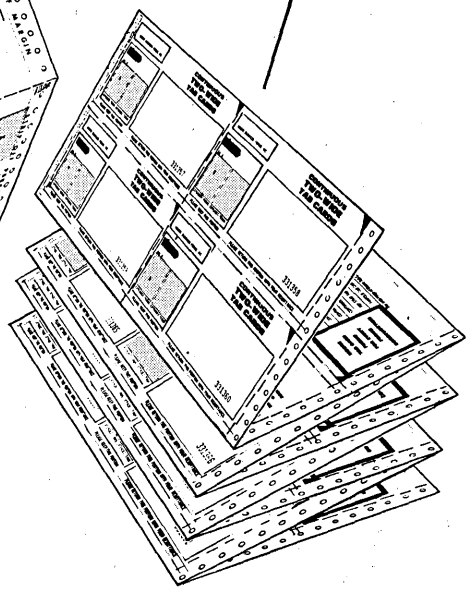

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Quality materials. Precision manufacture.
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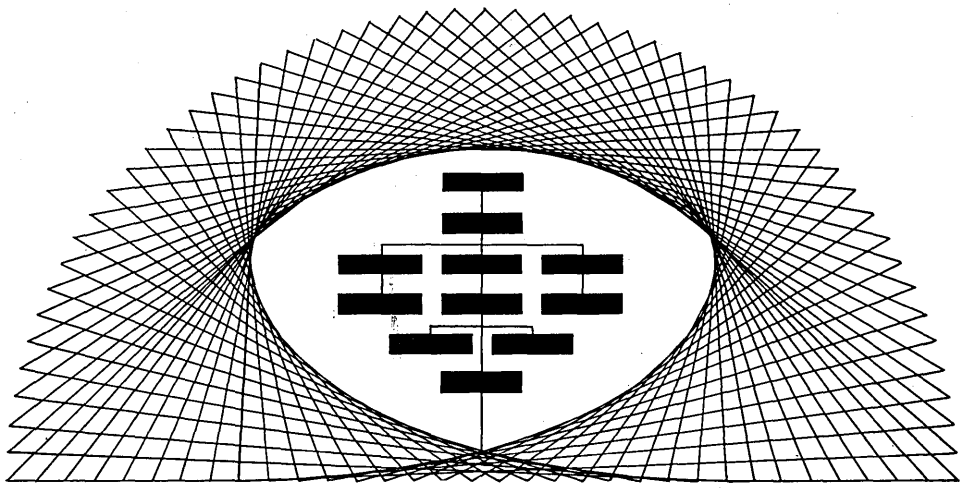
CIRCLE 44 ON READER CARD



At PRC we begin with Systems Architecture...

An automated management information system must be more than hardware/software analysis and design. The system must be visualized as a dynamic structure arching across the organization to provide an environment within which people function and do useful work more effectively. The structure must be patterned to the nature of the business. It must be flexible and expansible. And it must reflect the spirit and character of the enterprise.

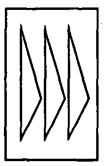
At Planning Research Corporation, we begin the design of an automated management information system by defining both the economic implications and the technical specifications; design and optimize the system to work efficiently with the people who use it; procure the most effective hardware for the job (not necessarily the most expensive); produce the software; and train your personnel .....we tailor a system to fit your total needs.

This we can do because PRC is a most unusual group of people whose disciplines include economics, business administration, behavioral psychology, most branches of engineering, the classical sciences, and mathematics. These and other disciplines interact on multidisciplined teams to form the most powerful analytical tool yet achieved for the solution of computer system problems.

For example, at PRC the design and implementation of an automated system for an airline, railroad, or any other carrier begins with transportation specialists on the system design team. Our approach ensures that the whole system will work efficiently and interact successfully with the people who use it.

Although we do not manufacture hardware, our hardware specialists are thoroughly knowledgeable in its design, selection, and application; thus PRC maintains total objectivity in your behalf.

Why not start with Systems Architecture? To find out what it can mean to you in terms of increased efficiency and profits for your business, contact Mr. J. N. Graham, Jr., Vice President and General Manager, Computer Systems Division.



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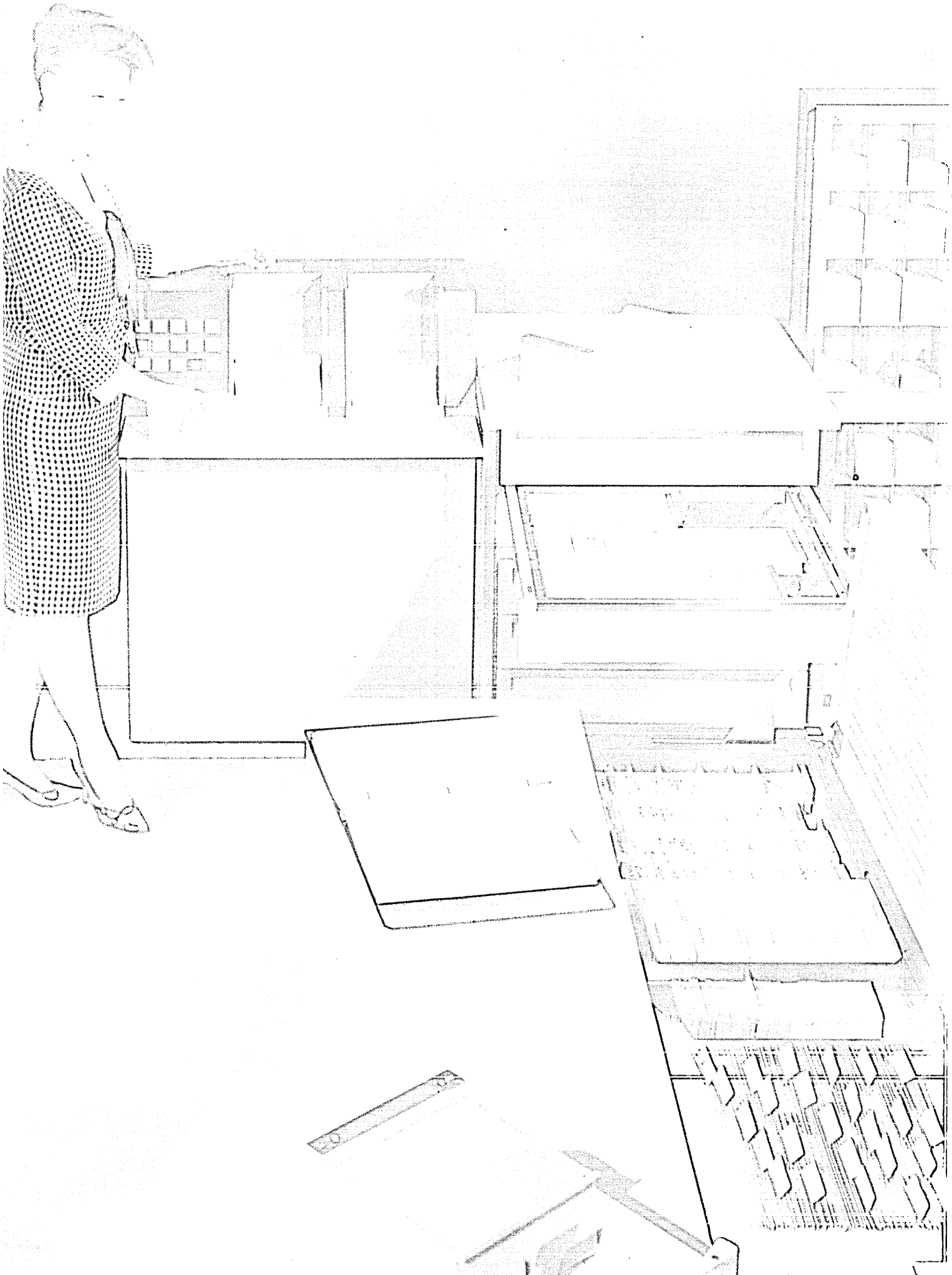

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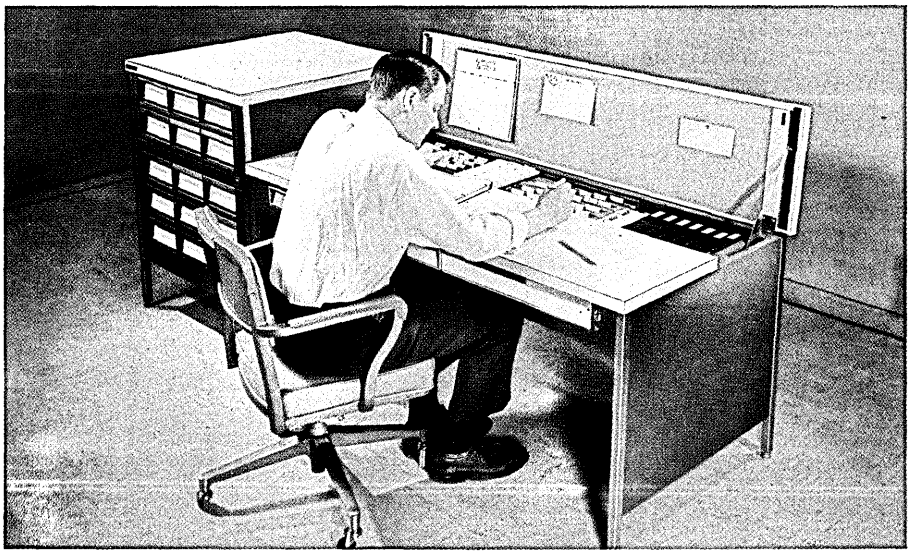
AN EFFICIENT COMPUTER-STYLED SYSTEM FOR WORK FLOW, CARD HANDLING AND SUPPLY STORAGE

Over a year ago, one of the first IBM 360-20 installations was made at Wright Line. This installation provided the opportunity for Wright Line Data Processing and Product Development groups to study the system, and to develop accessories keyed to its specific needs.

The result is the new 360-20 Accessory Group. It includes a dramatic new Control Center with a push-button, flip top with built-in scheduling board and tub storage for object decks, procedure manuals and letter or legal size file folders . . . a cross file for use at the MFCM . . . the first desk ever designed specifically to meet the needs of the Data Processing Manager or Programmer . . . plus storage cabinets for forms and complete card handling equipment.

Every piece is designed to meet a specific need, and to provide maximum utilization of available machine time. All are handsomely computer-styled and color-coordinated to the basic 360-20 equipment.



If you presently have a 360-20 System, installed or on order . . . or if you anticipate ordering in the future, you will want full details of Wright Line's 360-20 experience, plus complete information on the new 360-20 ACCESSORIES. Just circle our reader service number or write to us at: Wright Line, Division of Barry Wright Corporation, 160 Gold Star Boulevard, Worcester, Massachusetts 01606. The information will be in the mail to you the same day your request is received.

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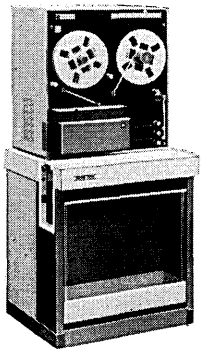
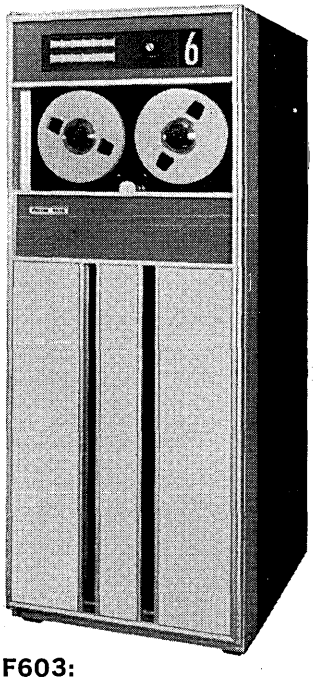
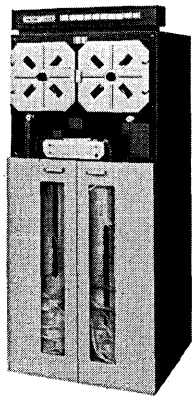
A computer cannot express direct dissatisfaction with her peripheral system. But there are ways you can tell. Lagging input, a piled up printout job or too much off-the-job time. FUJITSU can satisfy you AND your computer with a perfect range of high-performance peripheral equipment. Each component has high-speed treating capability and fieldproven reliability backed up by our proven technology. Hire them and your computer will take a new lease on efficient operation.



Paper Tape Perforator F766A:
Precise and rugged model with a perforating speed of 200 rps. 6 or 8 code level and built-in feed check device.





Paper Tape Reader F748A:
Dependable and economical. 1,000 rps reading speed. 6 or 8 code level. Double-read check system built in.

Magnetic Tape Unit F603:
A single capstan, direct-drive unit that assures more than ten times longer tape life; simple tape loading and fast, smooth operation. Five models available. 200, 556 and 800 rpi recording density. Tape speed: 75 and 120 ips. 7 or 9 tracks. Compatible with IBM-729 and 2,400 series. Backward reading feasible.

Line Printer F642:
Rugged, high-speed printer with wide compatibility. Printing speeds: 500—1,500 lines/min. Number of printable characters: 16—109. 136 columns. Low-speed model F643 also available—400—120 lines/min. Number of printable characters: 50 or 100. 80 columns.

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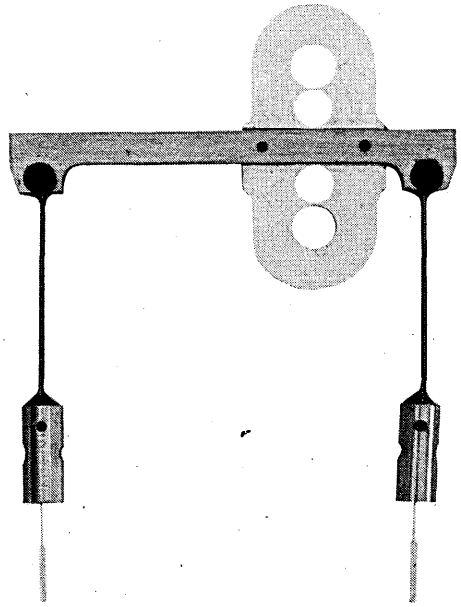
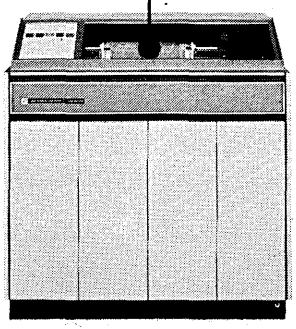
For the full details on these peripheral equipment, please write to:

FUJITSU LIMITED
Communications and Electronics
Marunouchi, Tokyo, Japan

CIRCLE 47 ON READER CARD



small wonder



This is the Mark-II hammer, a relatively small but important part of a Data Products' LINE/PRINTER*. It has no moving parts, is virtually friction-free, and requires no adjustments. There's no wear either, for that matter. Maintenance and downtime are reduced to a bare minimum.

You won't find the Mark-II hammer in any catalog. Designed originally for our rugged Model RO-280 (XN-2)/UYK military LINE/PRINTER, it is built by us, and only by us, expressly for use in our LINE/PRINTER.

Controlled flight time and short dwell time contribute to clear, sharp print-out, without smear, and to the straightest lines in the industry. Add to this the LINE/PRINTER's extended, interchangeable fonts of up to 128 characters, speeds to 1200 lines-per-minute, clutchless paper feed and the ability to handle all forms, from one to six parts, and you'll see why the LINE/PRINTER has been so widely accepted for applications on-line and off-line where quality, reliability, low cost and maintainability are "no-compromise" requirements.

Small wonder? Yes . . . but the Mark-II hammer is only one reason why Data Products' LINE/PRINTERS can do *and are doing* the job.

The LINE/PRINTER is available in commercial, ruggedized, militarized, and full Mil-Spec configurations.

A note or phone call will get you the full LINE/PRINTER facts-and-figures story.

*LINE/PRINTER is a trademark of *data products corporation*

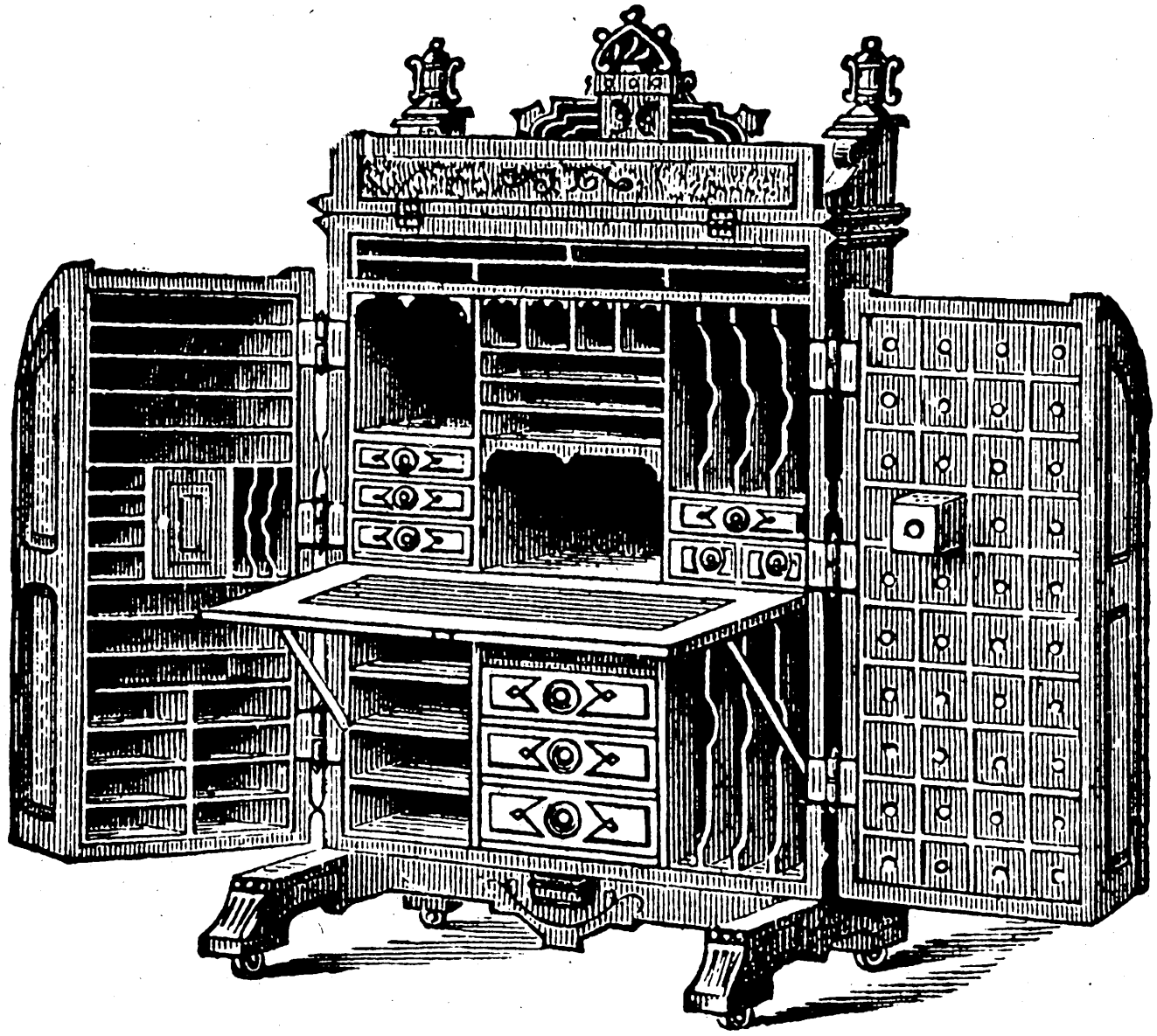
data products corporation

8535 Warner Drive, Culver City, California 90231
Telephone: (213) 837-4491 *Telex:* 674734

Data Products Corporation also manufactures the DISCFILE® random access memory storage system.

CIRCLE 48 ON READER CARD

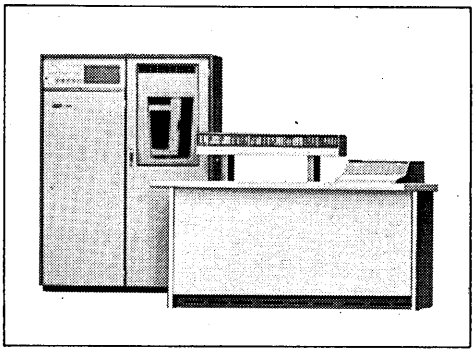
NCR announces the new 353-5 CRAM, most versatile random-access file system since this one:



Access was pretty random with this Victorian beauty. NCR's new 353-5 CRAM is less decorative and more efficient. Modular design permits the NCR 353-5 CRAM's capacity to grow as your needs grow. You don't pay for storage capacity until you use it. You can step-up ON LINE capacity to a total near 2 billion digits.

An NCR 353-5 unit can access, read or write and write/check at a rate of five magnetic CRAM cards a second. These functions are time shared with additional on-line units with the result that you get almost instant access to any record or a group of records.

Access speed is averaging less than 125 milliseconds, a rate made possible because random refiling of CRAM cards is shared with access time. 344 cards are stored in easily removable cartridges, and can be changed in less than a minute. Each 3.65″ by 14″ card contains 144 recording tracks with a storage capacity of 1500 six-bit alphanumeric characters to the track. Total capacity of each unit is 82,944,000 six bit characters. One last spec: CRAM cards ride on a cushion of air to insure a long lifetime of effective performance.



NCR

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CIRCLE 79 ON READER CARD

news briefs

SOCIAL SCIENCE COUNCIL HOLDS DATA BASE CONFERENCE

The Council of Social Science Data Archives held its fourth annual conference at the Univ. of California at Los Angeles June 14-17. The theme of the meetings was "Modern Computer Analysis of Complex Social Science Data Bases." The council, established in 1965 with the support of the National Science Foundation, seeks to "coordinate data acquisitioning activities; set standards for processing, documenting, and storing data, work toward procedures for servicing user needs; disseminate information pertaining to the operation of archives," and to develop computer application in the social sciences.

General commentaries at this year's conference were provided by Dr. Karl Deutsch of Harvard Univ. in a keynote address entitled "Computer Data Bases and Social Science Research of the Future," and later by Angus Campbell, director of the Univ. of Michigan's Survey Research Center.

Dr. Deutsch outlined a succession of data revolutions in the social sciences: the first in the 1790's with the first use of statistics; the second in the 1820's with the development of evolutionary models; the third around 1935 with the introduction of new methods of gathering data; and the fourth occurring now with the use of multiple methods of dealing with complex data bases. He predicted that social scientists, as they refine their techniques and develop increasingly precise formulations, are approaching a time when converging and accumulating evidence will make possible all to all comparisons between data collected by a variety of methods. Such a phenomenon was seen in physics when a quantum theory of light superseded opposing particle and wave theories. Dr. Campbell's address was also supportive of developing archives, but injected with the cautionary note that even the best collections of data are not a substitute for human imagination and creativity.

The meetings were divided into user and technical sessions. The user sessions were devoted to the use of data archives for secondary analysis, federal government data sources, and data bases and protection issues, including privacy. The technical sessions concentrated upon statistical and computer methods for handling missing data, and the identification of data record entities for data management.

Three council subcommittees, Information Retrieval, Computer Development, and Standards, held open meetings. Howard Burnaugh of System Development Corp. demonstrated the BOLD (Bibliographic On-Line Display) system and a panel of Information Retrieval Subcommittee members discussed retrieval from data banks.

NASA AND ARPA FUND OCR RESEARCH PROJECT

System Development Corp. is developing a system that will allow a computer to recognize hand-printed characters (symbols or alphanumeric) when drawn on the surface of a graphic input device, such as the RAND tablet or the GRAFACON 1010A. The CRT input will be connected on-line to a time-shared computer where a recognizer program will identify the character. The program will be flexible enough to recognize the penmanship variations that will occur for each character.

The project, funded by the National Aeronautics and Space Administration and the Advanced Research Projects Agency, is headed by Morton I. Bernstein, and is being designed to function in real-time, either under a t-s system or a free-standing environment.

AUSTRALIA ESTIMATES COMPUTER POPULATION

Recent estimates of the computer population up to 1967, released from Australia, show that country's total systems (including those on order) at about 460. (An IBM survey, this includes computers of all makes.) A Control Data estimate, made at the end of '65, had guessed the total number of installations at 357, and gave a breakdown of 320 small systems, 30 medium, and 7 large.

The large systems, all owned by the commonwealth government, reportedly have been successful and productive installations, with the result that the government, formerly more concerned with small scientific computers, has now put an emphasis on the purchase of large-scale systems. Some 4% of the total installations belong to the commonwealth government.

The medium-scale computers are, for the most part, installed in universities, which account for 10% of the total system population. The large majority of these systems are rented.

In the private business sector, which uses about 85% of the computers in the country, small systems are used, almost exclusively on a rental basis. Most applications cover invoicing and elementary stock control, payroll and sales analysis.

U.K. MERGER WILL RESULT IN MAJOR COMPUTER FIRM

Two of Britain's biggest electronics companies, English Electric and Elliott Automation, are merging to form a new $500 million combine. This will be one of the biggest steps taken so far in amalgamating Europe's profit-bedevilled computer industry into larger and more viable units.

Both parties to this merger have activities ranging far outside the information processing field. English is strong in the heavy electrical, nuclear reactor and diesel engine field. And Elliott has a big stake in electromechanical control systems. Both have strong military connections in avionic systems—English Electric through the Marconi company, which dominates the heavy radar and marine business.

Bringing the two organizations together creates in itself a number of problems. Elliott's computer policy has pitched the company almost exclusively into the military, scientific and process fields with its range of 900 series integrated circuit defense machines and larger 4100 series systems for the university and engineering customers. Eschewing the commercial dp business, Elliot has agreements with NCR, for whom they make the 315's for areas outside the U.S. Recently, Elliott was negotiating to take over the Computers and Automation company of British GEC (which in turn makes SDS systems under license.)

With the new deal, both these activities must halt. In fact, GEC has made a brief statement to the effect that talks had broken down and that the company would resume operations under old agreements. In the commercial field, NCR and English Electric Computers compete directly. It seems likely that as an alternative manufacturing base, NCR may now

news briefs

extend facilities at Dundee, Scotland, to include full computer making. At present these plants manufacture the small accounting machine products up to NCR 395 size.

All indications of this latest grouping point to English Electric as the much-favored son of the U.K. government's national computer policy. First, a government agency, the Industrial Reorganisation Corp., has forked over $42 million to oil the wheels of the merger. The IRC was set up 12 months ago to help industry organize in more viable units, and this is its first baby. Following hot on the heels of the first deal, the Industrial Finance Corp. for industry agreed on July 18 to loan English Electric a further $20 million for expansion of the computer company.

English Electric Computers' hopes are staked on its System 4 computers, based on RCA technology in the middle of the series, but extended in design for large time-sharing systems on order for university computing centers, banks and the Post Office. The merger makes the combine the first European corporation with a full product line covering every niche in the information processing market. But there are still deficiencies in peripherals that affect the industry as a whole.

The biggest sufferer from this arrangement may be ICT, for they may find themselves relegated to the ranks of conventional dp suppliers. Certainly ICT has not succeeded with proposals to government for large machine support that would take them into big-time time-sharing. Earlier attempts to get ICT and English Electric to merge fell through. But it is still government policy to cut the industry down to one general-purpose main frame maker with a handful of smaller firms producing specialist processors and peripherals.

INDUSTRY PERIPHERY NO PLACE FOR BRYANT

A murderous, or at least maiming, squeeze is on the independent peripheral equipment maker, say spokesmen for Bryant Computer Products. General manager R. O. Wilson and government contract manager L. R. Caveney outline these reasons:

- Computer makers are swiftly developing and improving in-house peripheral capabilities in many areas, drastically reducing their contracts with independents and competing with them for other OEM contracts. Bryant, a $15-20 million division of Ex-Cell-O Corp., has seen business with such firms as Control Data and RCA slip from a large percentage of their annual volume to almost zero for this reason, they say.
- The independent alone, long relying on these OEM contracts, cannot always provide the sales and maintenance forces needed to satisfy the end user market he is being forced into.
- The major edp customer, the government, is using many archaic, inefficient procurement practices which "are destroying the very competition it seeks to maintain." "These procurement organizations," says Caveney, "have a tendency to call the top computer manufacturers because, in most cases, they are completely void of the technical aspects of both software and hardware," and "not because of the best equality or price—a very poor way of determining the expenditure of the taxpayer dollar."

In a recent DATAMATION interview at Bryant headquarters in Walled Lake, Michigan, both Wilson and Caveney detailed the woes of the independent, firing stinging criticism and accusations at private and government sectors. But, they also proffered a host of solutions ranging from an association of independent peripheral firms to government reforms that would probably require several acts of Congress and the overriding of

protests from powerful manufacturer lobbies.

Since the cost of peripherals in a computer system is rapidly becoming the major hardware expense, it is obvious that mainframe makers will put their resources in that area, said Wilson. He estimated that non-IBM mainframe makers now produce over 75% of their own peripherals, versus 50% two years ago. But this increasing I/O expense is all the more reason for buyers, especially the government, to examine what's available in the field, rather than going to a single source for the total system. Two cases in particular led Caveney, an ex-procurement officer well versed in and disgusted with government procurement practices, to start bending the ears of congressmen and agency officials about inequities. He related that one university, ordering a system for a government-funded project, would not hear a Bryant proposal for the memory portion, preferring to go to the computer manufacturer; Caveney's complaints in government circles reopened the case. In another university government-funded project for a prototype system, Caveney said that the firm that won the computer award also stole away the large-scale disc memory contract by offering a system at a greatly reduced price. Thus the job, which Bryant hoped to vie for, never was opened for competitive bid on the assumption that no one could beat the price.

The Bryant spokesmen are in favor of the "black box" procurement method. Said Wilson: "The degree of sophistication of some government users is increasing and today some scientific branches of the government are actually purchasing computers systems and equipment, with hardware and software often coming from different sources, with even maintenance being supplied by a third party. Some large industrial users are going this same route and the trend is definitely toward using hardware-oriented people to make the purchasing decision on the basis of merit of the individual equipment service. . . ." He particularly commended the U.S. Navy weather facility for using this approach.

The stumbling block to "black box" buying in many cases is the interface between the computer and an "alien" peripheral. The ultimate solution of this problem is a "federal standardization in the industry" of these interfaces. Realistically, a standard controller is not feasible until the next generation of computers, Wilson admitted, but for now, each computer manufacturer should be required to offer a general purpose peripheral adapter, which would in effect be a second translator for the controller. Honeywell for one, says Wilson, has one, the PA2A, although like all interfaces that may be available on computers for another firm's peripherals, the information doesn't appear in GSA schedules and is hard to come by. Bandying cost comparisons showing a Bryant product at one-tenth that of a smaller OEM mass-memory system now installed in industry, Wilson noted that the cost of such adapters, which are in the $25K range, would be more than offset by the advantages provided. Bryant is currently offering the XLO-1000 controller as a compatible interface between their 4000 disc file and the Honeywell 200 adapter, as well as any other similar adapter. And he emphasized again, such adapter interfaces with some description ought to be mandatory in the GSA schedule.

The means of obtaining a strong voice, the Bryant leaders offered, are via an independent association which could make its complaints and information known before all agencies and other user groups, and via government commissions:

—Wilson is seeking comment from the industry on an association, and has thus far received support from Hewlett Packard and Western Telematic. Such an association, which would include communications equip-

ment firms, could also attack the sales and maintenance problems. Wilson suggests that interested firms, perhaps in non-competitive sub-groups, could set up one office per location for these functions, thereby dividing the often prohibitive costs of servicing the end-user market nationwide.

The recent uproar over the Air Force Phase II contract, in which congressional pressure forced the cancellation of the award to IBM and a reopening of the bidding, illustrated legislative awareness of the conflicts over procurement practices. Indeed, there are bills pending before the House and Senate calling for the establishment of a two-year 14-man commission to examine the statutes, regulations, procedures, and practices that govern Federal procurement. And this is a body that Bryant hopes will be a major instrument for correcting the problems of the peripheral maker. It would consist of congressional members and technical experts from outside the government, and Richard Caveney is hopeful of being nominated to this group—making it one of the first times, he said, that a subcontractor is represented on such a commission.

Caveney also feels that Congress ought to take a more permanent role in the procurement process. Once these legislative bodies affirm appropriations, he said, they lose most of their control over how the money is spent. What is called for is a Senate/House Technological Department. "Upon passing appropriation bills for large procurements of computer systems, space programs and aeronautical programs, etc." a rider would require that before any award is made, the "Executive Branch involved" would first have to submit to this department all the proposals, stating the award decision and reasons for it. The department would then evaluate it and report its recommendations to the Senate and the House.

Caveney would also reform laws governing the Small Business Administration. Too often, he says, when a prime contract is awarded, SBA approaches the winner to recommend that he subcontract jobs to small businesses. But in the case of the computer maker, Caveney complains, such subcontracts often go to "nuts and bolts or paper makers" and not to peripheral firms if the mainframer produces his own peripherals. Thus SBA should designate the types of equipment that should be subcontracted, based upon knowledge of what is available and economical. The agency should also change its criteria for determining a small business from a flat people and earnings limit for all industries to a limit varying according to product.

But while the I/O industry waits for these acts of Congress and for action from the commissions and other groups that *may* be created, Wilson asks now for pro and con comments on the idea of an association, addressable to him at Bryant Computer Products, Walled Lake, Mich. 48088.

NYSE COMPUTERS BID FAREWELL TO MANHATTAN

The Floor will never leave Wall Street, but most of the New York Stock Exchange computing operation begins its move west next April, when the first modules of a four-computer IBM 360 system will be installed at Paramus, N.J. (The site is an ITT data center being vacated next November.)

The exchange is not trying for a crash conversion of its real-time Market Data System, which handles millions of stock transactions a day, but will operate the present 7010/7750 system in parallel with the 360s for some time. Cut-over should take until at least 1970, since the new configuration, which reportedly consists of either three model 65s and one 50 or two of each "attached to a very large memory device," will not be fully installed until late '69, according to present schedules.

One of the reasons a newer, larger system is needed is that the present equipment can only handle 1,790 securities and by '69, the market will exceed that. The 360s, expandable in modules, are expected to handle "several times" the present system workload.

But more immediately, as the first 65 is installed at the electronic systems center, the exchange will begin to implement its other services on it: central computer accounting, central cerificate service, clearing and settlement, and odd-lot settlement. NYSE's Central Computer Accounting Corp. has priority, since the continually high volume of daily transactions has buried workers in the paperwork involved in the physical transfer of certificates. (There's a four-day deadline on the transfer.) In fact, the exchange closed early several times in August to give the brokers a chance to catch up. CCAC is trying to accomplish transfer of many certificates for the broker by simply crediting and debiting accounts in a computer, leaving the actual certificates in an exchange vault. Such a system is in test now, on-line input from brokers on the day's transactions going into a Honeywell 1200; mag tape from this system is now being put on a 360/50 which executes the account changes.

Two 360/50s and two 30s are being used for all these non-real-time services at present and some or all will be kept at a permanent center in New York to do testing and debugging of new programs, as well as those "printing functions" which can't be done as effectively at a remote site. These include stock listing distribution to firms, payrolls, billing, etc. The dual 7010s and 7750s must go.

Reliability is vital for the tight real-time requirements of the market data system. Past failures on the present system. NYSE has seen bugs and other failures on the present system, though down time was only in minutes, snarled reports for days. Past NYSE president Keith Funston said the new system will be one of the most reliable complexes in the U.S. IBM's Federal Systems Div. is working on that problem.

NEW FIRM OFFERS COLLEGE SELECTION BY COMPUTER

A Los Angeles company called The American College Selector is offering a service that assists high school students to make a rational choice of colleges by comparing the student's interests and abilities to the characteristics of 1079 accredited U.S. liberal arts colleges and universities.

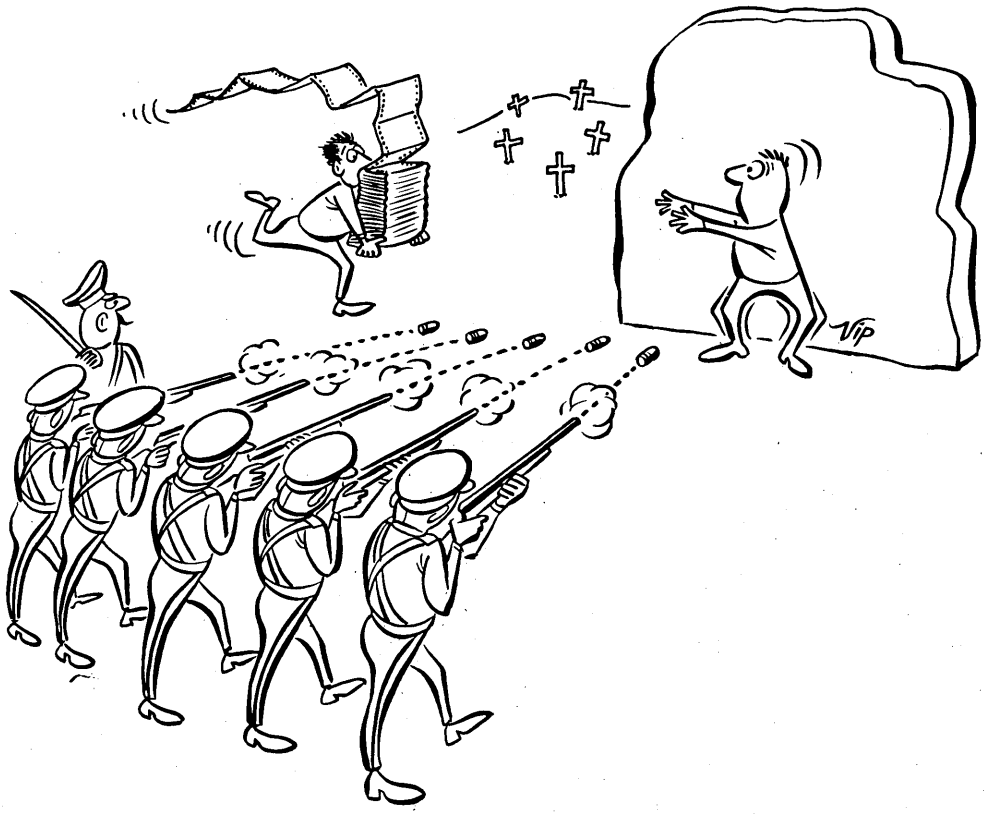
System design and programming were done by United Computing Corp. of Redondo Beach, Calif. for a 360/50. First runs were on Allen-Babcock's computer in Palo Alto.

Cost to the student is $10 and for this he gets a list of six colleges most likely to meet his needs and preferences, plus a guide for getting further information from the selected schools to help him decide on first choice among them. The program operates on data supplied by the student, who fills out a questionnaire about a dozen pages long. Many of the questions are detailed, allowing five degrees of enthusiasm about hypothetical characteristics of the college—ranging from "strongly agree" through "strongly disagree." Samples: "Should the college have a student body of diverse backgrounds? Do you expect the college to regulate student behavior?" A measure of the complexity of the program: it takes 500K bytes of core.

PHILCO-FORD ACTIVE IN TIME-SHARING

Philco—now Philco-Ford Corp.—which bowed out of the general-purpose computer business several years ago to devote its talents to special contracts, has been "re-examining where we ought to be going," ac-

EXECUTIVES, ANALYSTS, MANAGERS, PROGRAMMERS



if you ever need information fast and can't get it in time...

if you don't want to pay the price of doing it the old way...

YOU NEED QWICK QWERY!

QWICK QWERY* is a much needed breakthrough in man-computer communications. Easy-to-learn, easy-to-use QWICK QWERY forms let you tell the computer, in plain language, exactly what information you want. Hundreds of analysts, executives, managers, and technicians without computer programming experience have already learned QWICK QWERY and now express their data needs directly to the computer. Professional programmers use it too.

- QWICK QWERY extracts the specific data you want to see now.
- It analyzes, sorts, summarizes and displays this data the way you want to look at it this time.
- It eliminates almost all of the time and cost previously required for special computer reports.

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CIRCLE 50 ON READER CARD

KEYED TO MOVE DATA FAST...AND AUTOMATICALLY

It's 5:00 p.m. in Los Angeles! In the branch sales office of a nationwide company, the day's work is done. All sales orders and other vital data have been recorded on punched tape by an operator using a Teletype automatic send-receive set.

As she leaves for home, the operator inserts the tape into a Telespeed 750 high-speed tape-to-tape sending set, flicks the "on" switch, then forgets about it!

Later that evening, the home office a continent away, in sequence polls this and other Telespeed 750's in similar sales offices scattered throughout the country. Thus, the day's accumulation of data is transmitted to the home office automatically, unattended, and at low cost.

For any multibranch operation, especially where time differences are a factor, Telespeed 750 high-speed tape-to-tape data communications equipment offers many advantages.

Operates unattended! Once the Telespeed sending set is loaded and turned on, it requires no further attention. It is polled automatically by the company's data processing center. After polling, the sending set shuts off automatically.

Table model Telespeed 750 sending set requires no operator during transmission; shuts off automatically.

Reduces cost. By confining transmission to night hours, data can be sent when communication lines are less busy, more economical.

Even if transmission is done during the day, the speed and efficiency of Telespeed data communications equipment lets you take advantage of every minute of line time.

Because transmission is automatic, the operator can devote her entire working day to logging of data. Thus, she can process all orders and other data received at the branch for later transmission; no need to carry over to the next day, no delay in handling important information.

Teletype equipment is fast. The Telespeed 750 machines operate at 75 characters per second; 750 words per minute. The time required to transmit a full day's sales orders, or other data, can be reduced to a matter of minutes.

Increases accuracy; improves customer relations. A major acceptance corporation, providing installment loan service for thousands of their retail outlets, uses Telespeed 750 equipment to good advantage.

Their many branch offices across the country average 300 transactions daily. Every afternoon, the processing center contacts the branches allowing each branch three minutes time, including the time required to make the connection. Thanks to the speed of Telespeed 750's, the transmission of the punched-tape data, almost 60 feet daily from each office, can be handled in 1½ to 2 minutes.

The company's computer is now able to update each account, determine collection action, and prepare notices daily.

Results: streamlined office procedures; increased accuracy in handling accounts; improved customer relations for the retailers! They no longer worry about payment reminders being sent to customers who have already paid.

The Telespeed 750 receiving set collects all branch office data recorded on the punched tape; all automatically, all unattended.

Gives you the jump on competition. With competition ever-increasing, the company that "services" best is the one that gets the most business. Telespeed 750's, working with data processing equipment in auditing, production, inventory control, and shipping, give any company a competitive edge.

High-speed tape-to-tape transmission is but one example of the many capabilities of Teletype data communications equipment. Discover why Teletype equipment's versatility is the low-cost answer to your data communications needs. Read our new brochure, "HOW TELETYPE EQUIPMENT MOVES DATA FOR YOUR BUSINESS OR INDUSTRY." For your copy contact: Teletype Corporation, Dept. 81J, 5555 Touhy Ave., Skokie, Ill. 60076.

TELETYPE

CIRCLE 52 ON READER CARD

news briefs

cording to Lloyd Cali, general manager of Communications Switching and Data Systems Operation (CSDS). A change in direction was indicated by the Philco announcement to its user group this spring that it would be offering time-sharing systems using the 102 communications computer and the series 2000, model 212 processor.

"We're still not going into the general-purpose computer market" says Cali, but "in recent months we've been looking at the outputs from our special programs," particularly the NORAD system and AUTODIN; and on the basis of the talents developed, Philco-Ford's Communications and Electronics Division is eminently qualified to tackle the "computer/communications" market (CSDS is part of this division). Other manufacturers "so far have exhibited no real communications capability, being unable to cope with such areas as the statistical problems of handling many lines simultaneously and multi-programming."

While the firm won't turn down requests for time-sharing systems from non-Philco users, the "first thing we'll do is build these systems for ourselves and for the parent company Ford, then probably for two other Philco-Ford divisions," says Cali. These will be operational in a year. The CSDS group has begun its own service center, first using the 102 for putting remote batch scientific jobs on mag tape, which is then manually transferred to the 212. Ten outside customers are now using this system. Gradually the 102 will be tied to the 212, and then time-sharing modifications and software will be implemented on the 212.

Ford Motor Co. in Dearborn, Mich., after considering large-scale time-sharing system offerings from the field, has decided to go with equipment on hand, which means a system of one 102 and two 212's, which will also be modified.

As for future service networks, or utilities, Cali says that Philco is interested but, again, wants to make their own systems work first.

Philco is already working on projects in computer-assisted instruction and other areas of education, and feels qualified to pursue this promising area. (Fortune has predicted a $500 million business in CAI by 1970.) One possible approach is time-sharing centers to serve schools that can't justify their own computer. But Cali says, "the problem now is that computers in education is at the point where the general field of computers was in 1950—everyone has ideas but they don't really understand what they're trying to do."

Philco also hopes to build capabilities dedicated to other industries and the first will be the $9 billion/year motor-freight industry. Jack Blodgett, heading the special applications sales effort, says that Philco will focus its attention on this segment for the next two-three years. "We intend," he says, "to concentrate on totally integrated systems at costs below (perhaps 60-80%) what the trucking companies are paying now. Other manufacturers have not in the main helped trucking companies do more than back-office accounting with data processing, he claims. Philco plans first to go after the large companies, helping them develop applications requiring on-line operations and communications switching, such as remote entry of reports or freight bills. Freight bill computation is a major problem, says Blodgett, and Philco plans to help a freight company analyze a year's worth of bills to determine which of the multitude of rates are used most, storing those in the computer to provide automatic computation.

BANK EDP PLAN OUTLINED AT SEMINAR

A five-step plan to take banks into the computer age was presented by Benjamin W. Taunton, banking and finance industry manager at Honeywell EDP, to a banking seminar in New York recently.

Taking three to five years to implement, the five steps begin with the standard batch processing on magnetic tape. The second step, direct access processing with audio-visual communications equipment, leads into on-line processing (e.g., in teller systems). The fourth step is the establishment of a central information file, with the end goal of inter-bank processing: the exchange of information between bank computer for purposes of credit checking and transferring funds.

Taunton suggested that these steps be set up on a third-generation system, and begin with the processing of fundamental banking operations rather than customer service tasks.

NBS SERVICE BUREAU MAY BE FIRST IN NETWORK

The first of what may become a nationwide network of government-run dp service bureaus has been operating since May 1 at the National Bureau of Standards in Gaithersburg, Md. Rates are about half those asked

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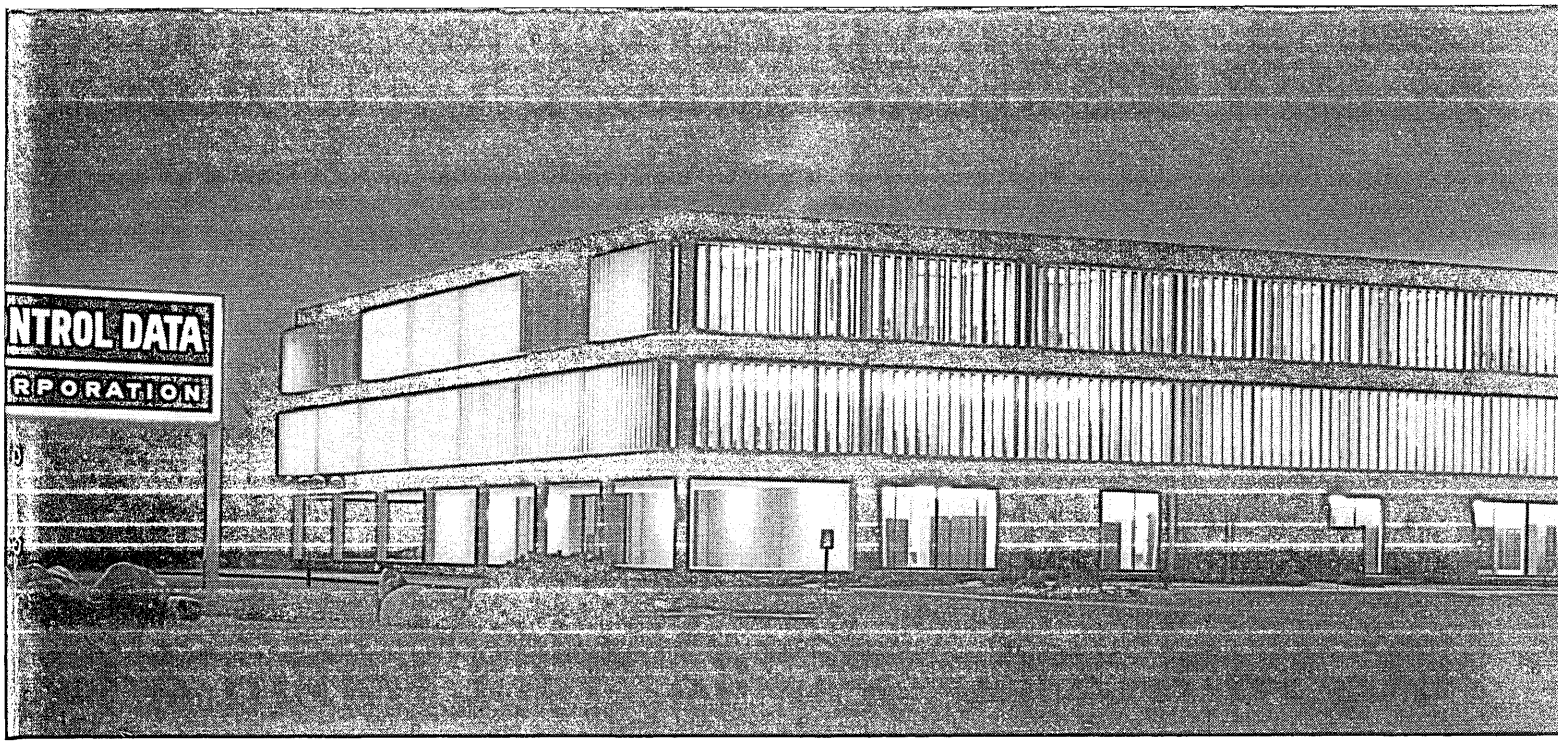

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CIRCLE 54 ON READER CARD

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by commercial service bureaus for similar capability.

So far, this differential hasn't diminished the government's use of local software contractors and machine shops. Erwin Voltin, manager of the NBS facility, doesn't see a competitive threat because "the government's dp workload is growing so fast there should be enough for everybody." Obviously, however, without a government facility, there would be more business for contractors. A government service bureau network might have an even bigger impact.

The General Services Administration is now actively developing this network. As we reported in the August Washington Report, a service center in Huntsville, utilizing NASA-discarded 7094s, will probably be established about the first of the year. Another is likely soon afterward. It will grow out of an existing Agriculture Department facility in St. Louis. GSA is trying to make similar arrangements with several other agencies. Many have balked, but Circular A-54, which requires maximum sharing of existing hardware before new equipment is acquired, gives federal adp managers substantial clout.

GSA manages the NBS service center, so it could very easily become a model for the others.

The equipment configuration at Gaithersburg consists of an 1108, 65.5K words of main memory, and 273 million characters of auxiliary storage. The latter includes two Fastrand-IIs (92 ms. access time) and six model 432 fast access-drums (4.25 ms. access time). The other peripherals include eight mag tape drives (two 7-track, six 9-track units), two 600 lpm printers, two 615 cpm card readers, two 200 cpm card punches, and an incremental X-Y plotter. Three remote terminals are now on-line, and three more should be in before the end of this year.

Gaithersburg charges from 7 to 20 cents for each second of 1108 time. For the top rate, the customer gets a 10-minute turnaround and up to 40 pages of output. Programming and analysis services cost from $8-21 per man-hour.

Officially, the NBS center has been operating since 1964, but it was experimental until the beginning of this year and didn't really get revved up until the 1108 went on-line in May. Currently, the center has about 450 customers, operates about 64 hours per week, and averages 1½ shifts per day. It has 28 programmers and a maximum machine room crew of six. The applied mathematics and

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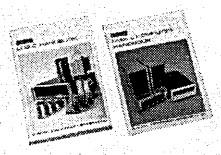

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technical analysis divisions of NBS provide additional support for especially complex programming and system work.

Voltin says he can offer his customers—who must be federal or non-federal government agencies—as broad a range of services as any private shop. The workload—which runs the gamut from esoteric scientific to mundane business applications—tends to support this contention. Those jobs requiring technical help, rather than machine time alone, must be given precedence. Eighty percent of the present workload falls into this category.

Roughly half the total machine time is used by NBS subdivisions, another 10% by other Commerce Department agencies, and the remaining 40% by other federal organizations—notably NIH, Office of Emergency Planning, and Army Map Service. Revenue in July totaled about $70K, of which 20% came from support services.

Voltin believes his present system can efficiently accommodate another 4-8 hours of work per day. Several additional applications are being developed to attract this business. The first will be text-editing, which should be available early in '68.

SJCC '68 CALLS FOR PAPERS

The technical committee for the Spring Joint Computer Conference, to be held April 30—May 2, 1968, in Atlantic City, N.J., has announced a call for papers. Five copies of an original paper, typewritten and double-spaced on one side only, and not exceeding 6,000 words, must be submitted by Oct. 30, 1967, to Professor T. R. Bashkow, Dept. of Electrical Engineering, 1312 S. W. Mudd, Columbia Univ., New York City 10027. Each page of the manuscript should list the name of the senior author, and be numbered; all figures should be labeled and numbered.

FJCC MEETS IN ANAHEIM: OLD PROBLEMS STILL NEWS

It may be the winter of our discontent: the Fall Joint Computer Conference, meeting Nov. 14-16 at the convention center in Anaheim, Calif., is not dwelling on the recent favorites of privacy (what if?) and time-sharing (what now?). In the more than two dozen sessions, the emphasis is a quest for new insights on the old problems: machine organization, programming languages, memory technol-

ogy, conversion, analog/hybrid systems. Only three sessions offer fairly new topics on interdisciplinary fields: communications and computer utilities, problems of intelligence for robots, and the impact of LSI on future computer systems.

In an effort to "get right down to business," (according to Technical Program Chairman, Harry T. Larson of Philco-Ford), there will be no keynote session this year. Featured speaker, at the Wednesday luncheon in the Disneyland Hotel, will be Ray Bradbury, noted science-fiction writer. Bradbury will speak on "Unthinking Man and his Thinking Machines"—a forecast of the possible consequences of current technology.

Two special sessions directed at laymen in the computer community will be features of this year's meeting. A Community Relations Committee, headed by DATAMATION editor Bob Forest, will provide an edp orientation lecture and tour of the exhibits for an invited group.

Dr. Gloria Silvern, of Education and Training Consultants in Los Angeles and chairman of the Educational Program Committee, will conduct a tutorial and discussion session for southern California school superintendents and trustees. Entitled "What School Superintendents Should Know About the Use of Computers in Education," the one-day program will include basic orientation lectures, and panel discussions on planned and current applications and state systems. An overview on CAI is also scheduled; the session will conclude with a tour of the exhibits.

Registration for the conference will be in the convention center Monday, 5-9 p.m.; Tuesday, 8:30 a.m.-6 p.m.; Wednesday, 8:30 a.m.-9 p.m.; and Thursday, 8:30-5. Registration fees (for three days, with a copy of the *Proceedings* included) are $20 for an AFIPS member; $30 for a non-member; $3 for a full-time student. One-day fees are $10/member and $15/non-member. A non-member who joins one of the sponsoring societies during the conference, or within 90 days after the conference, is eligible for a $10 rebate.

Despite problems due to the lack of centralized information, and the small number of adequate accommodations in the immediate conference area, the '67 FJCC promises to draw a larger-than-ever crowd.

Sponsoring societies—all members of AFIPS—are the Assn. of Computing Machinery, IEEE Computing Group, Simulation Councils Inc., American Documentation Institute, and the Assn. for Machine Translation and Computational Linguistics. Chairman of the conference is L. C. Hobbs of Hobbs Assoc., in Corona Del Mar, Calif.

UTILITY FIRMS TEST REMOTE METER READER

The homeowner may never see his meter reader again. Ripley Co. in Middletown, Conn., has now developed and patented a system which permits direct meter reading onto tape recorders from a unit attached to the outside of the home and is also in the process of building a system for remote automatic reading over telephone lines. Pilot tests in 1964-65 at Hartford Electric Light Co. (which now has 375 units installed) showed meter reading and bill preparation costs of a utility can be cut by about half. The orders have begun to come in: Greenwich Gas Co. will put 200 in this fall, and a Canadian utility has purchased 200 more. Ripley feels the market for such a unit is the number of gas, electric, and water meters—138 million in the U.S. alone.

In the basic system, an a-d encoder is added to the present meter in the field and encoder output is brought to the outside of the house to a reading receptacle which contains a coded matrix for format compatibility. The meter reader simply plugs a digital tape recorder into this receptacle to take the reading. At the home base, the tape cartridges are put onto a translator for conversion to cards, tapes, or, in the future, discs. Cost for the encoder and receptacle is said to be $20 in quantity. The recorders and translators, says Ripley, vary.

In the proposed on-line system, to be completed late this year, the reader receptacle would not be needed, but a scanner interface for data transmission (now being patented) would be attached to the encoder, data being recorded on off-line units at the remote site. Ultimately, Ripley expects some companies will transmit data directly to a computer.

LITE DATA NOW AVAILABLE ON LEASE

Data base and program tapes developed for LITE, the computerized Air Force information retrieval system, are now leasable to non-government users, it was disclosed at a recent House subcommittee hearing. Aside from lawyers, this news should interest government contractors because the data base includes ASPR regulations up through Revision 22, published and unpublished opinions of the Comptroller General, the

news briefs

Defense Contract Audit Manual, and related material.

LITE, which stands for Legal Information Through Electronics, is the only operational, full-text computerized retrieval system, and thus has state-of-the-art significance. The AF Accounting and Finance Center launched the project in 1961, but it wasn't until last year that much search activity occurred.

Between October, '66, and June, '67, 757 searches were completed, including nearly 100 for federal agencies other than the Air Force. This outside business is likely to grow.

At the hearing, conducted by Chet Holifield's Government Operations subcommittee, both the Justice Department and the General Accounting Office indicated they were thinking of becoming major customers. There was some talk of establishing a remote on-line terminal in the Washington, D.C. area.

The hardware—consisting of a Spectra 70-Model 45F, is located in Denver. Currently, it is a simulated 1410, but Delcos, Inc., contractor for the LITE project, is rewriting the programs to make full use of the Spectra 70's capabilities. The data base is being expanded at the rate of 1.25 million words/month. Delcos, a subsidiary of McDonnell Aircraft, performs both of these jobs, and conducts searches, for about $27K/month.

Two days before the hearing, AF officials announced the new leasing program. LITE data base is available for a penny per punched card or the mag tape equivalent (about 10 words). This is the price for unrestricted use by outsiders. Researchers in information retrieval can get the same data for less. The lessee, in either case, is allowed to copy the cards or tape, but can't resell the data to a third party without an AF OK and payment of an additional fee.

A KWIC (key word in context) index of the Comptroller General's published decisions is now being prepared by the LITE project staff. It will be printed on a Linotron recently installed by the Government Printing Office, and then sold to the public. Several other KWIC indexes have already been printed for in-house AF use, and these may also be offered for public sale, along with cross-reference indexes, citation lists, and collections of statutory material relevant to particular subjects. Col. Charles A. Kelley, who manages LITE for the Air Force, reported that publication of KWIC indexes on microfilm is being considered.

IEEE '68 COMPUTER MEETING CALLS FOR PAPERS ON LSI

A call for papers has been sounded by the committee preparing for the second annual IEEE Computer Conference, "The Impact of LSI on Information Processing Systems," scheduled for June 25-27, 1968, in Los Angeles. Authors are requested to submit 2000-word abstracts of their papers by Jan. 15, 1968, to Dr. Harold Petersen, Program Committee Chairman, The RAND Corp., 1700 Main Street, Santa Monica, Calif.

MICROWAVE VS. WIRES MOVES NEARER DECISION

The David-and-Goliath struggle between Microwave Communications, Inc., and the Bell System, Western Union, et al, has moved a step nearer a final decision.

Late in July, FCC's Common Carrier Bureau said the commission should grant MCI authority to operate a low-cost common carrier microwave system between Chicago and St. Louis. In a 46-page opinion, Bureau Chief Bernard Strassburg strongly endorsed several arguments advanced by MCI—arguments the carriers had strenuously contested. A key point was that MCI would not offer

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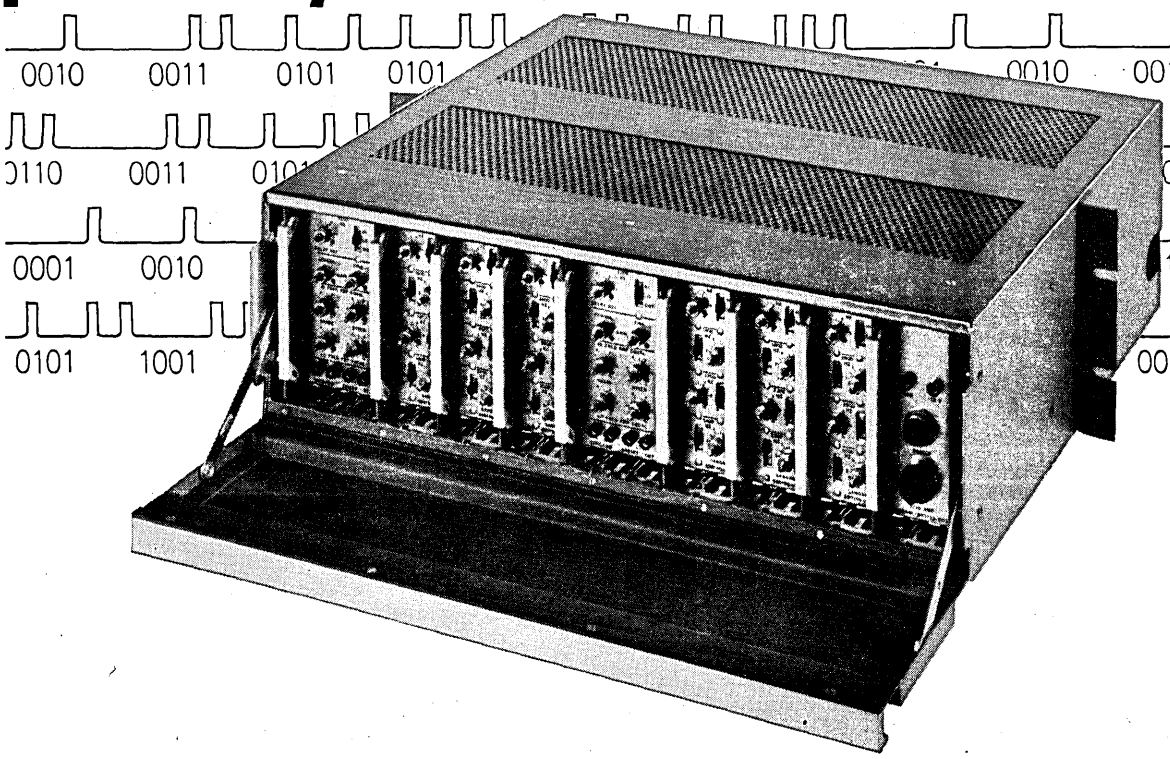

With the increased use of 2400 bits per second and higher data rates, the necessity for equalizing *both* amplitude and phase becomes paramount. The new Sangamo LC-1 line conditioner does both with virtually independent adjustment... permitting faster adjustment with increased accuracy.

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Phase equalization is accomplished with 13 individual time delay sections on 200 Hz spacings (option 600 to 3000 Hz or 800 to 3200 Hz). Each section has a 3-position ranging switch to set the vernier time delay control to: 1.28 to 2.28 milliseconds, 0.4 to 1.4 milliseconds, or section bypass. This unique configuration provides fast initial ranging of the equalizer and permits 1 millisecond resolution control for fine tuning. The 13 sections can insert up to 3.5 milliseconds delay at 1900 Hz as related to the delay at the band edges. Minimum time is required to compensate an average line to ±80 microseconds time delay variation through the pass band.

The resonant frequency of each of the 13 sections can be field changed by +67 Hz, +100 Hz, or −67 Hz. When two or three LC-1's are operated in tandem, this subspacing permits placing 26 sections on 100 Hz spacing or 39 sections on 67 Hz spacing, reducing the overall ripple to a minimum while inserting up to 10.5 milliseconds of delay.

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T67-08

CIRCLE 60 ON READER CARD

a redundant service because its potential customers comprised a "submarket" of smaller-volume users not being reached by the giant carriers.

The case won't be decided for another year at least. Opinions must be written by Hearing Examiner Herbert Sharfman, and probably by a review board, before the commissioners issue their verdict. The Common Carrier Bureau's recommendation could be overturned at any point along this administrative chain but, according to an expert outside observer, "it isn't likely. The bureau has developed a solid foundation for its conclusions."

Data processors have a big stake in the case because MCI plans to offer substantially lower rates, plus three valuable service modifications that the existing carriers have long opposed: shared use of public message channels; foreign terminal attachments, and discounts for less than 24-hour turn-around service.

Initially, MCI would serve no more than 50 users, but the ramifications of the case are much broader than that statistic implies. As the bureau put it: "The development of this sub-market would provide an incentive for the existing carriers to search out and develop latent sub-market demands that are not being optimally served today. There is a very real possibility that MCI's offering will provide substantial benefits to the remaining users of the services of the existing carriers."

MCI, alone, probably would have trouble mounting the competitive pressure needed to change AT&T and Western Union tariffs. But many other firms are ready, willing, and able, as soon as the MCI case is settled, to apply for similar authority. There are enough potential applicants to create a new, nationwide common carrier network in relatively short order.

The commission, assuming it approves MCI's petition, probably would want to observe the results for a while before considering any other requests. During this test period, the major carriers almost certainly would offer concessions designed to forestall establishment of a competing network.

Wire connections will link most of MCI's customers to the company's microwave system. Since these end-on connections must be provided by the major carriers, they have a way of squelching MCI, at least theoretically.

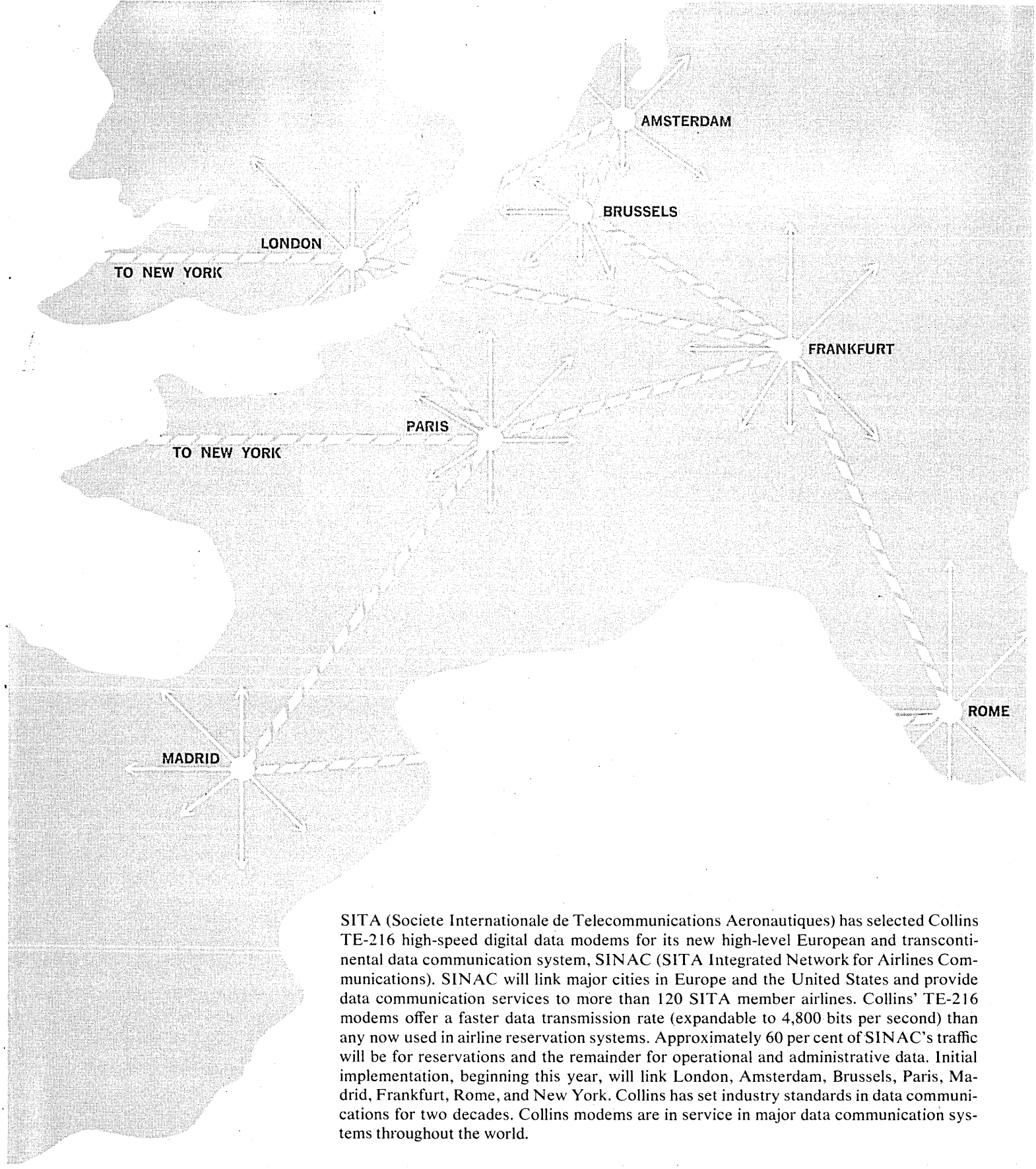
During the hearing, the carriers "expressed serious reservations about the likelihood of (interconnection) agreements being voluntarily consummated," Bureau Chief Strassburg reported. But according to the bureau's interpretation of the Communications Act, the carriers have a "duty . . . to provide end-on service to MCI customers upon reasonable request." If this issue has to be resolved in court, that statement could be crucial.

STANFORD UNDERTAKES BIG LIBRARY PROJECT

With a $417,000 grant from the U.S. Office of Education in hand, Stanford Univ. is planning to attack the library problems with the 360/67 recently installed at the computation center.

Project BALLOTS, which has nothing to do with voting machines but stands for Bibliographic Automation of Large Library Operation using Time Sharing, is headed towards eventual development of a university-wide library system. Within three to five years, some 50 terminals will be attached for remote access. Head of the project is Rutherford D. Rogers, director of libraries. Principal investigator is Allen B. Veaner, assistant director of libraries for automation, who said "the hardware is at hand; it's only a question of building the software."

Initial emphasis of the project will be on selection, purchasing, cataloging, indexing, selection of materials



SITA (Societe Internationale de Telecommunications Aeronautiques) has selected Collins TE-216 high-speed digital data modems for its new high-level European and transcontinental data communication system, SINAC (SITA Integrated Network for Airlines Communications). SINAC will link major cities in Europe and the United States and provide data communication services to more than 120 SITA member airlines. Collins' TE-216 modems offer a faster data transmission rate (expandable to 4,800 bits per second) than any now used in airline reservation systems. Approximately 60 per cent of SINAC's traffic will be for reservations and the remainder for operational and administrative data. Initial implementation, beginning this year, will link London, Amsterdam, Brussels, Paris, Madrid, Frankfurt, Rome, and New York. Collins has set industry standards in data communications for two decades. Collins modems are in service in major data communication systems throughout the world.

For information on Collins TE-216A-2D (2,400 bps), TE-216A-3D (3,600 bps) or TE-216A-4D (4,800 bps) Data Modems, write or call Collins Radio Company, Marketing Division, Newport Beach, California 92663. Phone: (714) 833-0600.

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CIRCLE 63 ON READER CARD

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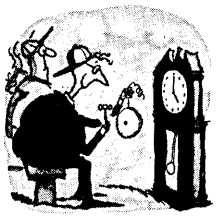
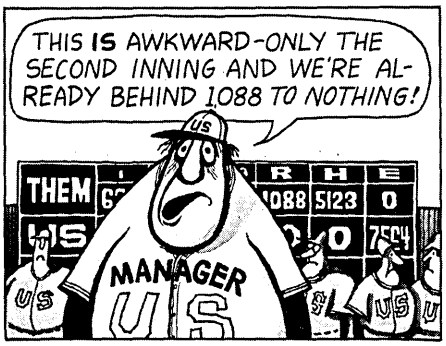
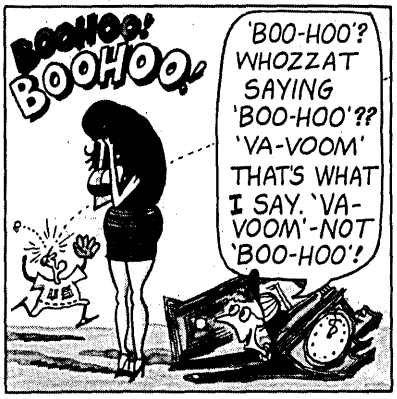
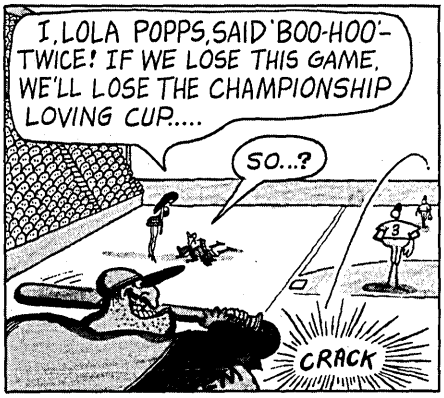
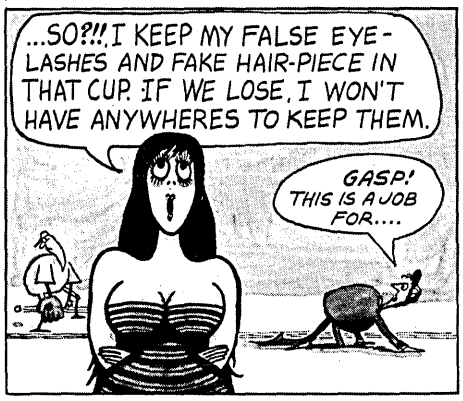


CLARK'S MANAGER, 'CORKIE' POPPS, SOLILOQUIZES....

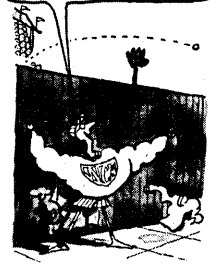








QUICKLY AND ADROITLY, CLARK CANT BECOMES...



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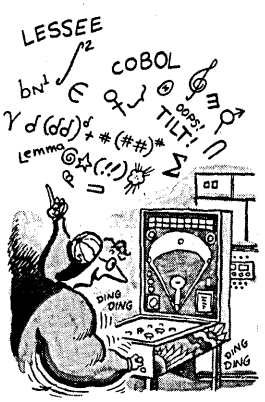
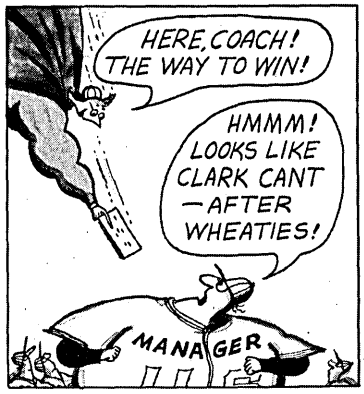
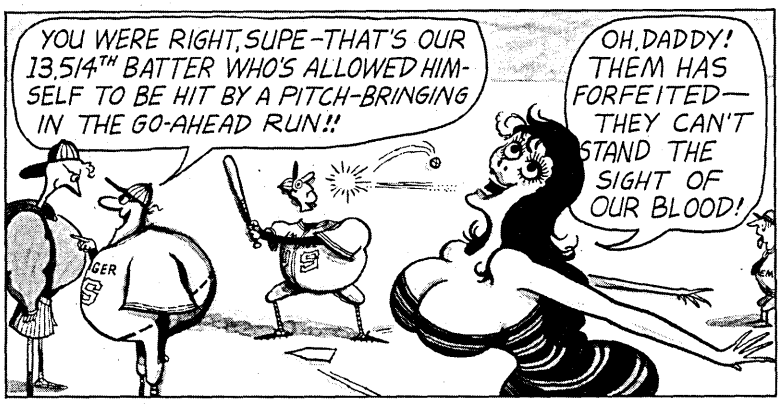
NATIONAL COMPUTER ANALYSTS

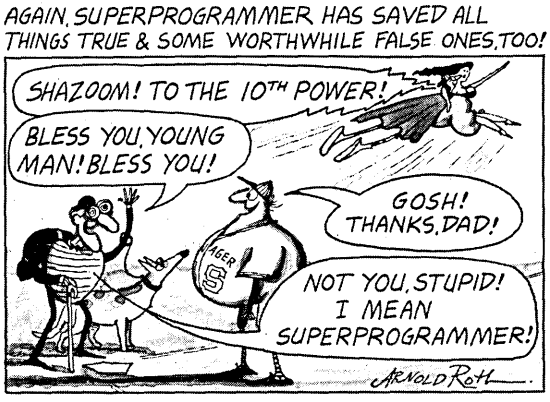
PRINCETON, NEW JERSEY 08540







AGAIN, SUPERPROGRAMMER HAS SAVED ALL THINGS TRUE & SOME WORTHWHILE FALSE ONES, TOO!



news briefs

for public use, and circulation to users. It is expected that the system to be developed will eventually become part of a national library communication network. To this end, the project will conform to national bibliographic standards now being evolved at the Library of Congress.

● Congressman Jack Brooks (D-Texas) speaking last month before the House Government Activities Subcommittee, of which he is chairman, stated that documented savings of $300 million have already resulted through the effective governmental use of computers. He also predicted that, in future implementations, the entire U.S. code (federal statutes) will be placed in a memory bank with remote terminals on Capitol Hill, and in executive and judicial agencies. The Comptroller General, he added, is already conducting a feasibility study of such a system.

● The Data Processing Management Assn. has announced that the 7th annual examination for the Certificate in Data Processing (CDP) will be given Feb. 24, 1968, at 100 test centers in the U.S. and Canada. The three-hour exam will consist of 220 multiple choice questions. Certification is given to those who pass the exam, meet a three-year experience requirement in data processing, and fulfill the academic requirements (a number of college-level courses in business and mathematics). DPMA membership is not required. Study guides and application forms for the '68 exam are available free of charge from DPMA 505 Busse Highway, Park Ridge, Ill. 60068. Deadline for filing applications is Nov. 1, 1967. Applications must be submitted to DPMA headquarters.

short lines . . .

The USASI Working Group X3.4.2 on programming language specifications is seeking opinions on the need for, and feasibility of, specifying a standard operating-system input language. Some of the questions: should top-level input language to operating systems be standardized? Is it possible? What are the difficulties? How far should it go? Suggestions and comments should be sent to M. H. Perstein, Member, X3.4.2., c/o System Development Corp., 2500 Colorado Ave., Santa Monica, Calif. 90406. . . Net operating income of C-E-I-R for the first nine months of its 1967 fiscal year dropped to 6 cents a share from 33 cents in the same period last year. . . A unique origanization—the IV League, a software users group—has been formed for companies using Informatics' Mark IV File Management System. There are now 50 installations . . . Lockheed Missiles & Space Co. has a study contract from the U.S. Public Health Service to figure out how best to handle hospitals' operating-report paperwork problems . . . American Airlines has installed the biggest-ever solid state power system for its Sabre system, a 1000 kva unit made by GE . . . The Univ. of Illinois is getting a 360/75 and a 360/50 for the Urbana campus. The National Science Foundation is helping with a grant for $850,000 . . . Scientific Data Systems will set up a time-sharing center at its El Segundo facility this fall, using an SDS 940. More than half the time will be allotted to company projects . . . IIT Research Institute has concluded an agreement with Allen-Babcock Computing to offer the RUSH time-sharing system in the midwest. IITRI will be able to handle 25 subscribers . . . English Electric Computers Ltd. has closed a deal with the Soviet foreign trade corporation for a System 4-50, costing about $1.3 million, to be used at a central planning headquarters in Moscow for allocation of orders to factories and warehouses.

Do you go nuts trying to find stored-away information when you need it?

Storing data is one thing.

Retrieving it instantly is quite another. It can be the finders-keepers-losers-weepers situation all over again.

No more.

Honeywell EDP's family of direct access computer systems has changed all that. With disk pack systems. With disk drive systems. With drum systems. With the right systems.

And the size of your data cache is no problem. Honeywell has all sizes of systems for all sizes of users.

It's Honeywell's third-generation Series 200: the hardware, software, and peripheral equipment that's eager to help you accumulate, process, store — and then retrieve — the information that's important to you.

Instantly. Reliably. Inexpensively. Simply.

If your present system has you climbing a tree, you'd better check with Honeywell.

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ELECTRONIC DATA PROCESSING

CIRCLE 67 ON READER CARD

washington report

EARLY BARGAINING ON PHASE II RERUN

GSA will begin procurement negotiations with Phase II bidders before, rather than after, AF selects a contractor Dec. 5--partly to save time, mainly to improve the government's bargaining position. Before the selection, bidders should be more willing than afterward to modify their original terms. The new arrangement may set a precedent and give GSA a substantially bigger voice in future DOD adp procurements.

IBM VS. USASI OVER MAG TYPE STANDARD

IBM's refusal to accept USASI's proposed 800 CPI (NRZ) mag tape standard was under consideration by the Information Processing Standards Board at press time. L. L. Griffin, head of Subcommittee X3.2, was hoping to persuade the board's 16 members to certify the subcommittee's recent 29-3 vote, approving the new standard, as a "consensus." If he fails, Uncle Sam may unilaterally adopt the standard. Basic issue is how to distribute USASCII's 7-character code set over eight tracks (plus parity). USASI wants the extra bit in the 8th position, IBM wants it in the 6th.

KEYPUNCH SERVICE SHARING BEING PLANNED BY GSA

GSA plans to establish keypunch pools nationwide, starting with Philadelphia and Chicago. IRS, VA, and DOD are among the likely users. Last year, nearly $125K worth of keypunching was contracted out by federal agencies in the Philadelphia area.

COPYRIGHT MODIFICATION APPROACHES STUDIED

Next year, Congress probably will enact a new copyright law establishing a moratorium during which non-profit users of computerized information systems could input copyrighted material without payment or permission. A COSATI task force recently recommended as much. The proposed bill's section 110, which restricts use of copyrighted material in CAI systems, may be liberalized--either during the moratorium, or instead of it. Meanwhile, Senate Judiciary Committee Chairman John McClellan's bill, S2216, establishing a commission to study computer-copyright problems, is likely to be enacted this year.

SUBCOMMITTEE CONSIDERS RESTRICTING SERVICE CONTRACTS

Cong. Porter Hardy's GovOps subcommittee is drafting a bill to curb use of technical support service contracts by federal agencies. Contract costs over a certain amount would have to be compared, in writing, to the costs of doing the same work in-house. The former could be higher, but not much, than the latter. Hearings are likely this year. Hardy tried, but failed, to get a similar restriction into NASA's fiscal '68 authorization, after GAO had criticized NASA's use of support service contracts.

CAPITOL BRIEFS

"The need for comprehensive national regulation of computer communications, whether federal or non-federal, should seem just as obvious as the need for national regulation of airlines," Cong. Cornelius Gallagher told the American Bar Association recently in Honolulu...The Joint Economic Committee has issued a report advocating "methodical" establishment of a national data bank. Privacy is a problem, JEC admits, but they want it to be tackled after the data center is organized...GSA's sharing exchange headquarters is now handling requests for equipment time on a 24-hour basis with the help of a Code-a-phone 770. Requests are being filled much faster as a result.

INFORMATION
INTERNATIONAL
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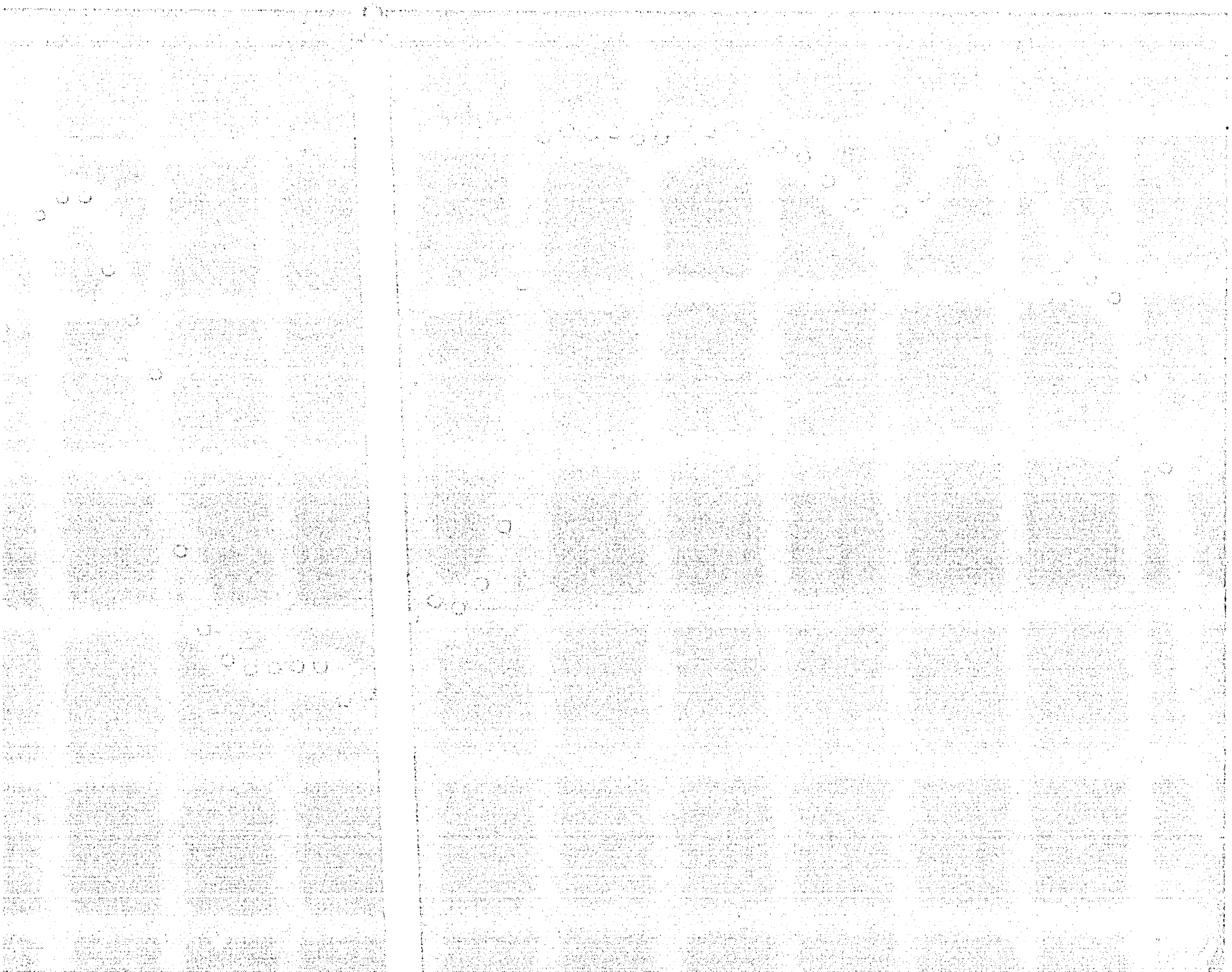


world report

COMPUTER GIANT STUDIES FATE OF 16-BIT MACHINE

The English Electric-Elliott Automation planned merger has called a halt to some developments among the firms' computer groups. Both managements are seeking the best way for combining the product ranges. Early victims of rationalisation are expected at the small end of the machine ranges.

English Electric Computers has a smallish machine, the IS4, whose fate is yet to be determined. It is the first 16-bit U.K. machine to challenge some of the better known systems out of Massachusetts and West Coast stables. IS4, a 16-bit parallel machine, is built on a central memory with a multiple-path highway to a number of autonomous stores and processors.

The central store is 64K in four banks. Each 4K is independently buffered and addressed. Three processor types hitch onto the highway--an arithmetic and logic processor and two input-output processors.

UNIVAC MEN OPEN DRUM, DISC FIRM

Computer Memory Systems Ltd., U.K., has been set up to develop drums and discs for Europe. The company has technical links with American and U.K. firms. It is run by former Univac men, John Knightley and Tony Freeman. Europeans are still almost totally dependent on the U.S. for drums and discs.

U.K. COUNCIL PROPOSES MEDICAL DATA BANK

Britain's Medical Research Council, which spends $35 million a year, has prepared a report on computer policy for the next three years. It recommended that a general purpose centre should be established for staff working in the London area. This is to be based on a GEC 90/300. Dr. C. C. Spicer, formerly chief medical statistician to the General Register Office, will be director of the unit. A general computing service is to be provided as well as research into new applications of computer methods for biomedical investigation.

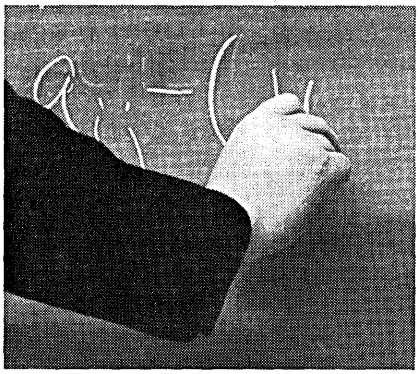
Plans are in hand for a national centre to provide researchers working out of London with computing facilities, and a programme to introduce more small machines into the bigger laboratory research units.

The Medical Research Council has also made proposals for a national system of record linkage. For mainly historical reasons, the responsibility for collecting information of medical interest about individuals is divided between a large number of government and hospital authorities. Each deals with a different aspect of health. Further fragmentation of records occurs when an individual migrates to another part of the country.

A special research committee has recommended a system of linked records that could be maintained on a national basis. This should be possible to maintain in a country that owns a unified state health service.

(Continued on page 107)

C-E-I-R may have the formula for your success



in any one of these vital areas:

Business Data Processing. Computer Systems Design and Programming. Multi-Access Computer Services. Management Sciences. Scientific and Engineering Computing. Economic Studies. Market Research. Television and Radio Audience Measurement. Management Information and Control Systems. Operations Research. Mathematical-Statistical Services. Automation Training. Data Reduction and Analysis.

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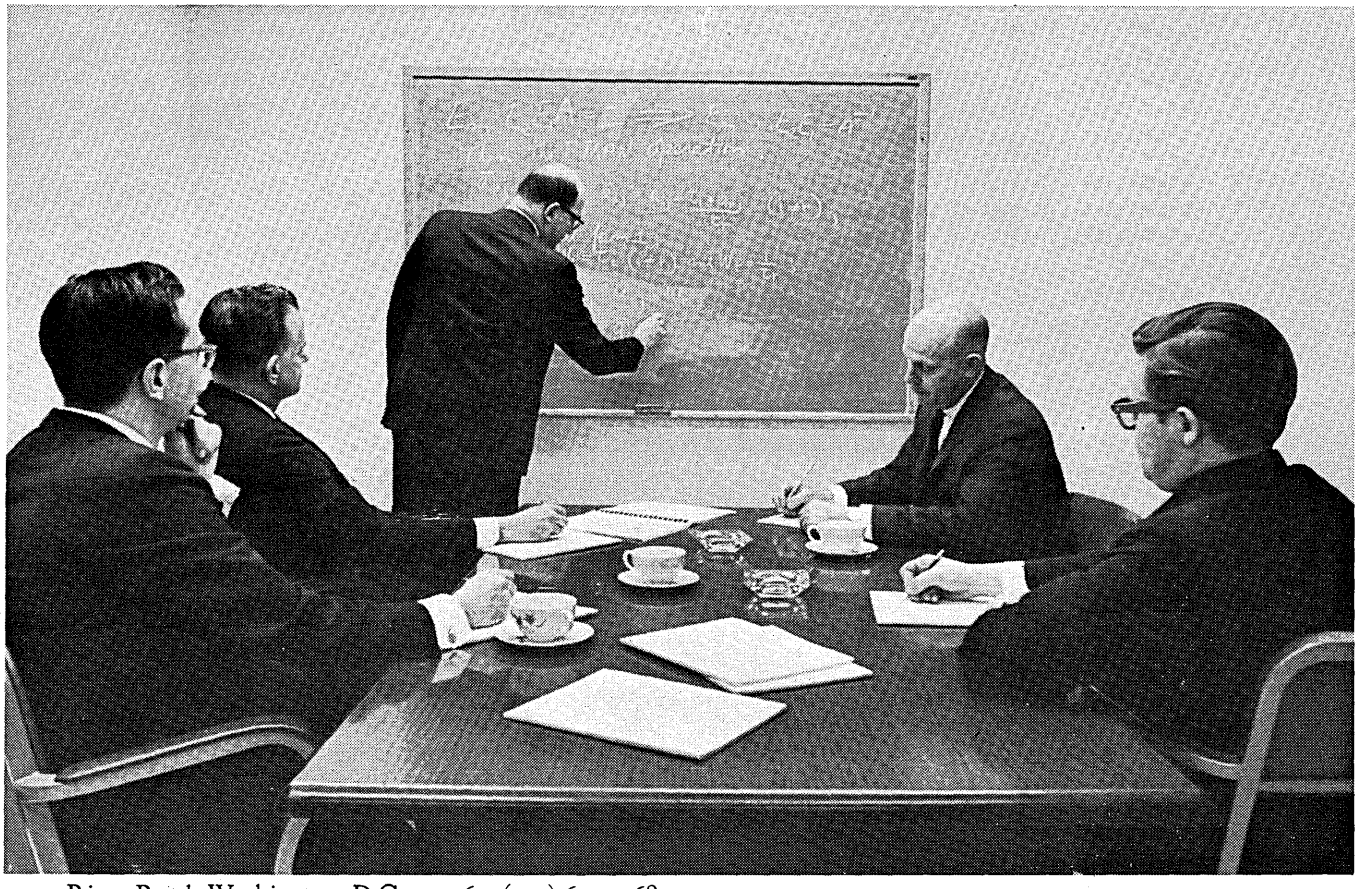

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CIRCLE 69 ON READER CARD

(Continued from page 105)

The basic units in the scheme would be the individual and the family. The idea is to embrace birth, marriage and death records with selected data of long-term interest from hospital in-patient records.

A report of this proposal, in the Council's annual report, stresses the need for confidentiality of data which would be fundamental to the scheme. It suggests that research workers would be far better placed to do their job with access to vital certificates and hospital in-patient abstracts. The proposed system would provide easily accessible information for follow-up studies on individuals classified in different ways--e.g., children classified at birth in respect of particular obstetric and social factors, and work people exposed to known occupational hazards. Moreover, it is expected to aid both prospective and retrospective field studies in genetics; the development of procedures for screening populations for the presence of early disease; and provide information for assessing delayed toxic effects of new drugs.

PROCESS CONTROL, DP NET GET PUSH IN JAPAN

The Japanese government is pressing ahead with plans for a state-run national dp network. Managed by the Ministry of International Trade and Industry, in conjunction with the Nippon Telephone and Telegram Corp., it will consist of complete centres installed in major cities. The dp systems will be run by a public company, but subscribers can select their own communications link for connecting into the service.

Having gained second place in the world league of commercial machines installed, Japan is now pushing hard for developments in process automation and the more elusive frontiers, such as programmed learning. Toshiba has bagged a dozen orders for the Tosbac 7000 series (licensed version of Gepac 400), but has also marketed the smaller Tosbac 3300, an independent development.

In a similar vein, Nippon Electric (cross-licensed with Honeywell) is pitching for the industrial user with the Nelog 310 and a recently unveiled integrated circuit system, the Neac, 2100.

The only big corporation with U.S. ties, Fujitsu, has added integrated circuits to its Facom 270 series.

Computer-aided instruction systems have come in for a fillip with a deal between Sony and IBM. The Japanese Investment Council has given the two the green light for developing a range of audio-visual teaching units. Sony is to provide the audio and video-tape elements, IBM the dp systems.

BITS & PIECES

The Plessey Company is marketing 500-nanosecond plated wire memories, with 60-nanosecond versions in the laboratory. ... Britain Post Office is offering a Datel 2400 service for data communication. This is for 2400 bps transmission over private circuits with a fall-back to public lines of 1200 to 600 bps if needed. ... Esso Europe Inc. (Standard Oil subsidiary) is installing Marconi H6010 data handlers in an information network linking France, Germany, Holland, Denmark and the U.K. ... The Chartered Bank of Victoria, Hong Kong, has installed an NCR 315 with data links to 15 branch offices on the island of Kowloon district.

Before you buy a terminal to talk to a computer make sure you can talk to the terminal.

Buy the wrong terminal and you may end up talking to yourself, instead of a computer.

The most widely used terminal on the market, for example, was orginally built to send telegrams. So it has a limited number of keys. An awkward keyboard. No lower case letters. And a tiny, telegram-sized carriage.

Maybe that's all you need for "HAVING A WONDERFUL TIME STOP." But it limits you to half the number of characters a sophisticated computer understands (a little like trying to carry on an intelligent conversation with a 4-year old).

Only one terminal now available can begin to match the input-output potential of a modern computer: the new 7100 Conversational Mode Terminal by Friden. The 7100 has the same, easy-to-use keyboard as an electric typewriter. But with one important addition:

The USASCII code!

USASCII puts 128 characters at your command. You can use them to write your own computer programs. And when you're done, the 7100 neatly prints out your program for later use—saving costly computer storage.

Nice? Just the beginning.

The 7100 is the only USASCII terminal with upper and lower case. The only terminal with a 13" writing line. And the only terminal that will reproduce a facsimile of all USASCII codes (except space and carriage return).

It even has a color shift. When you talk to the computer, it prints in red. When the computer talks to you, it prints in black.

The 7100 brings new ease and efficiency to time-sharing, on-line programming, information retrieval, and documentation.

To learn how easily it can let any corner of your company use a central computer, call your nearest Friden office. Or write Friden, Inc., San Leandro, Calif. 94577. Sales and service throughout the world.

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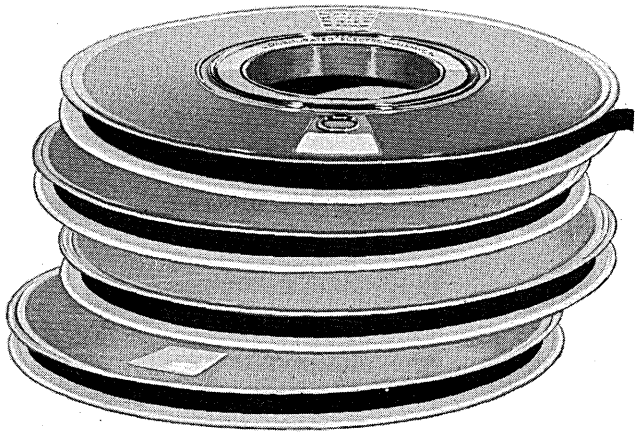
CIRCLE 70 ON READER CARD

Now there are four reliable computer tapes



(Delivery is another matter)

As you may surmise from the name at the bottom of this message, CEC is the new challenger in the computer tape field.

We would like to add that the performance of our tape is demonstrably superior to our three competitors'. But that would not be true. All four are well within allowable tolerances of the reference tape used by the computer industry. And all are certified "drop-out free" for the first pass, and remain so for many more.

Obviously, since CEC had no exclusive on excellence, we had to have a pretty compelling reason for climbing on the totem pole.

And we did.

Delivery.

From the time you place your order, you should receive your CEC computer tape within 24 hours — virtually anywhere in the United States.

If you're 100 miles somewhere west of Laramie, it might take a little longer. Perhaps as much as 48 hours.

Quite a difference, we suspect, from the delays you've become accustomed to.

This is no miraculous achievement on CEC's part. The advantage was already there. Namely, the largest established field force in the industry. Plus — the only warehousing facilities strategically located to serve the entire nation.

P.S. One more benefit: if you order CEC Analog Tape along with the new computer tape, you'll also realize some significant savings.

CEC/TECHNICAL SUPPLIES

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Please send me complete information about CEC's new Computer Tape.
Bulletin Kit 332-X1.

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ORGANIZATION _____

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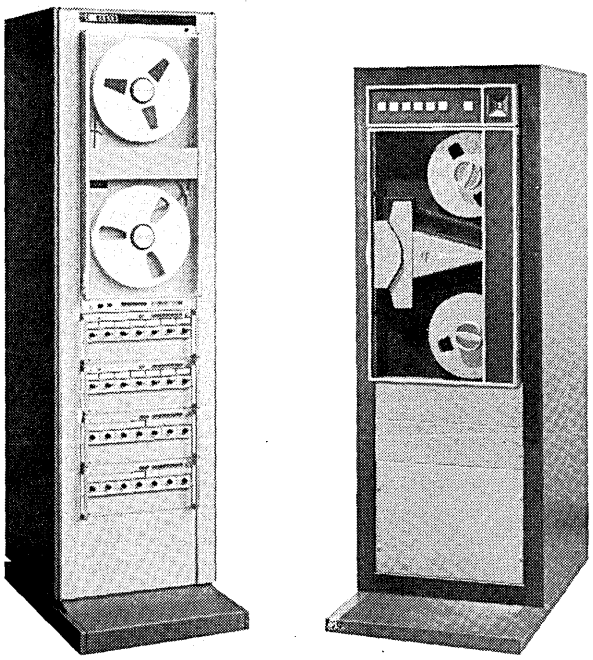
CITY, STATE & ZIP _____

MAGNETIC TAPE RECORDERS?

ask Hewlett-Packard



ANALOG or DIGITAL...

Reliability, ease of use, flexibility...these are the built-in extras you get with Hewlett-Packard magnetic tape recorders: today's most dependable tape transport; sturdy mechanical construction permitting long-term performance that can't be matched by more expensive recorders; electronics that are easy to adapt to your specific application; minimum maintenance. And, Hewlett-Packard service is only a phone call away. All this makes the low HP prices even more attractive.

For complete information on analog or digital magnetic tape recorders, call your local HP field engineer or write Hewlett-Packard, 690 Middlefield Road, Mountain View, California 94040; Europe: 54 Route des Acacias, Geneva.

ANALOG RECORDERS

IRIG compatible
7 or 14 tracks
½" or 1" tape
Direct and FM recording
Bandwidths to 1.5 MHz
Price: $10,000 to $20,000

CIRCLE 72 ON READER CARD

DIGITAL RECORDERS

IBM compatible
7 or 9 tracks
3 standard densities
½" tape
Choice of tape speed to 75 ips
Read and write
Price: $5000 to $15,000

CIRCLE 73 ON READER CARD

HEWLETT hp PACKARD

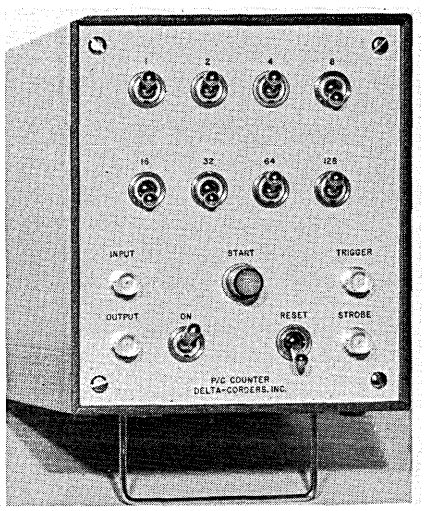
MAGNETIC RECORDERS

42704

new products

permutation/combination counter

The permutation/combination counter gives a repeatable pulse train number from 2-256 pulses. Front panel switch selection in proper combination provides the exact count desired at the output terminal from



input clock pulses fed from an external pulse generator. Hybrid micrologic circuits enhance the shape and sharpness of the output pulse train. Applications include incremental input devices where it is necessary to control pulse train start, stop and count. DELTA-CORDERS, INC., Burbank, Calif. For information:

CIRCLE 100 ON READER CARD

upgraded computer

The 810B computer system is a faster version of the SEL 810A: model B has a cycle time of 790 nsec, compared to 1.75 usec for the A; and an add/subtract time of 1.58 usec (A: 3.5 usec). The two systems are software and peripheral compatible, but the B offers some new options, including a second index register. The basic memory of the 810B is 4K, expandable in increments of 4K up to 32K, and it has 64 I/O channels. Cost for the basic 810B configuration is less than $30K; monthly rental is $600. Delivery is in 120 days. SYSTEMS ENGINEERING LABORATORIES, INC., Fort Lauderdale, Fla. For information:

CIRCLE 101 ON READER CARD

display system

A visual display system for industrial control systems, permits random access to up to 80 graphic displays. A 35mm random access projector produces images on a screen, and gives information on equipment location, wiring diagrams, circuit functions, schematics, logic diagrams, flow charts and organization tables. DECISION SYSTEMS INC., Paramus, N.J. For information:

CIRCLE 102 ON READER CARD

data printer

Solid-state data printer will accept analog signals from any device and convert them into digital form, presenting a printout of volts, concentration or other units of measurement, in three digits with sequential sample number in two digits. Model D 3 is a printing digital voltmeter; model G 2 is compatible with a Gilford mod 300 micro sample spectrophotometer; and model S 5 is compatible with instruments giving a transmittance output, with log conversion done inside the printer. BERKELEY SCIENTIFIC LABORATORIES, Berkeley, Calif. For information:

CIRCLE 103 ON READER CARD

data collection system

The 1600 and 1700 series of source record punches are desk-top electric data collection devices for tool cribs, parts supply rooms, delivery tickets and purchase order releases. The 1700 series will allow for both alphanumeric and numeric punching; the 1600s provide for numeric punching only. All the units merge constant, semi-variable and variable information in one recording, punching, ZIPCARDS and 80-column cards. In addition, models 1601 and 1706 are equipped with a plate imprinter; model 1604 is a six-bank keyboard unit that reads, punches and interprets information entered from a prepunched master tabulating card. STANDARD REGISTER CO., Dayton, Ohio. For information:

CIRCLE 104 ON READER CARD

rear projection readout

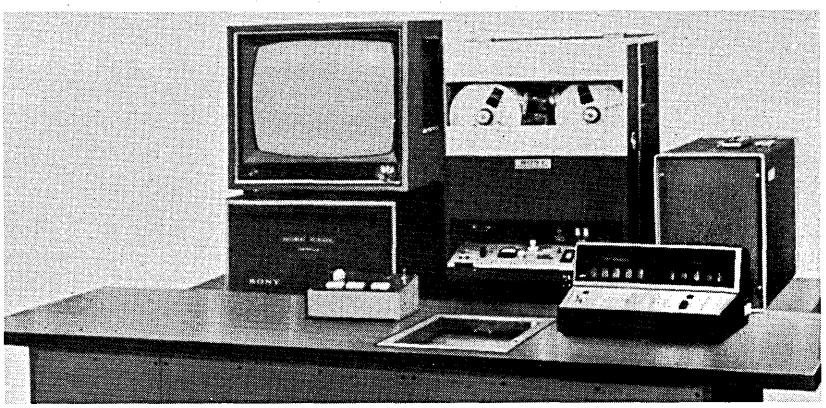
The SRO-90 series of 12 message rear projection readouts are packaged as plug-in units measuring .460" x

PRODUCT OF THE MONTH

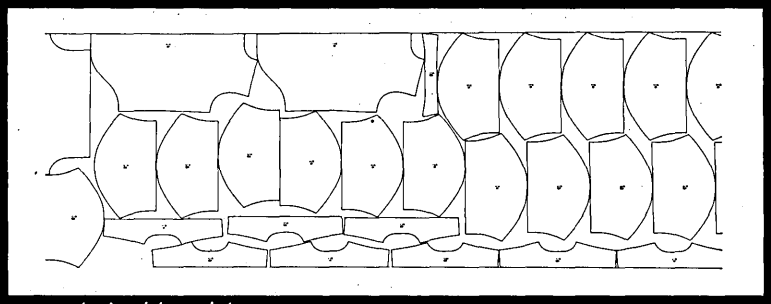
The Video Tape Document Retrieval System stores copies of 8½ x 11-inch documents on Videotape. A 600-foot reel has a capacity for 100,000 pages. The maximum retrieval time is reportedly two minutes, or an average of 15 seconds to scan 10,000 frames. Each frame is coded; when this code is entered on the keyboard, the image appears on a CRT. A hardcopy reproduction feature is also available.

The recording is accomplished by two rotary heads, and each image is recorded as 330 horizontal lines. With bidirectional tape feed, the images can be read in both the forward and reverse directions. The tape can be moved in any of three speeds.

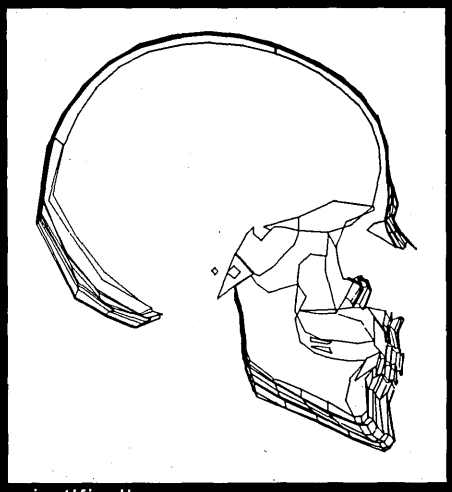
Despite a recent R&D agreement between this manufacturer and IBM, we understand that they do not consider this system—which they plan to market in the U.S. next year—to be included. The price is approximately $20K. SONY CORP., Tokyo, Japan.



Do you know what it takes to make your computer draw like this?

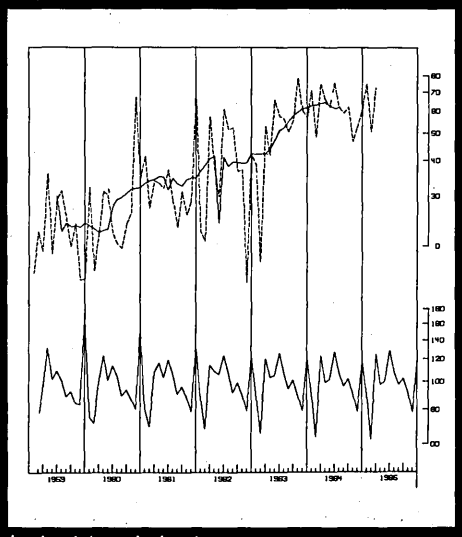


computerized templates

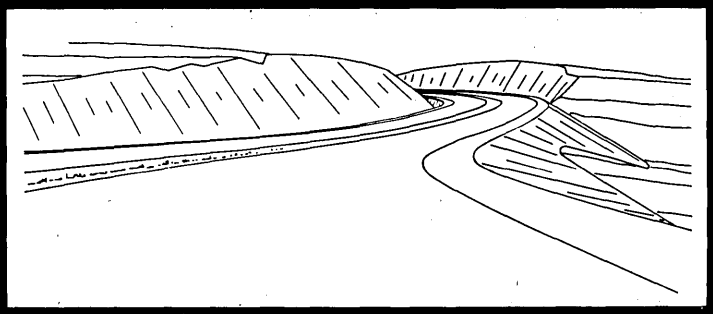


scientific diagrams

even masterpieces!



instant trend charts



perspective drawings

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CIRCLE 74 ON READER CARD

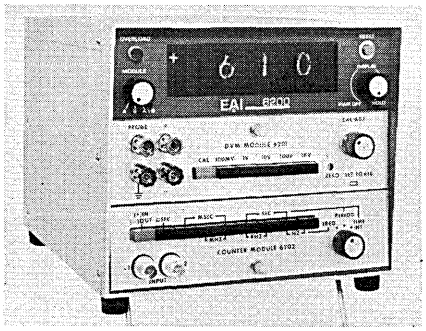
new products

2.68″ long (including terminals). Nearly 90% of the display screen is usable for character, symbol and multiple word messages, providing a maximum message height of .450″. Standard T-1 lamps are used, and replacement is accomplished from the front panel. SHELLY ASSOC. INC., El Segundo, Calif. For information:

CIRCLE 106 ON READER CARD

digital measuring system

The series 6200 digital measuring system is a portable instrument providing readout of four types of digital information. With additional modules, the unit can function as a voltmeter; frequency, period or time



interval counter; or an AC converter. Basic unit ($340) contains power supply, counting circuits, display time generator and numerical readout display. Modules are available separately. ELECTRONIC ASSOC., INC., West Long Branch, N.J. For information:

CIRCLE 107 ON READER CARD

core memory

The Nanomemory 2650 has a cycle time of 650 nsec, access time of 350 nsec, and a storage capacity of 8K (36-bit) words. The unit measures 7″ in height, with power supply and tester included, and will operate over a temperature range of 5°- 45°C. ELECTRONIC MEMORIES INC., Hawthorne, Calif. For information:

CIRCLE 108 ON READER CARD

structural analysis software

The SAMIS system (Structural Analysis and Matrix Interpretive System) simplifies automated structural analysis and eliminates reprogramming for problem changes. Requiring an IBM 7090/4 or 704X/709X computer with a minimum of 13 tape units, SAMIS was programmed with one FAP subroutine and 98% FORTRAN II.

The system consists of four components: the initiating link, Master Intelligence, operation links and the input data. Standardization is achieved for output formats, most input formats, error handling, tape handling and formats, and storage assignment. Modularity is accomplished by dividing the calculation into a number of tasks that can be performed in the sequence specified by the analyst. COSMIC COMPUTER CENTER (NASA), Athens, Ga. For information:

CIRCLE 109 ON READER CARD

card reader

The model 7140 card reader, for use with the Sigma family of computers, reads 1500 cards a minute serially by columns in either EBCDIC or BCD. The unit is program-compatible with the 400 cpm model 7120 reader, and will be available in the fourth quarter of '67. SCIENTIFIC DATA SYSTEMS, Santa Monica, Calif. For information:

CIRCLE 110 ON READER CARD

time-sharing system

Hardly new, but recently made available to the public on a lease basis, is the RUSH (Remote Use of Shared Hardware) system, which is currently operating commercially. In addition to handling remote multi-access terminals, there's also a full-time OS batch or background partition for multiprogramming operation. RUSH is supported on IBM 360/50, 65, and 75 computers with at least an H core configuration. Handling both scientific and commercial jobs, it uses PL/I. ALLEN-BABCOCK COMPUTING INC., Los Angeles, Calif. For information:

CIRCLE 111 ON READER CARD

numerical contouring control

The 3200 is a 3-axis i.c. numerical contouring control with an electronic resolution of .0001″, and a feedrate of 200″ per minute. The photoelectric tape reader reads 300 characters per second with standard 1″ 8-channel tape. An APT post processor written in FORTRAN IV is available for the 3200 control. BUNKER-RAMO CORP., Cleveland, Ohio. For information:

CIRCLE 112 ON READER CARD

tape recorder/reproducer

The VR-3400 magnetic tape recorder/reproducer has a 15″ reel capacity for extended recording time, and is convertible from 600 kHz to 2.0 MHz. A general purpose instrument, the unit has eight bi-directional speeds and electronic capstan control. VR-3400 offers direct response to 600 kHz at 120 ips and a low end response of 50 Hz at 1⅞ ips. The system can be expanded utilizing inter-

changeable wideband (2.0 MHz) electronics and heads. CONSOLIDATED ELECTRODYNAMICS CORP., Pasadena, Calif. For information:

CIRCLE 113 ON READER CARD

disc-drum memory

The DDC 7300 disc-drum memory has a capacity of 15.36 million bits (four discs, each with 3.84 million bits on 128 tracks) and an average access time of 8.5 msec. Storage on the hermetically-sealed unit may be organized in single or parallel track selection; formatting of bit, word and block addressing is flexible. Each group of four discs is mounted on a drum rotor. DIGITAL DEVELOPMENT CORP., San Diego, Calif. For information:

CIRCLE 114 ON READER CARD

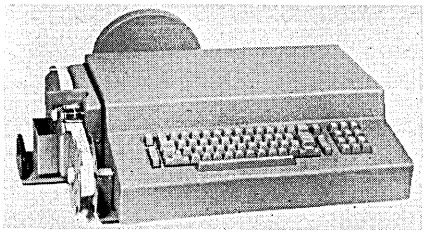
tape spooler

The RS-1000 tape spooler has a speed of 1000 characters/second with 2000′ of tape on 10½″ reels. Rewind speed is 2000 cps in either direction. The unit can operate under a temperature range of 0°-70° C. REMEX ELECTRONICS, Hawthorne, Calif. For information:

CIRCLE 115 ON READER CARD

keyboard perforator

The KBP-200-G65 keyboard perforator has a 65-key keyboard and can perforate all 64 TTS codes from single stroke action. The unit has a single character memory that permits entry of letter combinations in excess



of 20 characters per second. The standard model delivers a 6-channel code, with advanced feed hole, in ⅞″ tape; a power drive rewind reel and a chad collection box are also standard. CONNECTICUT TECHNICAL CORP., Hartford, Conn. For information:

CIRCLE 116 ON READER CARD

peripherals for small system

Two new peripherals have been added to the product line of the small-scale GE-115 computer. A disc storage subsystem has a maximum capacity of 60 million alphanumeric or 90 million numeric characters, and includes four DSC 130 disc controllers and 20 DSU 130 removable storage units. The CRP 100 card reader/punch operates at a constant speed of 300 cpm. First deliveries on both units are scheduled for this fall. GENERAL ELECTRIC INFORMATION SYSTEMS MARKETING, Phoenix, Ariz. For information:

CIRCLE 117 ON READER CARD

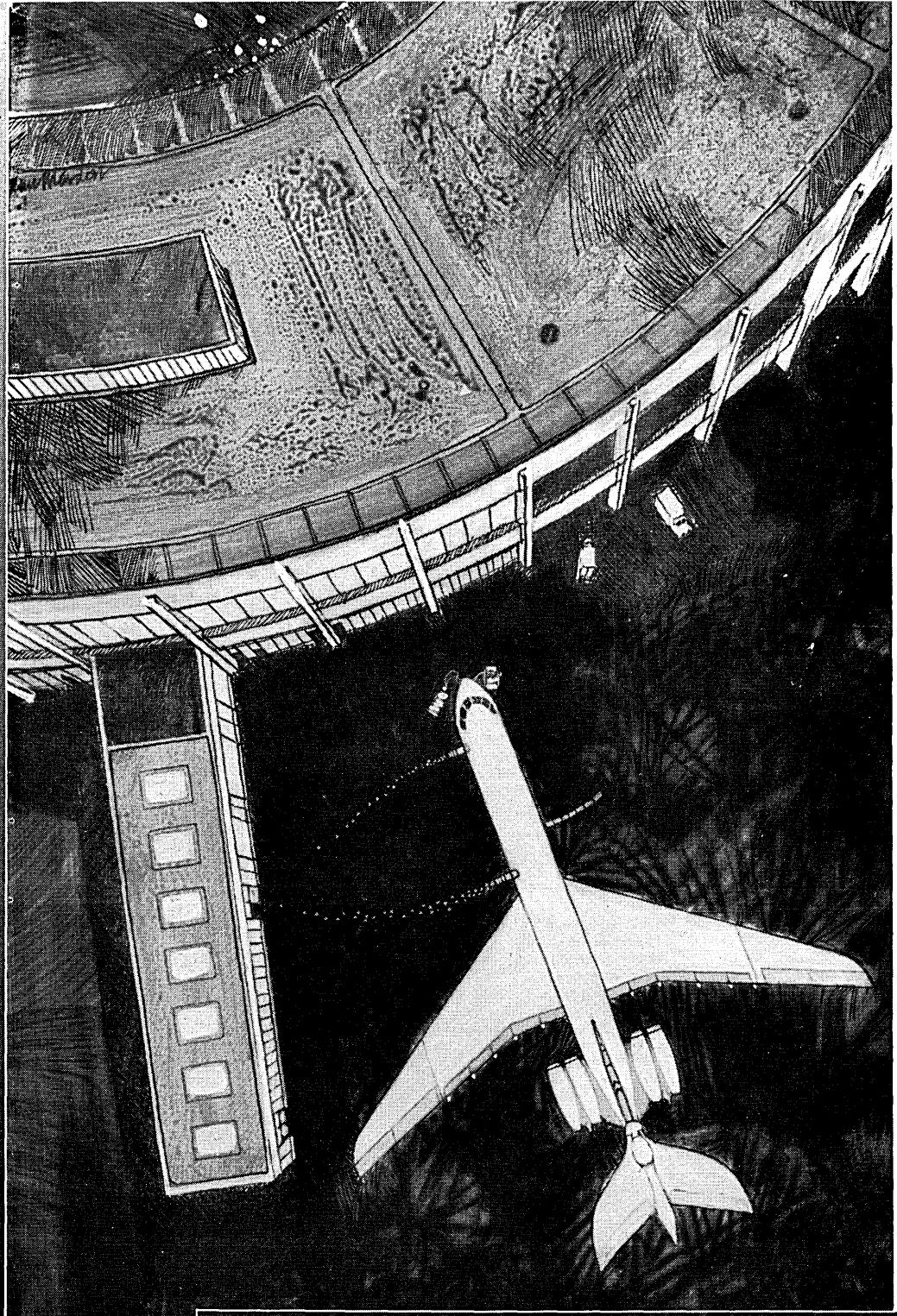
plotting subroutines

CSTRNG is a package of FORTRAN IV subroutines that will produce a contour graph for a user-coded bivariate function when used with the appropriate plotting subroutines. It reportedly is both plotter- and computer-independent, supplying x and y pairs to plotting subroutines associated with any plotter. This is a proprietary software package. PROGRAMMING RESEARCH INC., Van Nuys, Calif. For information:

CIRCLE 118 ON READER CARD

i.c. tester

ACT I (mod J133) tests digital integrated circuits by a method which allows it to perform functional tests and parameter measurements simultaneously. ACT I can do up to 10K parameter measurements in 1000 steps (1/100 of a second). Up to 15 simultaneous analog measurements can be made at a 10-usec logical step. The unit handles cir-



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Working in communications systems like BOAC's, the Kleinschmidt 311™ Data Printer "talks" with unbelievable speed and simplicity. It prints-out up to four times as fast as most other teleprinters. Operates with far fewer moving parts and far more reliability. *Outperforms* all competition.

And like other Kleinschmidt data printers, the 311 is compatible with telecommunications equipment of all makes. It can fit directly into the system you now have, or the one you are having designed for you.

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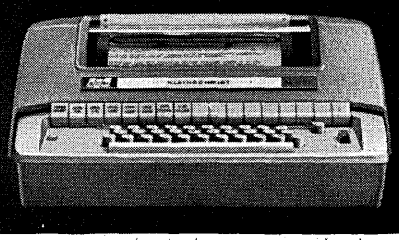


SCM®

CIRCLE 75 ON READER CARD

new products

cuits with up to 16 leads, comprising up to 10 inputs, four outputs, one supply and one ground lead in standard TO-5, dual-in line and flat packs. Testing is automatic; unit costs under $5K. TERADYNE INC., Boston, Mass. For information:

CIRCLE 119 ON READER CARD

hybrid cpu

A series of central processing units are available for the Ambilog 200 hybrid computer. The cpu's start at $45K for a configuration that includes 4,096 (30-bit) word memory, system controller, five channels of priority interrupt, and arithmetic unit and a Teletype I/O. The system can be expanded to a $500K configuration by adding hybrid arithmetic arrays, digital I/O peripherals and up to 32K words of core. ADAGE, INC., Boston, Mass. For information:

CIRCLE 120 ON READER CARD

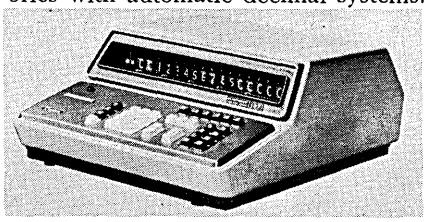
tape splicer

A splicer-gauge-punch has two stabilizing arms to hold the tape in place, and can be used for both paper and Mylar tapes. The unit includes a splicer, a gauge to assure proper code registration, and a manual punch for correction of errors. It can be used with 5-, 6-, 7- or 8-channel tape and with patches. DATA-LINK CORP., Los Altos, Calif. For information:

CIRCLE 121 ON READER CARD

drum memory calculator

The model 167 electronic calculator has a magnetic drum memory that includes two sets of cumulative memories and five sets of constant memories with automatic decimal systems.



The unit has an input capacity of 30 digits and addition and subtraction speeds of .01 sec. CANON U.S.A. INC., New York, N.Y. For information:

CIRCLE 122 ON READER CARD

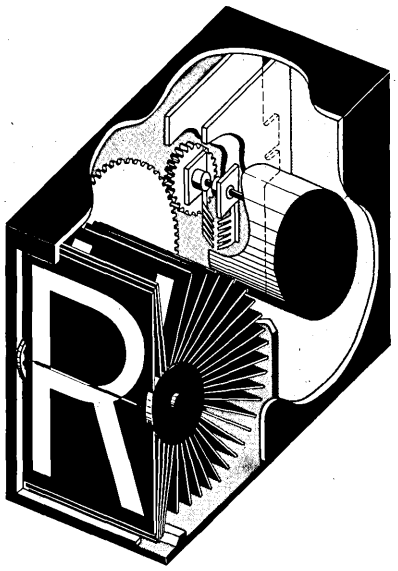
gp interface system

A general purpose interface system for the IBM 1130 computer enables it to perform data acquisition and transpacks. Testing is automatic; unit mission functions through the storage access channel. Transmission devices supported include Teletype, asynchonous data phone and calling units. The I/O features of the interface are supported by programmed routines in FORTRAN and assembly language. REALTIME SYSTEMS INC., New York, N.Y. For information:

CIRCLE 123 ON READER CARD

alphanumeric readout

The Type 404 is an electromechanical display system using the flap principle to show all numerals and the alphabet. Each unit has white characters on a black background,



four inches high and two inches wide, and unlimited selection of color combinations. Applications include process control boards, stock quotation boards, etc. Semiconductor control and memory are available. VISIONTRON CORP., New York, N.Y. For information:

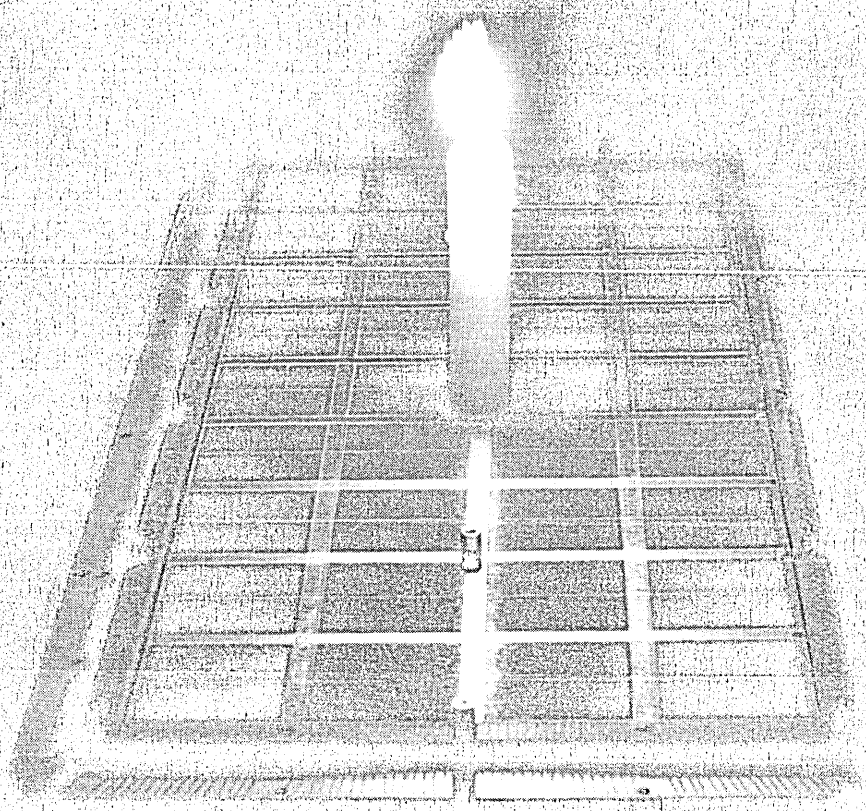
CIRCLE 124 ON READER CARD

gp computer

Announced late in '65 with only scanty specs, the 3500 processor has been reintroduced as the next step up for 3300 users. Unlike the latter, the 3500 has as standard (not optional) features the hardware floating point and the self-contained business data processor. The bdp executes code conversion instructions, allowing execution of variable-length instructions, and performs field searches, editing operations, arithmetic operations, and binary/BCD/ASCII conversions. In power, the 3500 is said to compare with the 360/65 in scientific computation and the mod 50 for business dp.

Core memory is expandable from 32K to 262K (24-bit) words. Memory cycle time is 900 nanoseconds, and access time is 600 nsec. In the hardware is a program-relocation feature

FOR ELECTRONIC MEMORIES CIRCLE 76 ON READER CARD→



in a memory system somewhere, one of our 2½D stacks is celebrating its first birthday

After we shipped that one, we started delivering stacks at the rate of nearly one a day. Several hundred to date. Capacities ranged from 4,096 to 16,384 words of 8 to 25 bits. Cycle times went from 900 to 650 nanoseconds. Some were off-the-shelf designs, some slightly modified.

All had wide operating margins and low system noise.

But one of the most important specs was reliability. For example, internal stack connections were reduced by 80%. Drive lines were shortened, and the inhibit winding was eliminated. The result was unsurpassed stack dependability and increased operational speed.

With a brand new design, that first birthday is very very significant. Infant mortality has plagued many an engineer. Now we're confident any one of our stacks could be around for a golden anniversary.

There's a new four-page brochure waiting to be requested. It has all the specs. Write for Litpak 5C.

electronic memories

12621 Chadron Ave., Hawthorne, Calif. 90250, (213) 772-5201

and the use of 2K-word pages, which are further divided into half- and quarter-page units.

Backing up the multiprogramming hardware is the MASTER operating system, currently operating on the 3300. Operating under MASTER are COBOL, FORTRAN, ALGOL, and the COMPASS assembler. Reportedly under development is a version of MASTER that will have multi-access capabilities, conversational time-sharing languages, and multiprocessing.

The smallest operating 3500 system will have a price of about $1 million, will lease for about $25K. First deliveries are scheduled for mid-'68. CONTROL DATA CORP., Minneapolis, Minn. For information:

CIRCLE 125 ON READER CARD

sort program

A three-tape sort program, for use with DDP-124, -24, and -224 computers, is for payroll preparation, inventory control, tracking and telemetry information. The tapes contain mag tape and card punch service routines, control and dispersal segments and a merge phase. Program accepts maximum logical records of 800 characters and up to seven sorting keys with a maximum key length of 128 6-bit characters. It requires a minimum of 8K core memory and three mag tape units. HONEYWELL COMPUTER CONTROL DIV., Framingham, Mass. For information:

CIRCLE 126 ON READER CARD

data terminal

A telephone coupler enables a teleprinter to serve as a data terminal by converting Teletype Mod 33 or 35 signals into selective audio tones for transmission over standard telephone

lines. For output, the tones are converted into pulses for teleprinting. Either electromagnetic or acoustic couplers are available for Teletype or EIA RS-232 interface. OMNITEC CORPORATION, Phoenix, Ariz. For information:

CIRCLE 127 ON READER CARD

drum memory

The 1104 S drum memory system with interface hardware and drum routine software adds 131K words to 4096-word core memories of PDP-8 and 8/S. It can monitor and control up to 62 I/O devices; average access time is 8.3 msec. Cost for computer using program controlled transfers: $9,950. VERMONT RESEARCH CORP., North Springfield, Vt. For information:

CIRCLE 128 ON READER CARD

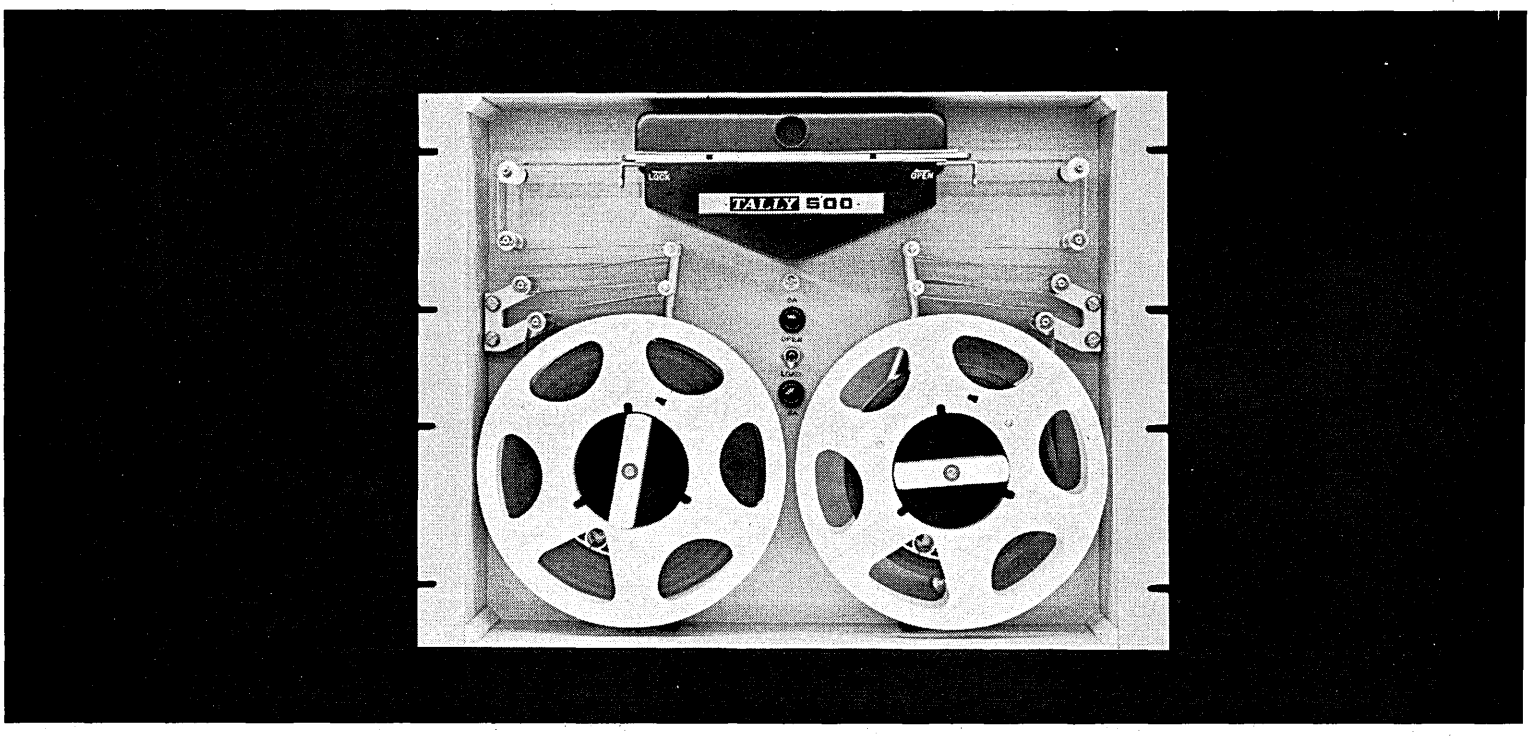
peripheral system

The Multiple Utility Peripheral System (MUPS) operates on a 64K 360/30, and can handle two printers, two reader/punches, six tape drives and a paper tape punch. The basic, open-ended program contains all interrupt and error handling routines for the peripherals, including formatting routines for reading and writing binary or BCD 7-track tapes. SERVICE BUREAU CORP., New York, N.Y. For information:

CIRCLE 129 ON READER CARD

New Tally 500 series photoelectric tape readers work up to 1000 characters per second.

That's not unique.



But working without pinch rollers, friction brakes, clutches, or solenoids—that is!

There's no point in Number 1 introducing just another "me too" product. Just to give you an idea of how good the new line is, in a recent life test, one photoelectric reader ran for 15,000 hours at maximum speed without a failure. You can see why we say these new readers represent genuine "state of the art" achievement. Adding them to the Tally line rounds out the broadest line of perforated tape equipment on the market today.

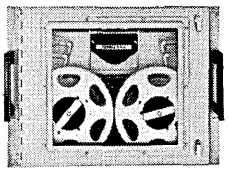
The 500R, 500RF, and 500T.

These three readers operate at up to 200 characters per second asynchronously (stop on character), up to 500 char/sec in the synchronous or free running mode (stop before next character), and 1000 char/sec in the wind/search mode. All feature printed motor direct capstan drive, and bi-directional reading and winding. The Model 500R (recess mounted) and the Model 500RF (flush mounted) are reader and spooler combinations, while the Model 500T comes without the reel servo system. For tape handling only, two spoolers using printed circuit motors and proportional reel servo are offered, one with 8 inch reels, the other with 10½ inch reels.

MIL-SPEC reader, Model 500RM and "ruggedized" reader, Model 500RF/10

Fully militarized, the Model 500RM is the first high speed reader that meets all applicable military specifications without exception. Featuring the same basic design as other Series 500 photoelectric readers, this unit will work in environments of −40°F to +145°F, in humidities of 100%, and take more than 15 g's shock. Pertinent RFI specs are met. MTBF is 5,000 hours. Expected life is 10,000 hours minimum.

Where severe environmental conditions are not encountered, the Model 500 RF/10 will perform with the same accuracy and life for about half the cost. Reading speeds for both readers are 150 char/sec asynchronously, 500 char/sec synchronously, and 1000 char/sec wind/search.



Model 500 RM

Full disclosure. For all the facts, call your full service Tally sales engineer (see EEM), or write Tom Tracy, Tally Corporation, 1310 Mercer Street, Seattle, Washington 98109. Phone (206 MA 4-0760. In Europe and the U.K. address Tally/APT, Ltd., 6a George Street, Croydon, Surrey, England. Phone: MUN 6838.

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Inventive maintenance.

There's an IBM lab devoted to it.

Nobody likes downtime.

That's why a select group of IBM engineers, mathematicians, psychologists and technicians have been assigned the job of inventing new ways to give you even more productive time on your system.

They work in IBM's Advanced Maintenance Development Lab—AMD. They work hard. And they've come up with some amazing new tools and techniques. Such as our new transistorized stroboscope (shown above) which makes fast-moving objects appear to stand still—or move in slow motion. This unique stroboscope is being used by Customer Engineers as an aid in installing and maintaining IBM data processing equipment.

They also developed a data communications system that speeds information on the latest maintenance techniques to service specialists across the country.

And they developed a SYSTEM/360 simulator console that helps Customer Engineers get additional hands-on problem-solving experience.

Great ideas. Great progress. But inquisitive minds are never satisfied. And our people at AMD are pushing further ahead—searching for new and better ways to minimize your maintenance hours.

Right now they're working on a special, long range project—trying to figure out the reasoning process that allows a man to diagnose a machine problem accurately and quickly. The answer to that one could change a lot of things.

We know how important it is to you to keep downtime down.

IBM®

new literature

LIBRARY GRAPHIC PRODUCTS: Brochure describes company products for the library, including Mark VI Docustat coin-operated electrostatic copies specifically designed for public use. Also describes microfilm enlarger and microfilm and microfiche reader-printers. DASA CORP., Andover, Mass. For copy:

CIRCLE 140 ON READER CARD

COMPUTER PERSONNEL RESEARCH: Copies of proceedings of the Fourth Annual Computer Personnel Research Conference, held over a year ago in June 1966, are now available for $5 from Prof. A.W. Stalnaker, School of Industrial Management, GEORGIA INSTITUTE OF TECHNOLOGY, Atlanta, Ga. 30332.

INTERFACE UNITS: 36-page brochure describes the use of standard, off-the-shelf components to interface a wide variety of external analog and digital devices to Sigma computers. Also contains functional descriptions of various company controllers, adapters, subsystems, and software support. SCIENTIFIC DATA SYSTEMS, Santa Monica, Calif. For copy:

CIRCLE 141 ON READER CARD

INSTRUMENTATION SYSTEMS: Illustrated four-page brochure describes turn-key services in design, installation, programming, and operation of analog /digital data acquisition and processing systems. Pictures typical instrumentation systems designed and built by the company. WYLE LABORATORIES, El Segundo, Calif. For copy:

CIRCLE 142 ON READER CARD

BANK SOFTWARE: Brochure contains information on the operation of the demand deposit accounting system, including MICR entry program operation, used with series 200 dp system. HONEYWELL EDP, Wellesley Hills, Mass. For copy:

CIRCLE 143 ON READER CARD

PROPRIETARY SOFTWARE: Eight-page brochure should interest prospective sellers and buyers of proprietary program packages, the product of this new firm. This capabilities brochure outlines requirements for marketable packages, and testing performed. It also summarizes other services performed. SOFTWARE RESOURCES CORP., Los Angeles, Calif. For copy:

CIRCLE 144 ON READER CARD

DISC STORAGE UNIT: Three-page specification sheet on model 81-65A fixed-head disc storage unit. Unit contains disc storage assembly and controller in one cabinet and provides random-access bulk storage of 227,328 (16-bit) words. SYSTEMS ENGINEERING LABORATORIES, Fort Lauderdale, Fla. For copy:

CIRCLE 145 ON READER CARD

CORE SUMMARY SHEET: Two-page sheet lists sizes, pulse drive characteristics, and output signals of 15 major ferrite core types produced by the company, including coincident current, coincident current lithium for wide temperature range applications, coincident current for 2D applications, switch, and linear. Defines terms commonly used in core technology. ELECTRONIC MEMORIES INC., Hawthorne, Calif. For copy:

CIRCLE 146 ON READER CARD

ACM SICPLAN BULLETIN: Decision Table Information Bulletin will be published under the auspices of the Special Interest Committee on Programming Languages of the ACM and will be distributed along with other information bulletins as occasional supplements to SICPLAN Notices. Editor welcomes contributions concerning decision tables that may be of interest to users and implementors, both potential and actual, or to computer programmers in general. Anson E. Chapman, DTIB Bulletin, 1850 Colby Ave., Los Angeles, Calif. 90025.

PROCESSING OF X-RAY PHOTOS: Data sheet explains how interpretation of medical and biological pictures are made easier if selected portions of the image are first enhanced by a digital computer. Methods used by Jet Propulsion Laboratory to correct various photometric, geometric, and frequency response distortions in the pictures received from TV cameras of the

new literature

Ranger, Mariner, and Surveyor spacecrafts led to the methods now being applied in medical and biological photographs. Cost: $.15. 67-10005. CLEARINGHOUSE FOR FEDERAL SCIENTIFIC AND TECHNICAL INFORMATION, Springfield, Va. 22151.

MODULE TEST SYSTEM: Eight-page brochure describes Auto Data 9400 series module test systems designed for automatic testing of multiple lead devices, performing checkout of printed circuit boards, modules, "black boxes" and systems. 3M COMPANY, St. Paul, Minn. For copy:
CIRCLE 147 ON READER CARD

INSTALLATION LOAN ACCOUNTING: Four-page brochure describes Ohio National Bank's reasons for computer installation and details its installment loan application. GENERAL ELECTRIC, Schenectady, N.Y. For copy:
CIRCLE 148 ON READER CARD

MOS MONOLITHIC SUBSYSTEMS: Second edition of "MOS Monolithic Subsystems: A Revolution in Microelectronics," is an introduction to MOS monolithic integrated circuits. Includes an historical sketch of the individual MOS transistor, explanations of the fundamentals of device and circuit operation, circuit advantages, descriptions of some of the basic digital and analog circuit design techniques, brief discussion of the system partitioning. 50 pages, illustrated. MICROELECTRONICS DIV., PHILCO-FORD CORP., Santa Clara, Calif. For copy:
CIRCLE 149 ON READER CARD

EXPERIMENTAL LANGUAGE: A guide to the capabilities and operations of FLAP language, written in LISP 1.5 for the IBM 7090 computer. FLAP language allows the analyst to handle symbolic mathematical data in a variety of ways and to transfer differential equations, and manipulate vectors and matrices. 54 pages. AD-647 549. Cost: $3; microfiche, $.65. CLEARINGHOUSE, U.S. DEPT OF COMMERCE, Springfield, Va. 22151.

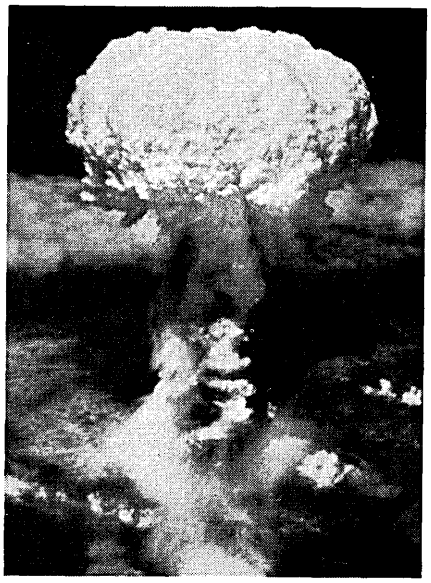
GRAPHICS PROCESSOR: Eight-page brochure describes the three modes of operation of Mark 8 graphics processor, consisting of a GP computer and a plotting table: 1) digitizing; 2) plotting; and 3) combination of these two to create "conversational" mode. Also describes optional equipment to aid in the generation, analysis, compilation and editing of graphic data. CONCORD CONTROL INC., Boston, Mass. For copy:
CIRCLE 150 ON READER CARD

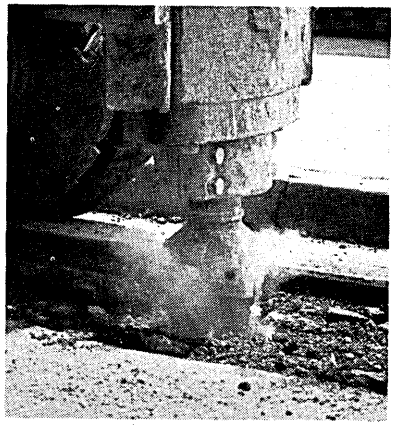
DISPLAY SYSTEM: Six-page brochure describes display communications buffer, including an I/O control, multiplexer, transmission control and synchronous modem adapter. Depicts schematics for both remote and local connections for the model 731 modular buffer unit which functions as parallel or serial interface between IBM 360 and Sanders 720 display. Contains complete glossary of source language for the company's file maintenance program, the software package for entry, retrieval, revision and manipulation of data files. DATA SYSTEMS DIV., SANDERS ASSOC., Nashua, N.H. For copy:
CIRCLE 151 ON READER CARD

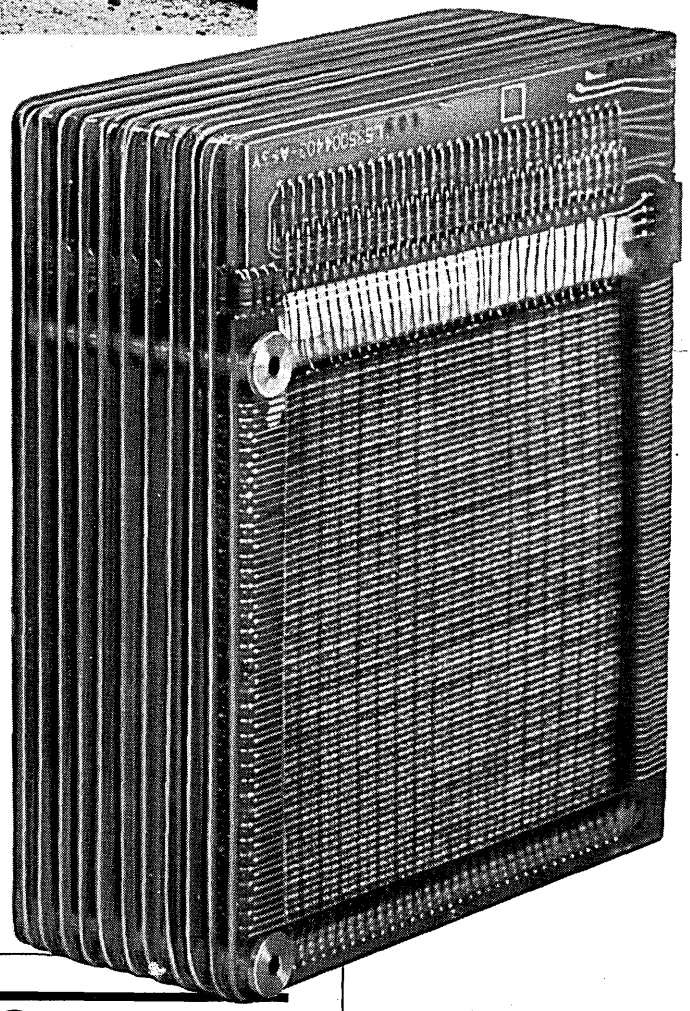
COMPUTER/MARKETING PUBLICATION: "Computer Operations," aims to provide an editorial forum to describe and evaluate new computer applications for business; to improve communications between computer people and the marketing manager, and to thus increase the more effective utilization of computers in marketing; to contribute to the development of basic computer research projects in those areas of interest to marketing management. Published quarterly. Subscription: $6 per year. Leslie Harris, Asst. Prof. of Marketing, Pace College, 41 Park Row, New York, N.Y. 10038.

PUSH BUTTON GENERATOR: Data sheet describes data generator which consists of 12 pushbuttons, each of which is capable of generating up to 24 characters, may be changed from 5- to 8- or 8- to 5-level code by replacing diode matrix cards. Unit can be programmed to stop on any predetermined character position for the insertion of variable information from the keyboard and can be used to punch paper tape, print page copy or transmit to a remote unit. TELETYPE CORP., Skokie, Ill. For copy:
CIRCLE 152 ON READER CARD

MAKE OR BUY LOGIC MODULES? 24-page illustrated booklet identifies and analyzes the factors management must consider in making decision whether to manufacture or purchase integrated circuit logic modules—long- and short-range production costs; effects of time loss or gain on competitive position; risk involved with short market life or possible obsoleted performance; and optimum utilization







When an irresistible force met a nondestructive (woven plated wire) memory . . .

38,880 NDRO bits took a 1000-G shock and emerged not one bit different.

This custom-woven nondestructive readout memory stack has an unshakeable story: zero readout error, zero physical degradation. Interrogated during and after severe environmental testing, data stored was data retrieved. Using minimal power. With all required memory exercises completed (equivalent to MIL-E-16400 and MIL-E-5400), these aerospace applications loom large on our horizon: program & instruction storage / look-up tables / executive programs / digital simulators / character generator storage / back-up memory. Write for detailed brochure and authenticated test results: General Precision Systems Inc., Librascope Group, Components Division, 808 Western Avenue, Glendale, California 91201.

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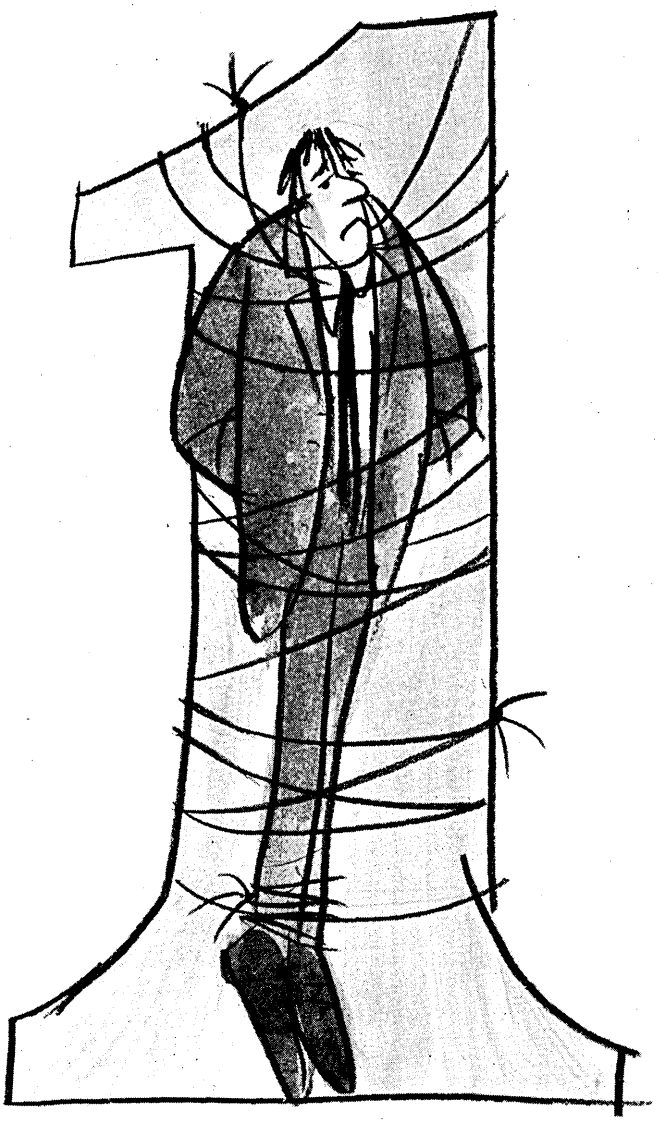

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CIRCLE 339 ON READER CARD

new literature

of capital investment, both human and financial. DATA TECHNOLOGY CORP., Mt. View, Calif. For copy:

CIRCLE 153 ON READER CARD

FOR RETAILERS: 16-page brochure covers pre-programmed applications using model 315 computer system, showing input, computer runs, reports and system advantages. Emphasizes processing advantages which stem from the ability to convert original-entry transactions into computer language as the transactions occur. THE NATIONAL CASH REGISTER CO., Dayton, Ohio. For copy:

CIRCLE 154 ON READER CARD

PHOTOELECTRIC KEYBOARD: Data sheet lists the various format and function options making series PK-200 photoelectric keyboard applicable to data handling and communication systems requiring unique or customized keyboard capability. Discusses availability of custom coding (up to 14 bits) and the use of photoelectric techniques to eliminate contact bounce and minimize RFI/EMI. INVAC CORP., Waltham, Mass. For copy:

CIRCLE 155 ON READER CARD

PROGRAMMING PERFORMANCE: 36-page study measures the performance of programmers under controlled conditions for standard tasks. Describes and notes methodological problems encountered in designing and conducting the experiments, limitations of the findings, and hypotheses to account for results. Cost: $3; microfiche $.65. AD-645 438. CLEARINGHOUSE, U.S. DEPT. OF COMMERCE, Springfield, Va. 22151.

LOGIC CARDS: Four-page booklet contains information on the MONILOGIC line of circuit cards, power supplies, and associated packaging hardware which has been designed for system integration. Covered also are various card types and drawer assemblies. MONITOR SYSTEMS, INC., Ft. Washington, Pa. For copy:

CIRCLE 156 ON READER CARD

CEMENT PLANT APPLICATIONS: Eight-page brochure describes cement control computer system developed to provide cost savings in feed blending, kiln control and clinker cooling. Details described pictorially, diagrammatically and in text. ELECTRONIC ASSOCIATES, INC., West Long Branch, N.J. For copy:

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FIVE COMPUTERS FROM BURROUGHS

Five multiprogramming computers capable of becoming multiprocessors in a dual-mainframe configuration—and ranging from medium- to large-scale systems—have been announced by Burroughs Corp. In size, they fill the gap between the B5500 and the mammoth B8500, and retain upward compatibility from the smaller B2500, B3500, and B5500. The five are the 6503, 6504, and 6506—part of the B6500 series—and the 7504 and 7506 processors.

Main memories used with these processors are either core (with a 600-nanosecond read access time) or thin film (which have a 300-nsec access time). With the 6503, which uses cores, memory is expandable from 98,304 bytes to a maximum 786,432 bytes. With all others, however, (both core and thin film) main memory can go up to 3,145,728 bytes.

For handling peripherals, including remote terminals, the baby 6503 can be configured with up to 1,024 lines, the others having a maximum 2,048. The use of I/O multiplexors allows up to 20 simultaneous I/O operations; they also control transfer of data between memory and peripheral devices, independent of the processors. Other features include memory paging and segmentation, as well as memory allocation. As with the B5500, now running for four years, these are variable-size pages, and they use internal directories.

Controlling the system will be an "improved" version of the Master Control Program, a feature also of predecessor processors; this is the executive or monitor. Compilers include COBOL, FORTRAN and ALGOL. In addition, there's also re-entrant code, which permits multiple users to have access to the same program at the same time; it saves main memory allocation by getting by with only one copy of the program in memory. Deliveries are scheduled to begin during the first quarter of 1969. ■

Processor	Memory Cycle Time	Access Time	Add Time	Multiply Time	Typical System Rental (Monthly)
6503	1.2 usec	600 nsec	0.4 usec	8.0 usec	$25K
6504	1.2 usec	600 nsec	0.2 usec	4.0 usec	33K
6506	600 nsec	300 nsec	0.2 usec	4.0 usec	38K
7504	1.2 usec	600 nsec	0.1 usec	2.0 usec	45K
7506	600 nsec	300 nsec	0.1 usec	2.0 usec	54K-90K

CIRCLE 135 ON READER CARD

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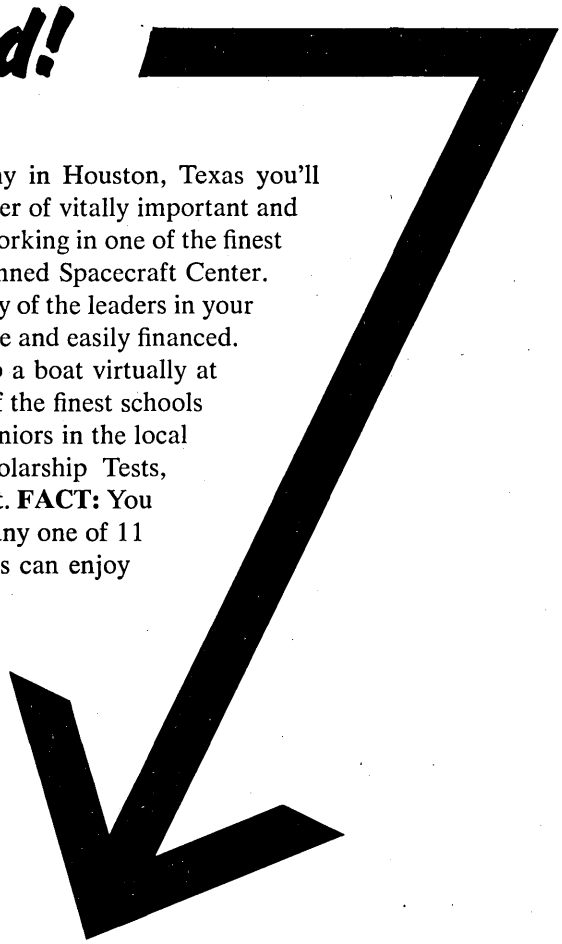

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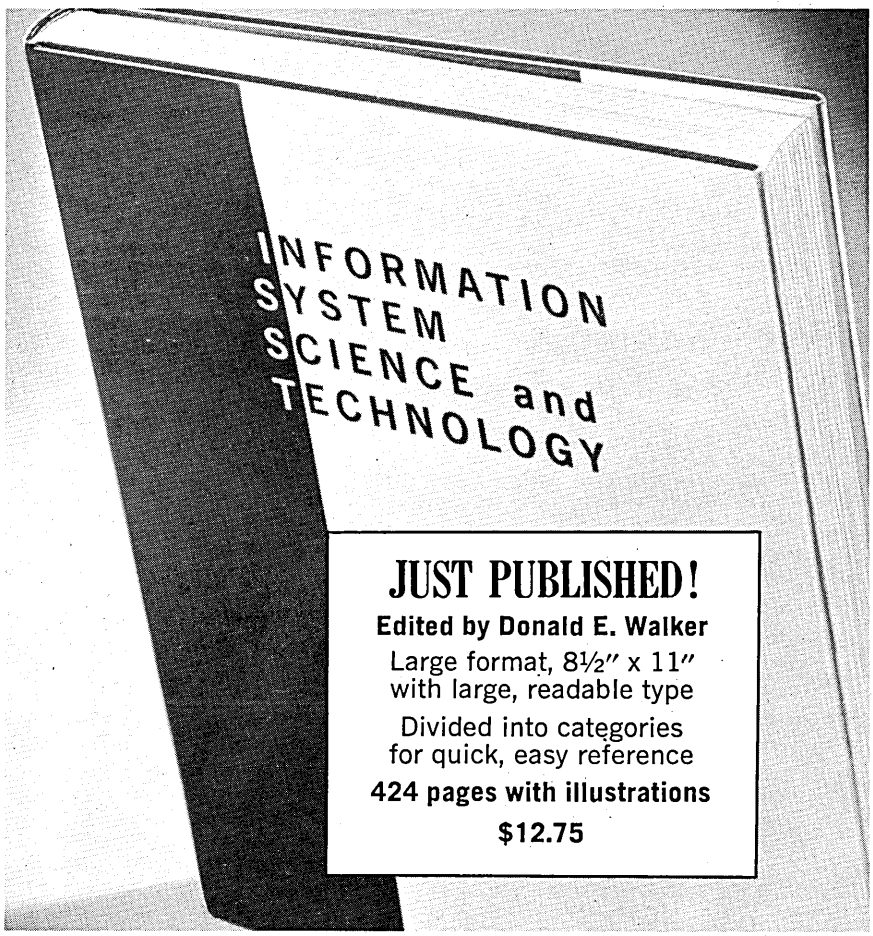
The papers contained in this volume, prepared for the Third Congress on Information Science and Technology, are the most advanced findings in the field. They provide vital points of reference for all who want to keep pace with the explosion of developments. All areas involving man-machine communication technology have been explored, with exciting forecasts and significant theoretical and practical breakthroughs. The section headings (listed at the right) read like a summary of perspectives for the coming decade!



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THE COMPUTER UTILITY AND ITS USER COMMUNITY

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books

***Electronic Digital Systems*, R. K. Richards, John Wiley and Sons, 1966.**

Dr. Richards' third book in the general area of computer technology impresses this reviewer as a highly ambitious and reasonably successful undertaking. It is ambitious in several ways—it is quite a lengthy book written in a deceptively simple narrative style with 30 or so line drawings scattered throughout to relieve only seldom the monotony of page after page of printing; it covers rather well the broad and technically sophisticated subject at hand, although it ranges unevenly in depth and treatment; and finally, the ideas and concepts are well enough handled so that they are and will remain current for a number of years to come.

Briefly, I think the best word to describe the author's work is the noun "survey" modified by the adjective "tutorial." The reader will find nothing in the text that he cannot find elsewhere, but Richards has organized the material into an exposition of connected concepts rather than a series of case studies, which generally is the alternate approach for a text of this type.

The 11 chapter headings will give an indication of the organization and range of material presented: history and introduction; theory of digital systems; the stored-program concept; automatic programming; digital data transmission; combined analog and digital techniques; telephone and message switching systems; the relationship between thinking and digital systems; miscellaneous digital systems; digital system reliability; and the automatic design of digital systems. Each chapter is followed by an extensive and well selected bibliography. Unfortunately, the index (which was probably done by the publisher) is much too brief in proportion to the contents, thereby reducing significantly the value of the book as a reference.

There appear to be no significant errors of fact in the text although, not surprisingly, I would differ with the author in points of emphasis. On the other hand, several rather obscure points brought out by Richards that I am familiar with are quite accurate and deserve the attention

books

he gives them. One interesting and unique section describing the early history of computers mentions the Atanasoff-Berry digital computer which was developed during the period 1938 to 1942 by Professor John V. Atanasoff and his assistant, Dr. Clifford E. Berry, at Iowa State College. I knew Cliff Berry from 1951 until his untimely death several years ago. In the early fifties his interest was still strong in the fledgling field of computer philosophy and design but this interest was maintained principally because he needed the computer as a tool for solving equations developed by another analytical instrument to which he contributed his considerable creative energies, the mass spectrometer. It is worth noting for the record that he and several others stimulated the company for which he was then working, Consolidated Electrodynamics Corp., into developing what became known as the Datatron computer, the design of which was initially justified as just indicated. From what Dr. Richards

says, it appears that this early work at the college acted as the initial catalyst to what are now both the Eckert-Mauchly/Univac computers on the one hand and the Electro-Data/Burroughs computers on the other! To the best of my knowledge, this remarkable early history, which predates *both* the ENIAC design and the Princeton work by von Neuman et al, has never before appeared in the literature.

It will be surprising if this book proves as successful as the first two. The book suffers because it does not appear to satisfy any significantly large segment of readers—it does not have the detailed technical information to justify its use as an engineering or college text, and it is too lengthy and detailed for the lay reader who sincerely wants to learn something about digital systems without exhaustion setting in. I am reminded of the comment made by my father, who was a prolific reader, that he seldom read lengthy books because it made his finger tired. I think this comment is appropriate here.

—JOHN ALRICH

book briefs

(For further information on the books listed below, please write directly to the publishing company.)

●

Residue Arithmetic and its Applications to Computer Technology, Nicholas S. Szabo and Richard I. Tanaka. McGraw-Hill, New York, N.Y. 223 pages. $12.50.

A summary of all known work in the field of residue arithmetic, with a tutorial description of principles and indicated applications.

Educational Data Processing: New Dimensions and Prospects, Richard A. Kaimann and Robert W. Marker. Houghton Mifflin. Boston, Mass. 1967. 326 pages.

A collection of articles and speeches from many sources, a few of them by the editors. They are grouped into the rather vague categories such as concepts, constraints, current impact, etc.

Principles of Data Processing, William J. Claffey. Dickenson Publishing Co., Belmont, Calif. 1967. 25 pages.

An elementary introduction for a first course in data processing, covering accounting machines, flow charting, and programming principles for the 1401 and 1620.

Numerical Calculations and Algorithms, Royce Beckett and James Hurt. McGraw-Hill, New York, N.Y. 1967. 298 pages. $9.95.

Intended as a text for college engineering and science students, showing general techniques of program solving with numerical procedures needed in engineering.

Control Systems Functions and Programming Approaches, Vol. B, Applications, Dimitris N. Chorafas. Academic Press, New York, N.Y. 1966. 276 pages. $11.

Discussion of a variety of applications, including process and data control, metals industry, transportation, and banking.

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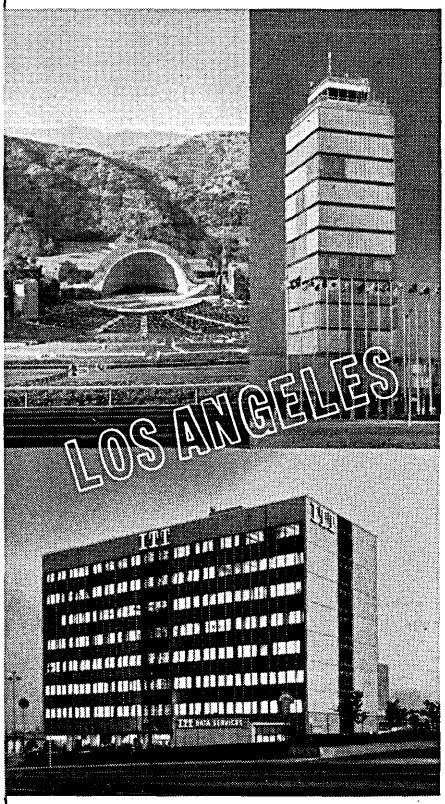

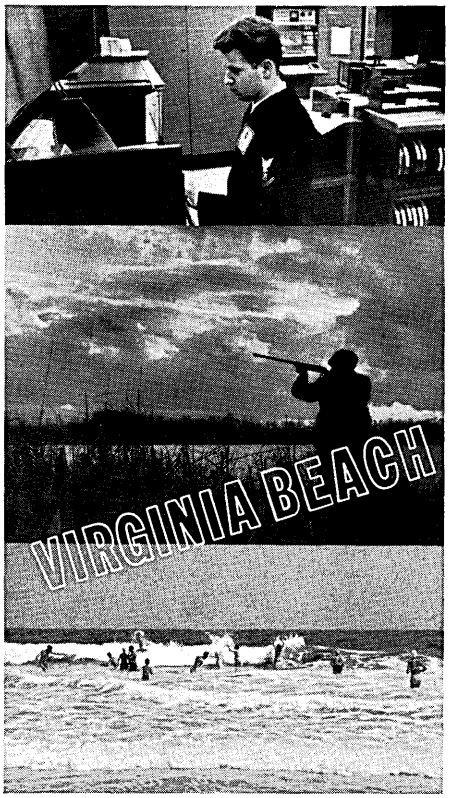

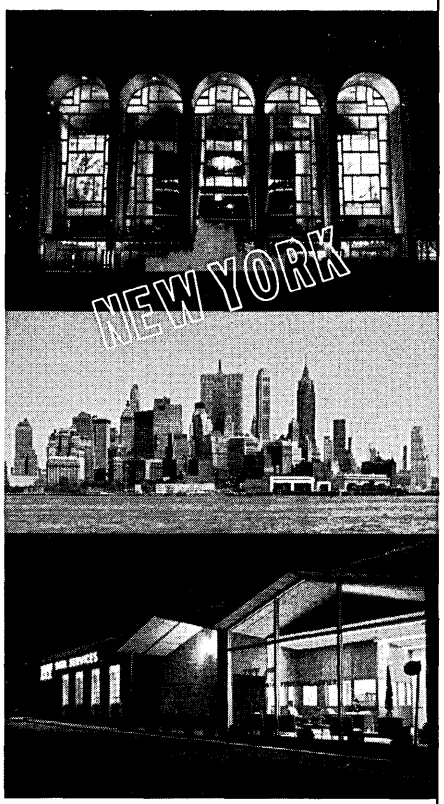

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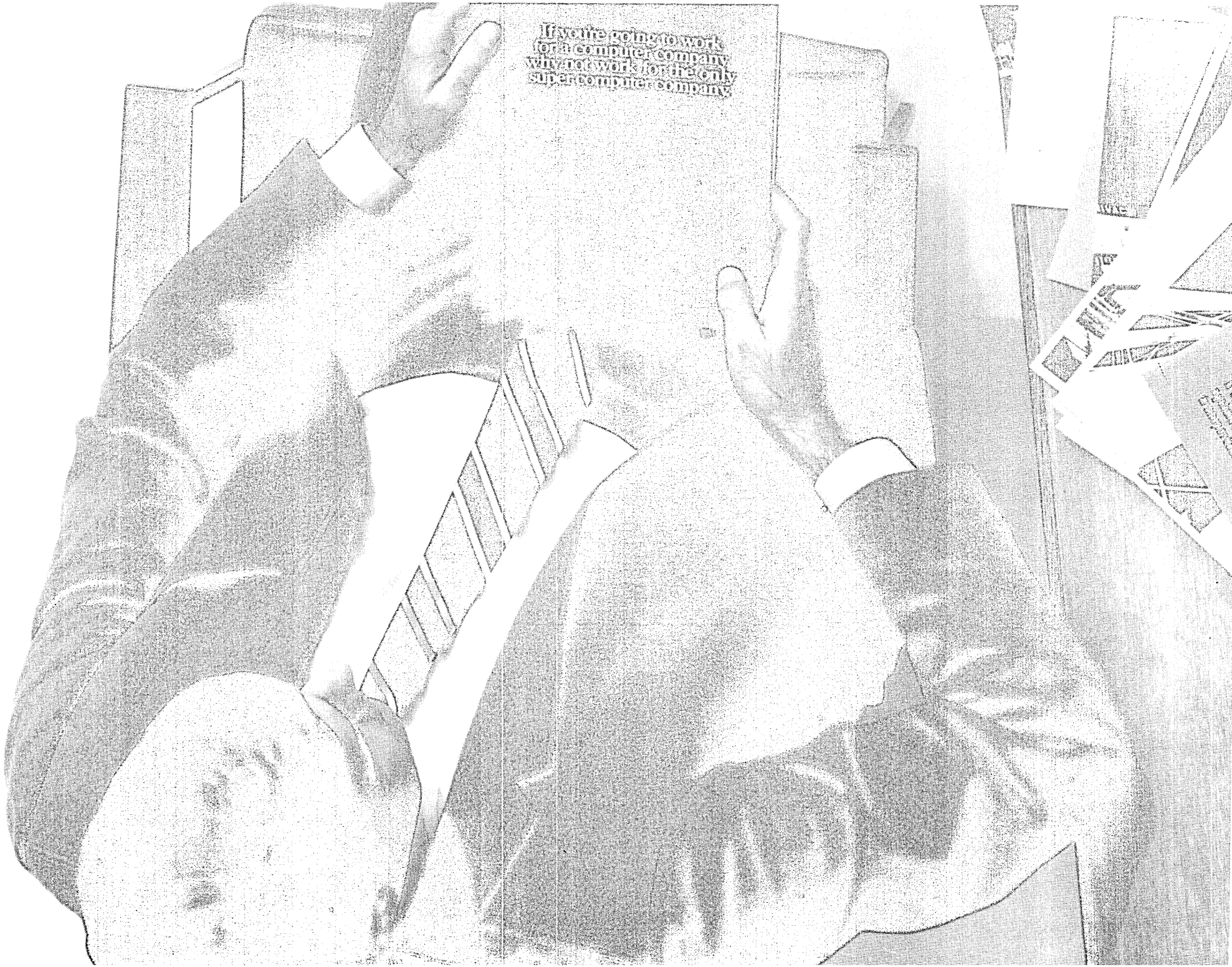
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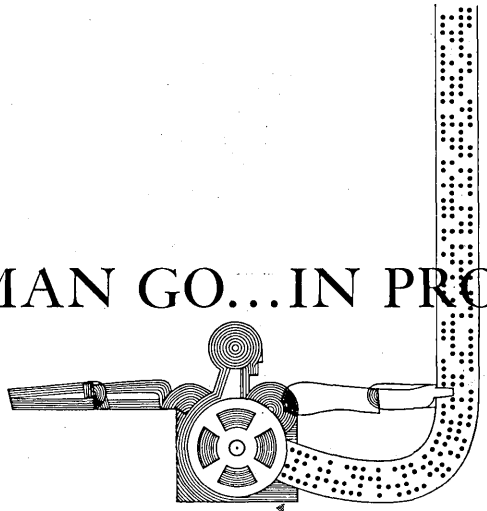
WHERE CAN MAN GO...IN PROGRAMMING?



From abacus to computer, human progress can be measured in increments of man's skill in processing data. Originally no more complex than the fingers of one hand, computer systems are today truly revolutionizing the very times in which we live. For as civilization grows ever more aware of the skills of these uncanny servants, so too grow in importance the programmers who initiate and then interpret all that these instruments are able to accomplish. Program: A trajectory for optimum ballistic flight far out in space. Program: Simulation studies. Program: Advanced software. Real-time management, and business systems. In brief, wherever there exists the need to do things better: Program. Lockheed offers an unusually wide range of advanced programming tasks at one of the world's largest centralized industrial computer installations. Write Mr. R. C. Birdsall, Professional Placement Manager, Sunnyvale, California. Lockheed is an equal opportunity employer.

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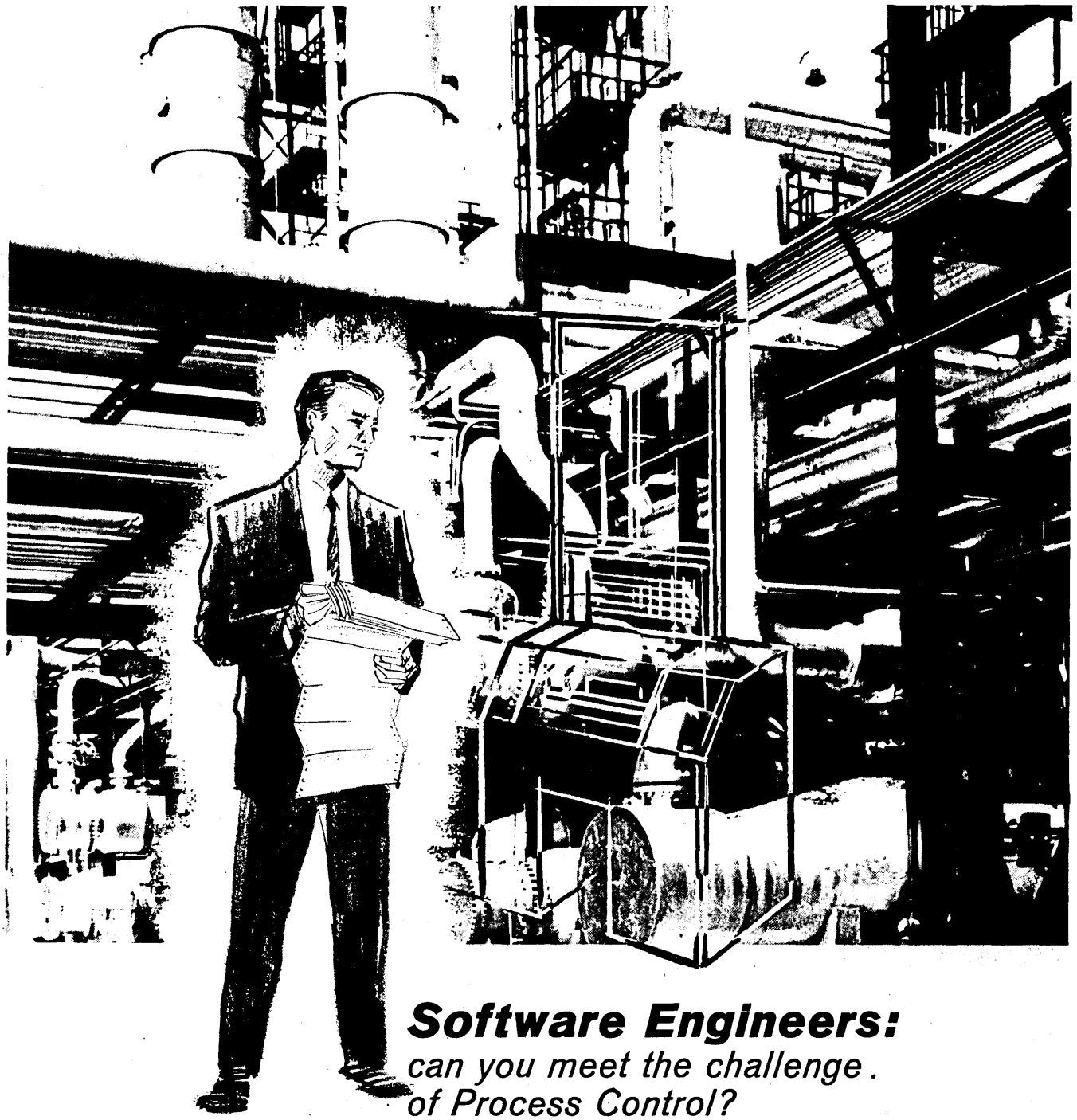

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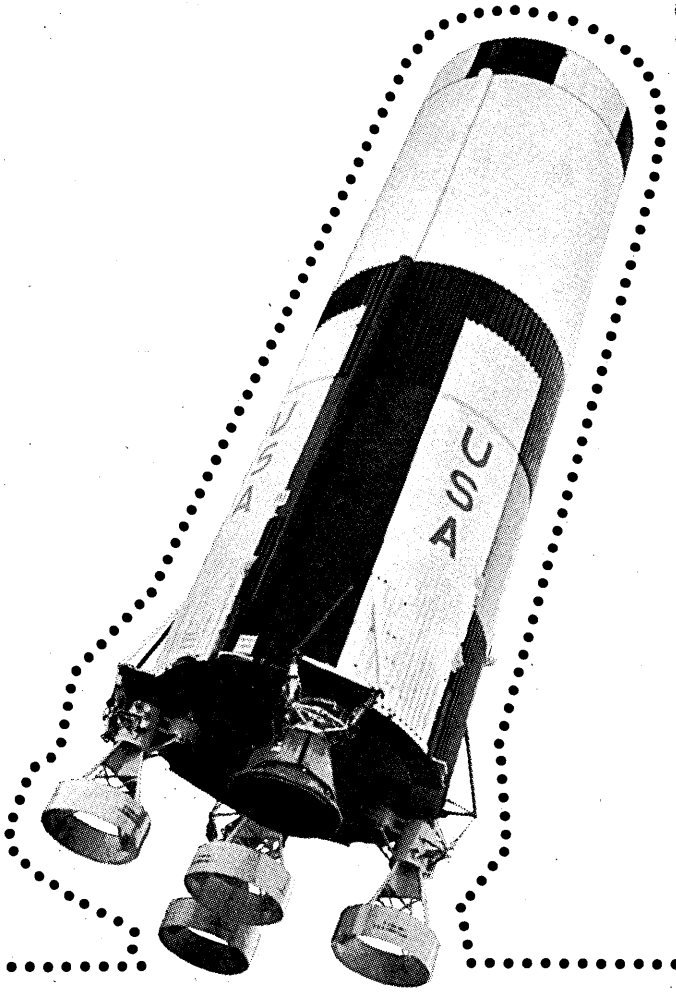
Computer openings on Apollo/Saturn V and other Boeing programs



Boeing's deep involvement with the nation's major space and missile programs provides immediate career opportunities for computer specialists at Huntsville, Alabama, and Seattle, Washington.

As a Saturn V support contractor to the National Aeronautics and Space Administration on Project Apollo, The Boeing Company is performing major systems engineering and integration functions at the Marshall Space Flight Center at Huntsville. Boeing also is weapon system integrator for the U.S. Air Force's advanced Minuteman II ICBM, prime contractor for the NASA Lunar Orbiter, and system integration contractor for SRAM, the new USAF Short-Range Attack Missile.

Immediate openings exist on the Apollo/Saturn V program at Huntsville for computer programmers in scientific digital programming and analog and hybrid applications. Minimum requirements include a B.S. degree in an applicable discipline, plus programming experience with hybrid analog or digital computers.

Positions are also available in Seattle on the Minuteman, Lunar Orbiter, and SRAM programs. Assignments include data processing software (analysis and programming), information systems research, and product computing systems. Minimum requirements include a B.S., M.S. or Ph.D. in an applicable discipline, plus two to five years experience.

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look ahead

(Continued from page 19)

In Hawthorne, Calif., Disc Pack Corp. currently has units in field test, a year later than the firm had projected, and should be making deliveries within a month. They're now a subsidiary of Memorex Corp.

But if you can't wait, or need some for a few days, Time Brokers Inc. in NYC rents the 1316 for $1/day.

ANOTHER SOFTWARE LEASING FIRM OPENS

A new firm, Computer Resources Corp., Wilton, Conn., has been set up by ex-IBMer Jerome Priest to attack the "software problem" by distributing proprietary packages. So far the 10-man company (to grow to 30 by year-end) has gathered programs "worth millions of dollars" from 20 suppliers to sell or lease, initially, to service bureaus and bank customer services departments. CRC-tailored documentation, training, and installation come with the package. And, using 20 independent consultants, CRC will also advise in such areas as setting up bank services. The firm, which will pay royalties to suppliers, figures program price will generally be around 1/4th the cost of development. Programs include a business package--Expand--for the IBM 1130, audio response, insurance agency, other accounting packages, simulations for education and training, and information retrieval.

TAX TREATMENT & PROGRAMMING COSTS

A significant case before the Internal Revenue's Income Tax Div. questions whether a computer user's programming, done by an outside firm, should be deducted as an ordinary expense or treated as capital expenditure, meaning amortization over more than one year, possibly over the life of the system. There's a "grass roots" movement among field agents to make programs a capital item (affecting software by outside programming firms since salaries paid for internal programming can't be amortized).

The ruling should be out late September or October. If it favors amortization, some feel it will not only hurt the users financially (tying up capital), but also cut down on contracts to outside firms and discourage conversion to new systems. One observer suggests it could give rise to a new kind of company--a hardware leasing firm that also provides special software packages whose cost is absorbed in the rent of the equipment.

RUMORS AND RAW RANDOM DATA

Biggest news out of Share: IBM says it will not offer extensions of Fortran & Cobol, will put its money on PL/I. The co. is more optimistic about TSS, expects the first release in October to service 20 consoles with "reasonable" response times, plus background batch equivalent to the 7094-II. Phil Cramer of SDC is new Share president...With its hybrid system sales higher than expected, EAI is de-emphasizing marketing of its digital computers as stand-alone units. The firm intends to improve its digital talent, specially in software, and will come out with a new line of scientific stand-alone digitals within a year...The August issue of Research/Development magazine has an article describing an experimental film memory with a packing density of 160 million bits/sq centimeter. Work was conducted at Eastman Kodak...Look for a new Univac computer, the 9400, to be announced later this year...SDC-developed Jovial (J3) has been adopted as the standard language for AF command/control jobs... Button seen at Share meeting said: "Nationalize IBM."

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.

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people

■ Dr. William F. Brown, former chief of mathematical and computing sciences at the Atomics International Div. of North American Aviation, has been appointed director of management systems and information sciences, a new directorate at Avco Missile Systems Division in Wilmington, Mass.

■ Jerry Koory has joined Programmatics as manager, systems programming, in Los Angeles. Formerly he was manager of the computer applications department at Planning Research Corp.

■ George Vosatka is now corporate vp, marketing, at Univac, a new post. Most recently he was head of marketing for Informatics.

■ Herbert Ohlman is now associate director for educational and information systems of the Central Midwestern Regional Laboratory, Inc., of St. Ann, Mo. He will be involved with all aspects of computer application and instruction for educational systems in this four-state CEMREL region. Prior to his appointment, Mr. Ohlman had been a scientist and product planner for Xerox Corp. in Rochester, N.Y.

■ Dr. Richard H. Fuller has been appointed manager of woven plated-wire memory engineering at General Precision's Librascope Group. Prior to his present position he had been manager of the information technology department of Librascope's Advanced Technology Center.

■ Merlyn C. Rue has been named director of information services at Travenol Laboratories, Inc., domestic subsidiary of Baxter Laboratories. He previously served as corporate director of systems and data processing for Allis-Chalmers.

■ Dan R. Carmichael has been elected president of the Teletype Corp. to succeed Maurus T. Goetz, who is retiring. Carmichael had been treasurer of the company.

■ Dr. Ronald I. Ribler has joined Computer Sciences Corp. as a senior member of the advisory staff of the company's computer sciences division.

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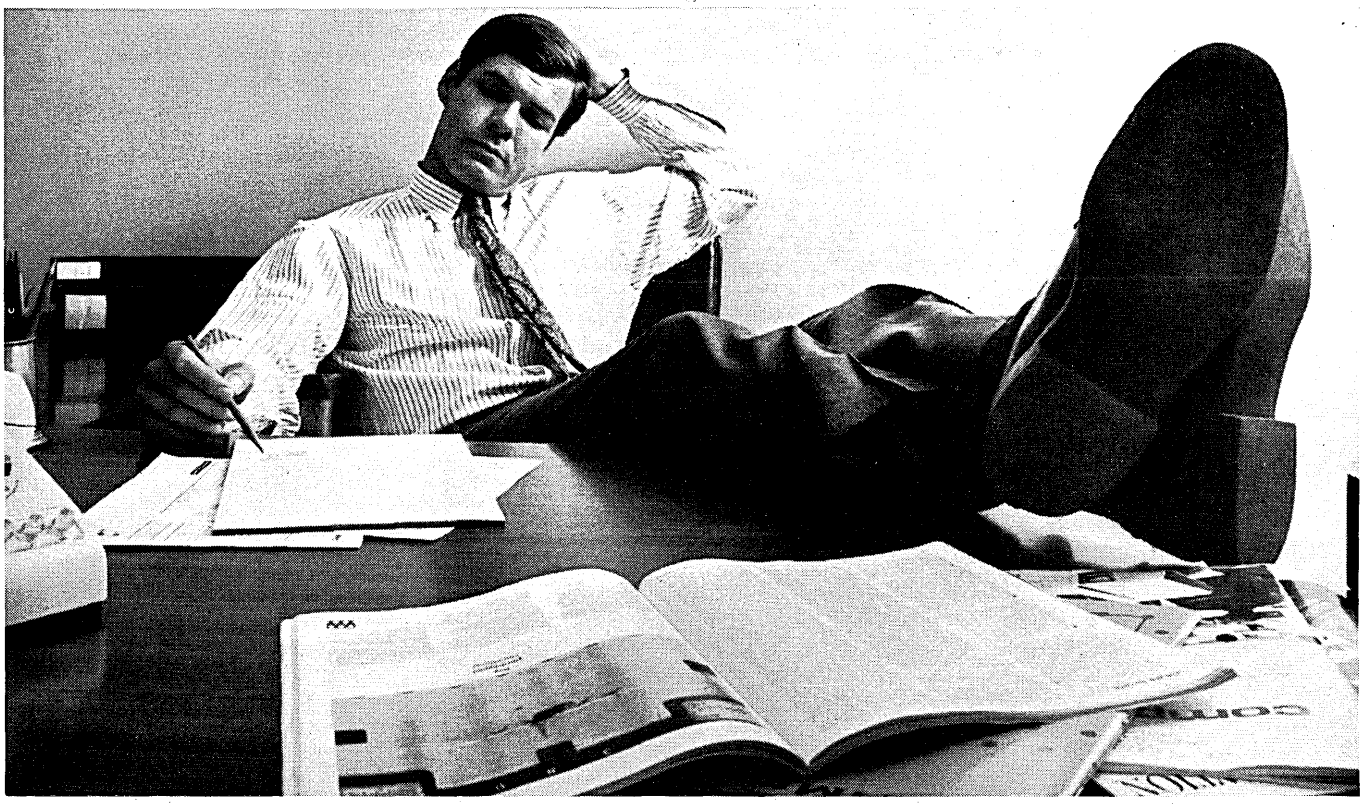

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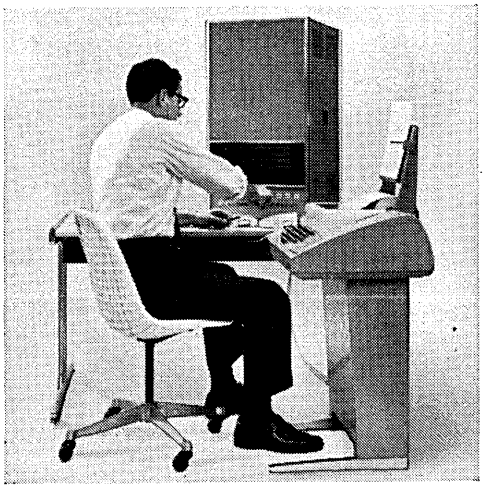

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the forum

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

A TIME TO ASSUME RESPONSIBILITY

Computer users, programmers, software companies and associations are demonstrating a surprising indifference to many issues that will have a material effect on the future of computing. Many individuals are not even aware of such issues. Those who are aware are not willing to take the time to investigate the questions involved. The few who are talking about issues cannot spare the time to do anything about them.

Everyone seems to be waiting for others to "do something."

A current issue that represents a good example of this attitude is the proposed patent legislation. A small part (Section 106) of this large bill says "A plan of action or set of operating instructions, in whatever form presented to cause a controllable data processor or computer to perform selected operations, shall not be patentable." Unless attention is focused on Section 106, it will pass unnoticed.

Congress is currently holding hearings on the proposed patent legislation. Programmers should send their views to Representatives and Senators. Here are some of the reasons for action:

1. The technology is so new that it is not appropriate to legislate against the future need for patent protection at this time.
2. Programming needs the encouragement provided by the patent system for qualified inventions if the users of computers are to realize the economic promise of the computer.
3. Programmers should be entitled to the same protection and opportunity to profit from their inventions as practicioners in other technologies.

The exclusion of patents for programs seems to be supported (certainly not opposed) by the computer manufacturers who could lose substantial future revenues if patent protection were afforded to programs. The patent office seems to feel that their workload would be unduly increased if programs were considered patentable.

The lack of interest and action on the patent question is just one instance of the basic problem. The fact is that there is very little professionalism in the computing community. Most programmers do not even read the trade publications. Less than 40% belong to any professional association. Probably less than 1% do anything in connection with an association that requires an extra effort on the individual's part. The one instance where all programmers agree to professionalism is salary: they expect to be and are compensated on a par with accountants and engineers. But let's not pin the rap entirely on programmers.

The computer users for the most part do little to support the associations. Their main concerns seem to be: how expensive programmers are; the difficulty of finding more programmers; how late and bad the software is, etc.

The software companies talk about forming an association to investigate and develop positions on various issues. However, when it is time to do some actual work in this connection, it is surprising how few can find the time.

The professional associations sponsor publications and technical conferences, form committees and discussion groups—but seldom take a stand on a specific issue. The associations have a right to expect more participation from the membership but the members should expect more from the associations.

The individual computer manufacturers do take positions on issues that arise which may adversely affect their revenues or control of a particular situation. They are also particularly discreet about being identified with issues that will work to their benefit. The manufacturers have a clear understanding of the need to protect their interests and have developed the mechanisms for doing so.

Let's hope that the other participants in the arena of data processing develop an understanding of their needs and the mechanisms for satisfying them in the near future.

—RICHARD C. JONES
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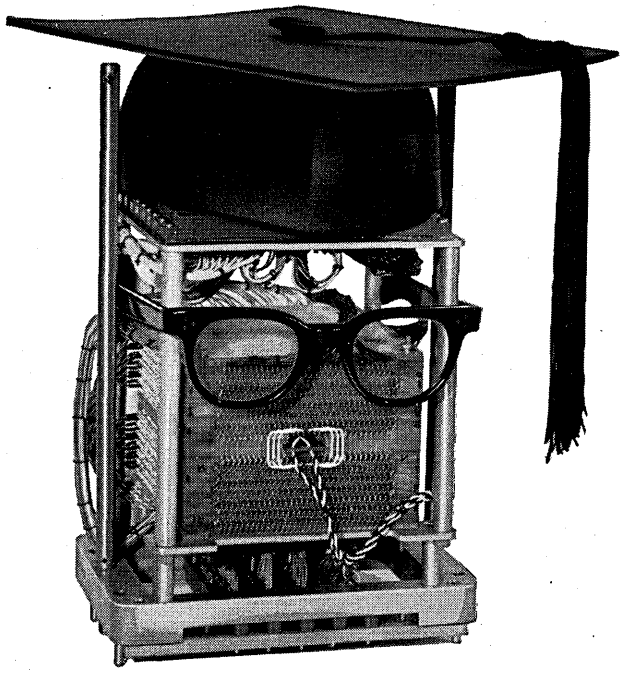

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