DATAMATION®

68

November

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So if you think you have enough work for two computers—see if the 520/i will do the job.

The new Varian Data 520/i with a 4K memory sells for $7500. If you would like to know more about it, write for a Varian 520/i brochure.

varian data machines

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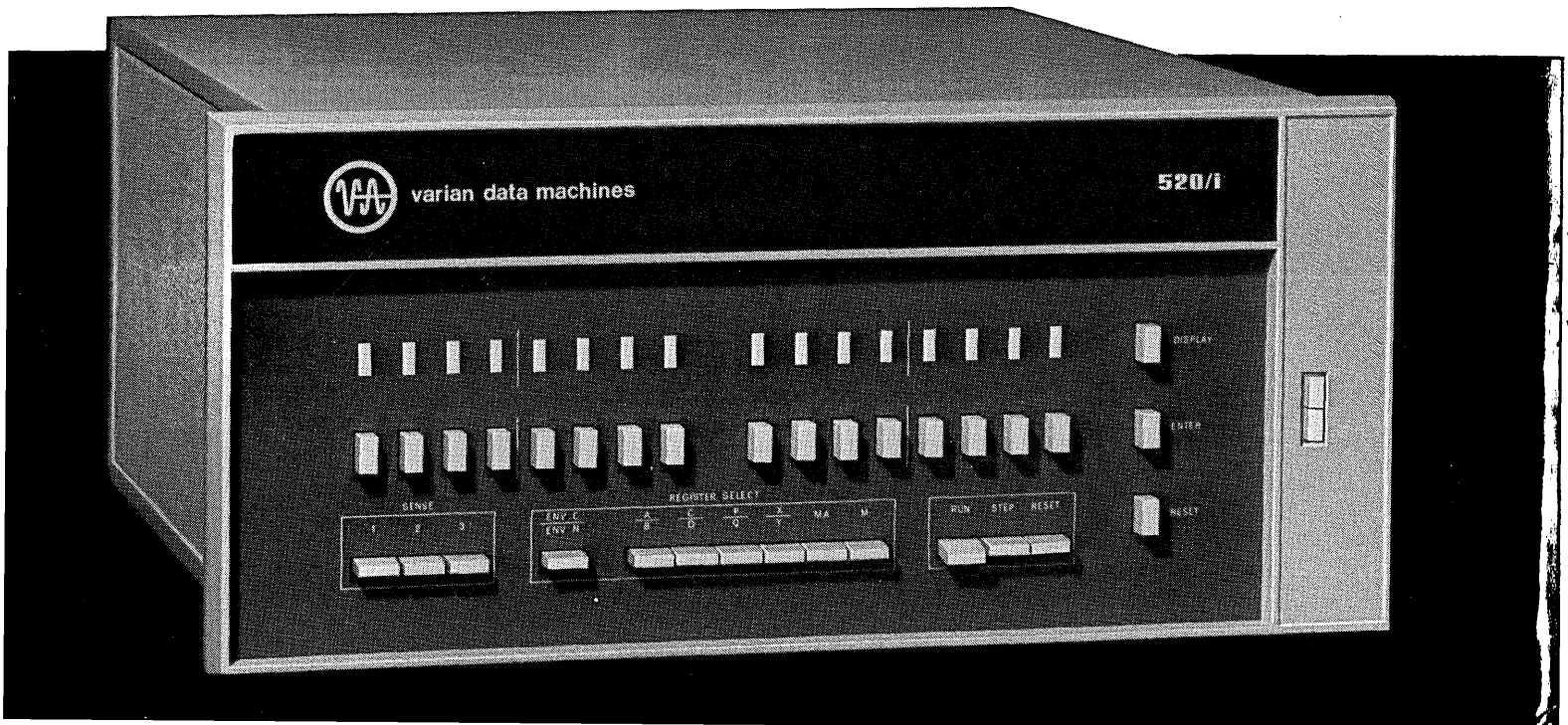

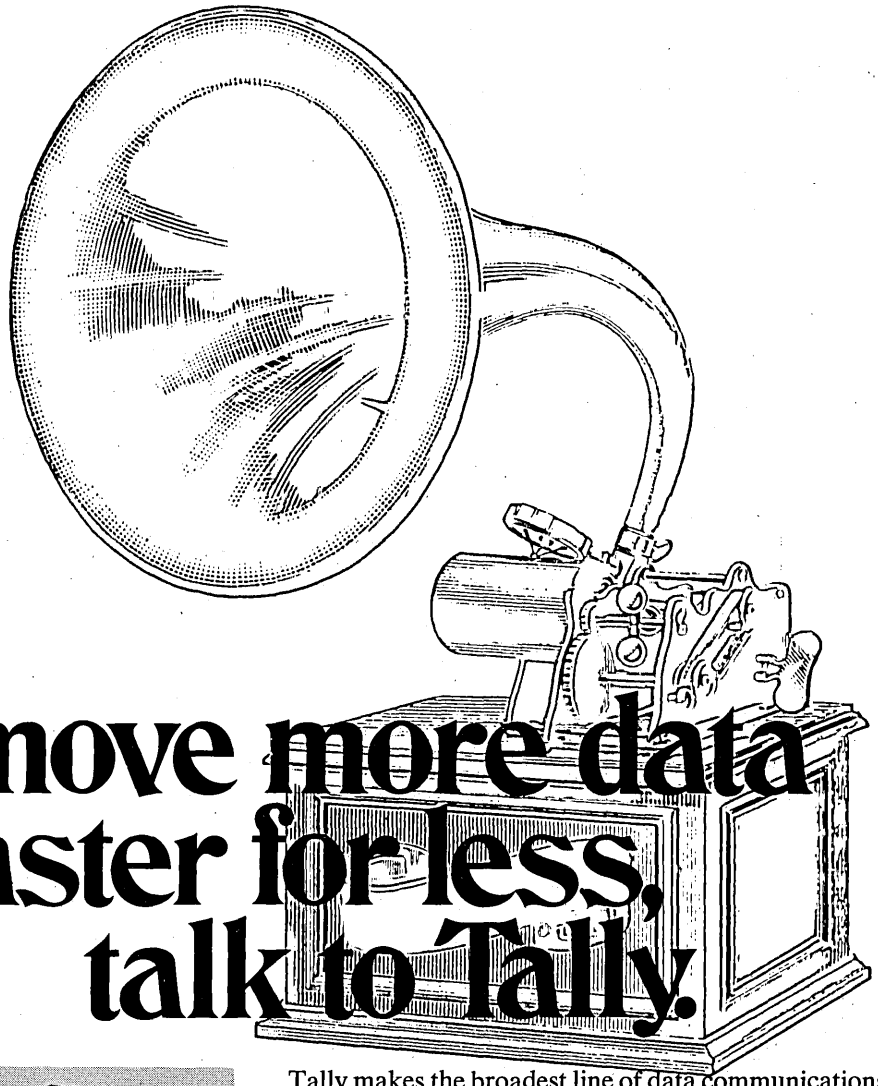

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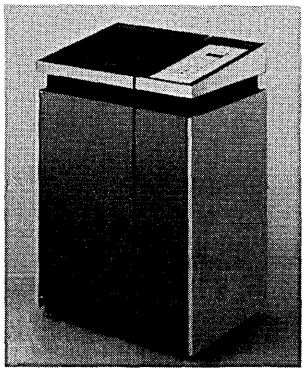

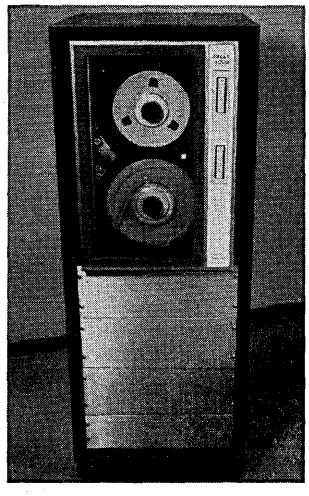

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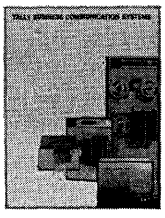
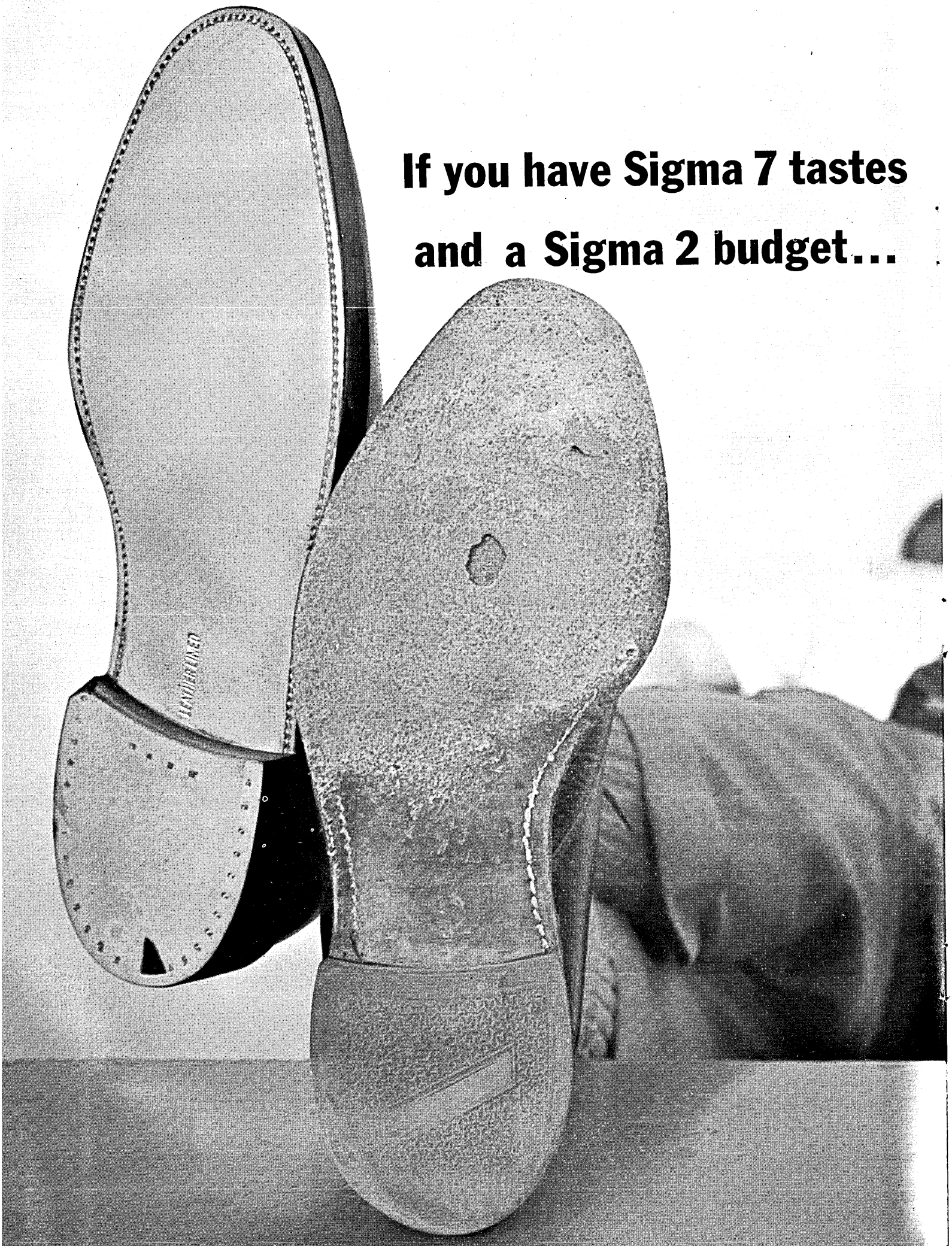


TALLY®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CIRCLE 5 ON READER CARD

DATAMATION

november 1968

volume 14 number 11

FJCC SJCC

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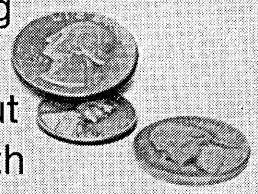
This issue 91,796 copies

Is it possible to get a really good computer for less than $10K? How about $9,950 and some odd change?

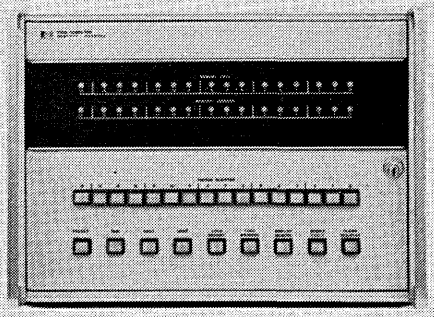
That's what the new Hewlett-Packard 2114A will be pegged at. But it'll heave to just like its big brothers. Throwing around big 16-bit words. Storing 4000 (or 8000) of them at a time in memory. Fetching them out of memory in two microseconds. It'll tie in I/O devices with standard plug-ins and use the same set of programming languages—FORTRAN, ALGOL and Conversational BASIC. It may be the littlest computer in the HP family... but even at that it more than holds its own against its big brothers.



That's right. The HP 2114A offers the most desirable price/performance ratio of any computer on the market. And it won't take up much room, either, not even on your desk. One compact package 12¼" tall houses both processor and power supply.

Yet the economy model is fully compatible with all the 2115/2116 software and I/O interfaces. The main frame accepts either 4K or 8K memory, has eight I/O plug-in slots and operates within a wide temperature range. Low-cost options include parity error check and power-fail protection.

If you think this powerful little computer is right for you, get more information from your local HP field engineer. Or write Hewlett-Packard, Palo Alto, Calif. 94304; Europe: 54 Route des Acacias, Geneva.



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november 1968

volume 14 number 11

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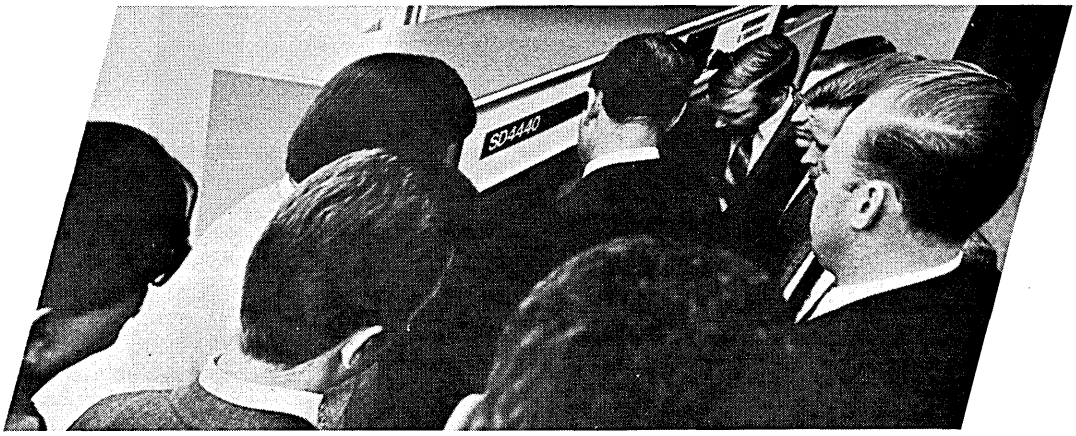

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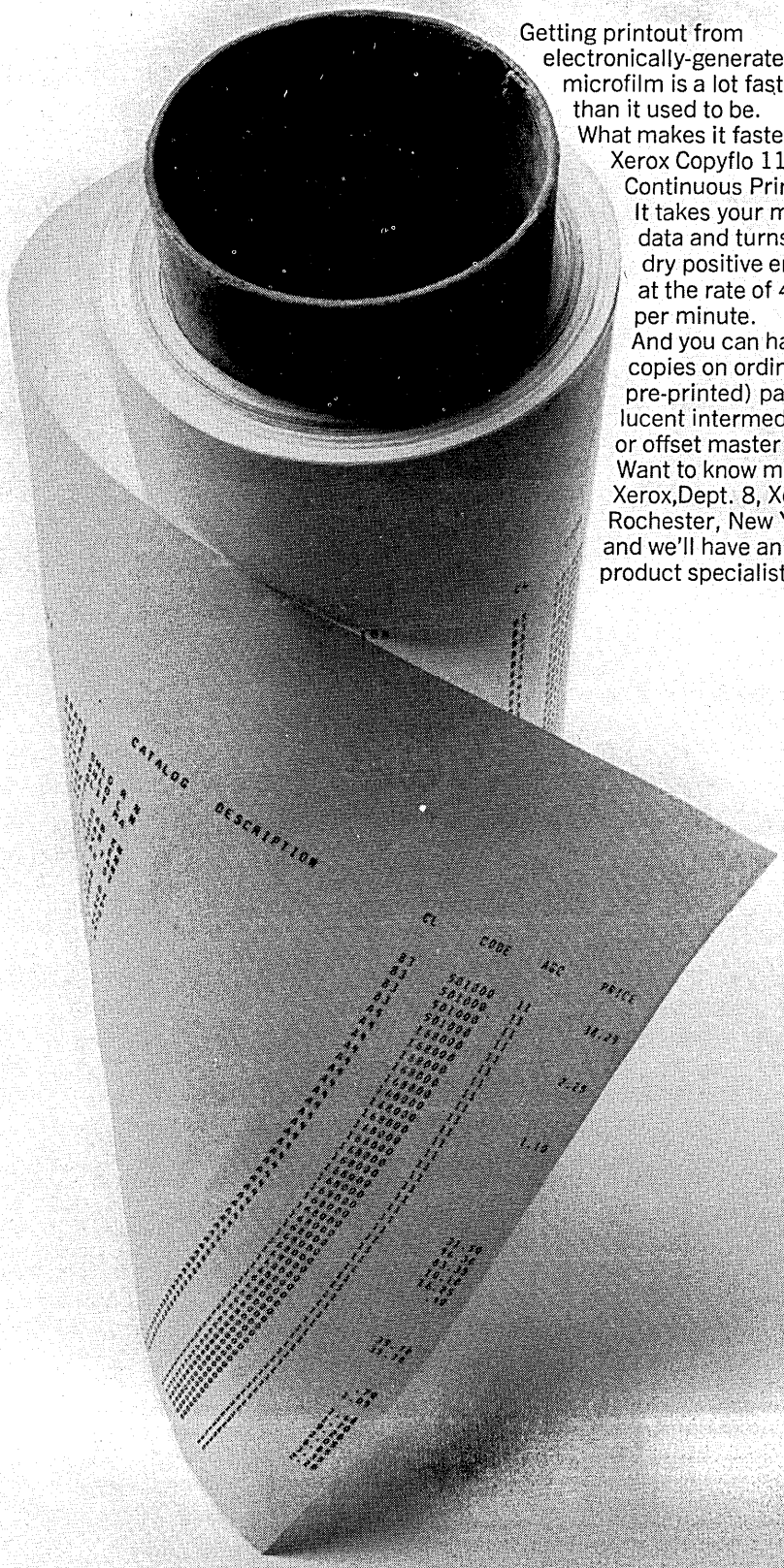

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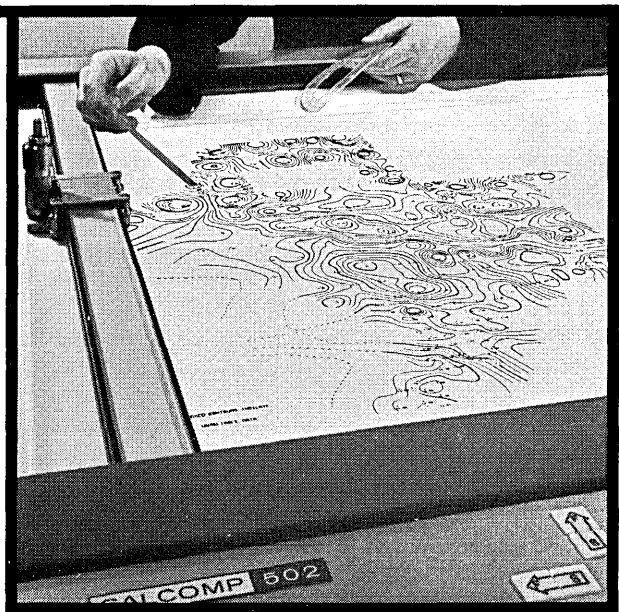

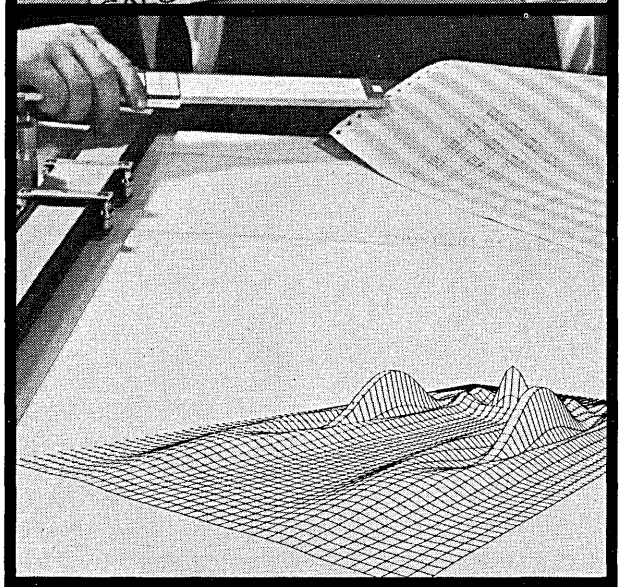

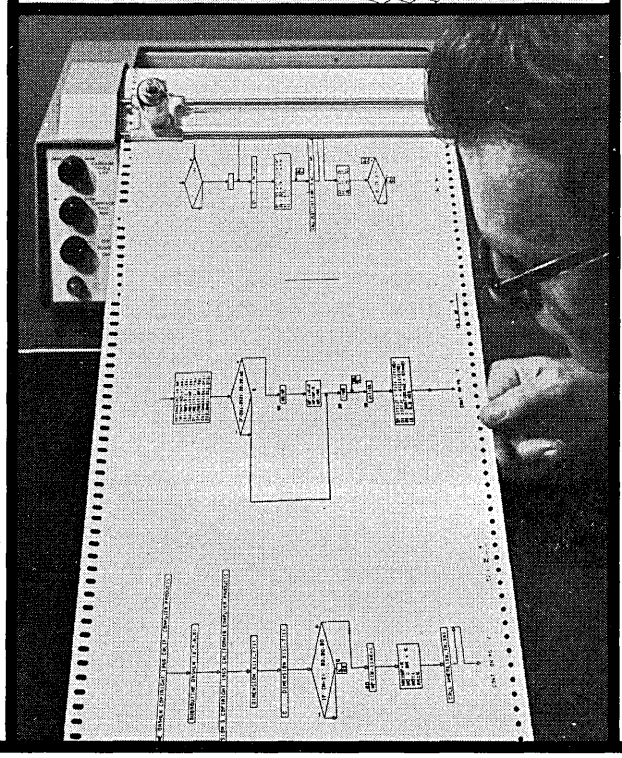

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(General Purpose Contouring Program)

This program automatically plots functions of two independent variables in the form of contour diagrams or maps. Written in FORTRAN IV, it is easy to use, extremely flexible, accurate, economical. It is about 30 times faster than manual and does jobs impossible to do by hand. Used with any CalComp plotter system, GPCP can be applied to such fields as geophysics, meteorology, engineering, biology and medicine.

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(Perspective drawing software package)

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(Flowchart software package)

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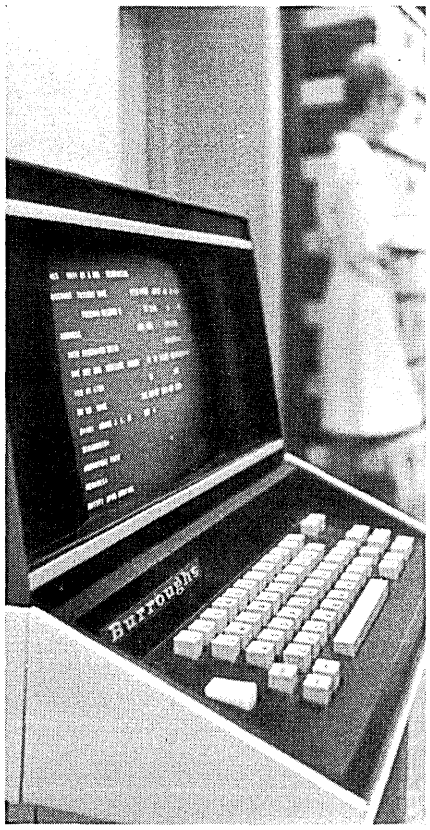

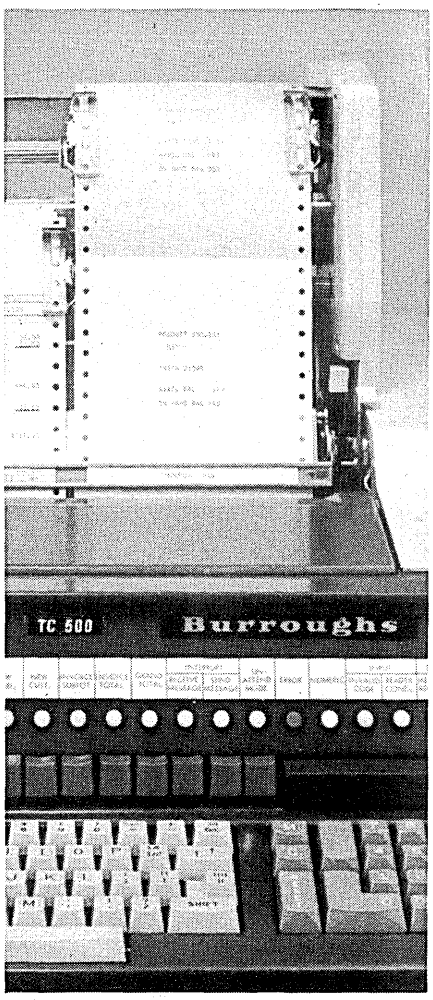

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CIRCLE 14 ON READER CARD

look ahead

UNIVAC QUIETLY PLANS MAJOR EDUCATION ENTRY...

With the development of COPI (Computer-Oriented Programmed Instruction), Univac has begun an ambitious move into the educational market that will lead to multi-1108 systems capable of handling a thousand terminals.

COPI-I, the research version of the language, is now operational on the Univac 30-bit machines--such as the 1230 MTC, 642B, and 494. Reason for this starting point is that the development group, headed by Robert G. Milburn, Jr., is part of the Federal Systems Div. in St. Paul, formally known as the educational systems development group, customer services division.

COPI-II, which will be released in several levels of capability, is now running on an 1108 in level A form. The B version has been specified--apparently to the satisfaction of one federal government agency, which has already signed a contract for it--and will be released in the spring of '69. Level C, scheduled for next summer, will be both cpu- and terminal-independent.

Univac's marketing plan is to sell the concept--with a very wide choice of equipment, depending on the need of the customer. COPI-I, for example, can make use of all Univac keyboard terminals plus the military 1551 crt display unit. COPI-II takes Model 33 or 35 and the Uniscope 300 displays (which United Airlines just bought a flock of). And a lower-cost version is in the works. Thus, with the completion of level C, a customer might go for a 10-to-14-scope 9300, anywhere up to the monster 1108 combinations. A special language--DISLAN--has been developed for handling the displays. Level C will also include a JOSS-like interpretive calculation mode, a PL/I-like string handler to allow course writers a means for setting up algorithms suiting their specialty.

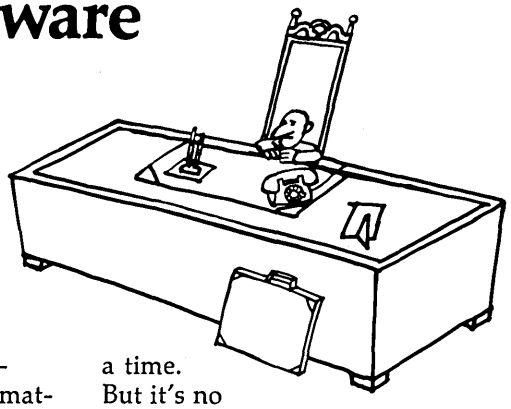
The company is also investigating the preparation of course materials and may work together with an educational institution on this thorny aspect. First, predictable development of course materials: a system for training programmers, to be ready for in-house operation next summer.

...IBM ON MOVE TOO

IBM reportedly is planning to become a major factor in the dp education field. Two recent developments support the rumor:

IBM education centers in Dallas, Boston, LA, and Washington will offer "Fundamentals of System Science" beginning Jan. 1, to those with minimum dp training and experience who can pass the ATPP, a widely-used aptitude test, and who have access to a computer (e.g. working dp technicians). The course will consist of 10 weeks' hands-on training, followed by six weeks of classroom work. The first 10 weeks will cost $3500, the final 6, $2500. Significantly, until now, the only dp training IBM has offered on

Instant software company anyone?



Call it Acme Software, All American Software, Worldwide Computer Technology. No matter what you call it, you are part of the rage of the late sixties—the software syndrome. A couple of desks, a smattering of jargon, a rough knowledge of what it's all about, some borrowed money—and you're in business.

Reminds us of the semiconductor spin-off binge of not so long ago. Anybody with a nanosecond's edge on R&D or a new wrinkle in a passivation technique rented a garage and had a go at it.

Some of them made it. More went down the tubes. Not because they didn't have talent and technical knowledge. But for a lot of other reasons that sum up thusly: they failed to convince the market place that they were around to stay. And customers didn't want to take the risk of trusting them with important business.

And that elusive goal of gaining the customer's trust becomes even more difficult to achieve in today's software industry. Customers are getting continuously more sophisticated and enlightened. You can dazzle them with mystique combined with a cheap solution. But before they sign on the dotted line, they're likely to ask some searching questions. Such as—why do you think these cost estimates are realistic? Or—do you really have enough good people so that we can count on continuous talent, not just warm bodies? And—will your company be around not only to complete the work but to give us support with the results?

Does the increasingly tough customer attitude mean an end of new company growth in the software field? We doubt it. Freedom to take a risk is what drives many an excellent mind out of the cool, restricted corporate offices into the hot little loft above the candy store. We know that. We did that once upon a time.

But it's no longer the same ball game.

We've seen the software industry grow, change in structure, and grow some more. Getting established in this business was difficult enough six years ago. It is many more times as difficult today. Not only because of the thousands of small competing companies. But because of the performance records of the leaders. You may deem it self-serving, but let's look at our own record:

We've worked on such projects as simulating the moon mission of Surveyer E for Jet Propulsion Laboratories; assisting the Michigan Department of Public Health to implement Project ECHO; implementing an election reporting system for CBS; and launching Atars, the fully automated airline reservation system for travel agents. And many others.

And along the way we've gathered financial strength, management skill, experience, organizational structure. Important customers *can* place their trust in us. And they know it. A few years ago there weren't any firms like ours. And that made it a lot easier to get started.

Today, there's a handful. We tend to think they'll continue to draw the most challenging work and the most demanding customers. And we think they'll continue to offer software talent its best opportunities.

So whether you're a potential customer or a potential employee, please drop in. To our cool corporate offices. But bring your own candy. The nearest store is now two blocks down the street.

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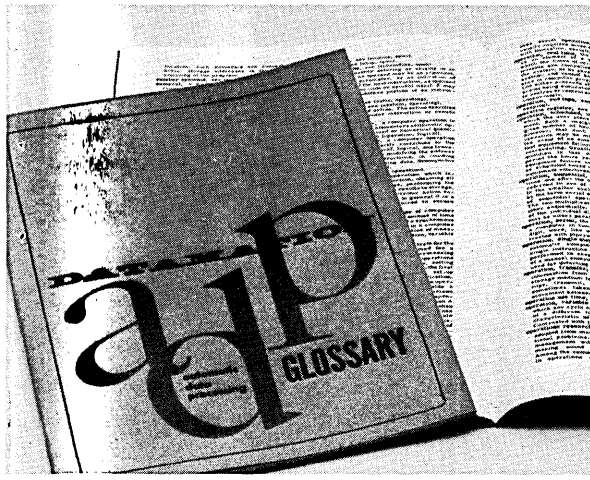

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a tuition basis has been a 4-week course in NYC. This one is given by SRI, a subsidiary, and is restricted to those with at least five years' experience in computer technology.

Science Research Associates, another subsidiary, meanwhile has begun marketing two programmed instruction courses--devoted, respectively, to programming the 360 in Fortran and Cobol.

NEW MA BELL TARIFF ANSWERS SOME EDP OBJECTIONS

EDP industry reaction to a new AT&T foreign attachment tariff permitting interconnection of customer-supplied communications systems and terminals through a "data access arrangement"--a signal controller and a protective device--was less than enthusiastic.

A dp industry spokesman said the new offering was a "noticeable improvement" over its predecessor--the foreign attachment tariff proposal Bell filed in September--but he still had objections.

"Bell has said the protective device will cost the user $10 for installation and $2 per month for service. Whether there will be an additional charge for the controller, and if so, how much, is unclear. We know of a company now selling both devices as a single unit, to independent phone companies in California, at a price which allows the equipment to be rented to the user for no more than $2.50 per month." (The company, reportedly, is Computer Security Systems, Beverly Hills, Calif.) "Furthermore, the independently made equipment provides automatic answering/calling capability, while the Bell arrangement doesn't. This is a feature we must have."

According to Bell spokesman, the phone company will add automatic calling/answering to its data access arrangement "by Jan. 1."

It seems likely that Ma Bell's customers and their suppliers will accept the new tariff offering provided the automatic calling/answering feature materializes and provided charges for the data access arrangement are lowered. The dp industry probably will continue pushing for further concessions, but its two chief spokesmen--EIA and BEMA--may be hamstrung by lack of enthusiasm; it is known that some members of both groups were willing to accept Bell's September offering.

If the new proposal brings about a truce, AT&T will retire from the bargaining table still in control of the terminal and system interface. Independent equipment makers will still be locked out of a substantial market, and users will still be able to exploit the benefits of better terminal equipment only as fast as Ma Bell and/or FCC allows.

DAVID TACKLES GOLIATH

Dave Ferguson, president of Programmatics, Inc., tackles IBM head-on this month with announcement of PI Sort (for DOS), a type-one program of which No. 1 has been--so far--proud (see New Products, p. 201). Users balking at paying PI for a program available free from IBM may first want to check out sort times of the two functionally identical packages.

GE RETAIL SYSTEM OPENS OFF BROADWAY

GE edp people, moving in small quiet numbers around the National Retail Merchants Assn. edp conference in '67, were at the Montreal show in October in fuller force. The GE retail systems group has moved from Paramus to Phoenix and seems to be gearing up to provide on-line point-of-sale systems using

(Continued on page 251)

the $188,000 graphics terminal

that costs $60k

It used to be you had to spend that kind of money to do meaningful work in computer graphics. Now you can buy a complete interactive terminal from Adage for $60,000 — and get a lot better performance. That's our model AGT/10.

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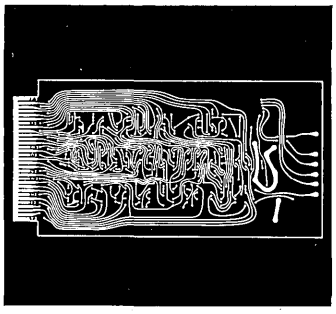
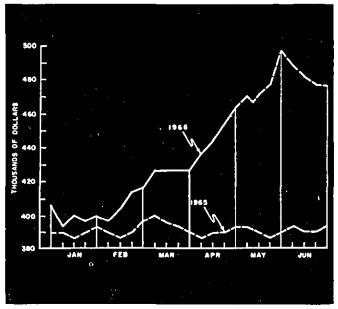
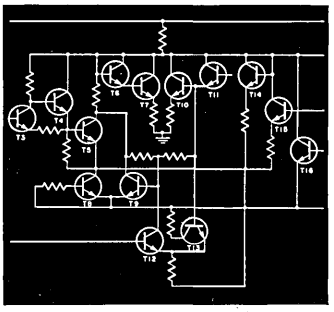


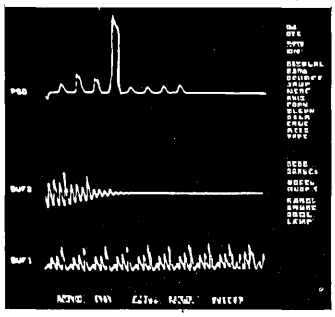
printed circuit layout



business management systems



machine-aided drafting



on-line signal analysis

If you'd like more information about our under-priced AGT/10, or a 16 mm movie showing the Adage Graphics Terminal in action, write D. Sudkin, Marketing Services Manager, Adage, Inc., 1079 Commonwealth Ave., Boston, Massachusetts 02215.

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CIRCLE 150 ON READER CARD

calendar

DATE	TITLE	LOCATION	SPONSOR/CONTACT
Jan. 13-14	Symposium: Applications of Sea-Going Computers	San Diego	Marine Technology Society, P. O. Box 2158, La Jolla, Calif. 92037
Jan. 15-17	2nd Annual Simulation Symposium	Tampa	Simulation Symposium, P.O. Box 1155, Tampa, Fla. 33601
Jan. 21-23	15th Annual Reliability Symposium	Chicago	IEEE, 345 E. 47th St., New York, N.Y. 10017
Jan. 30-31	3rd Annual Statistics Symposium	Los Angeles	ACM/Business Adm. Ext. Seminars, Rm. 2381 GBA, UCLA, Los Angeles 90024
Feb. 13-14	Mgt. Conf: Expanding the Service Center Markets	Las Vegas	ADAPSO, 420 Lexington Ave., New York, N.Y. 10017
Mar. 24-27	Int'l. Convention & Exhibition	New York City	IEEE, 345 E. 47 St., New York, N.Y. 10017
Mar. 26-29	16th Int'l. Meeting	New York City	Inst. of Management Sciences/B. Mayer, SBC, 1350 Ave. of the Americas, New York, N.Y. 10019
March 30-Apr. 2	Graphics Conference	Urbana, Ill.	W. J. Poppelbaum, Univ. of Illinois, Urbana
Apr. 1-3	6th Annual Meeting & Technical Conference	Cincinnati	Numerical Control Society, 44 Nassau St., Princeton, N.J. 08540
Apr. 21-23	Conference: Effective Use of Computers in the Nuclear Industry	Knoxville	Oak Ridge National Laboratory, P. O. Box X, Oak Ridge, Tenn. 37830
May 7-9	International Joint Conf. of Artificial Intelligence	Washington, D.C.	ACM/Rebecca Prather, Hycon Co., 700 Royal Oaks, Monrovia, Calif. 91016
May 14-16	Spring Joint Computer Conference	Boston	AFIPS, 345 E. 47 St., New York, N.Y. 10017
May 27-29	Symposium: Man's Environments-Display Implications & Applications	Arlington, Va.	Soc. for Information Display, P.O. Box 187, Kensington, Md. 20795

THREE CHEERS

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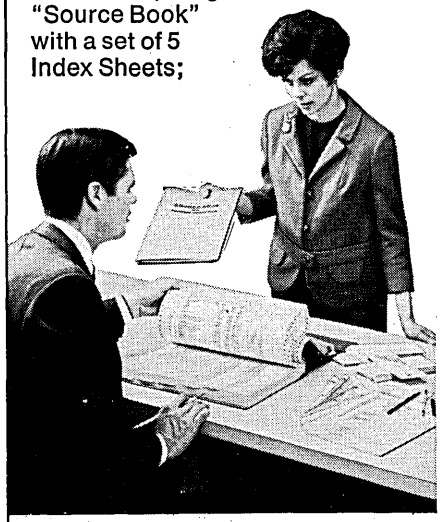

and 10 insertable EDP Titles; and a clear vinyl 14⅞" x 11" Envelope for 150 parameter cards. Loaded Organizers can also be prepared for filing in the Wilson Jones "Data-Racks" with the addition of Hanger Sets.
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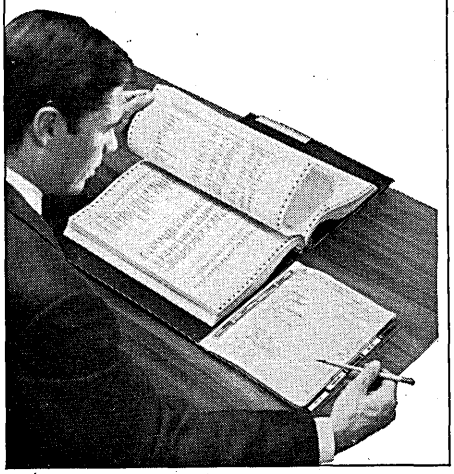

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letters

channel fog

Sir:

After reading the article by Pearce Wright (July, p. 23) "Time-Sharing in Europe," I come to the conclusion that a mistake has been made in the title of this article. It should have been "Time-Sharing in Great Britain."

Once Englishmen said "There is some fog over the channel and the continent is isolated!" This obviously is also the opinion of your "European" editor who discusses in detail the initiatives of most British universities but has discovered nothing about time-sharing in industry, state organizations and universities of the main part of Europe: the continent!

Poor information!

S. J. BOGAERTS
Brussels, Belgium

opscan protests

Sir:

Your item in Look Ahead (Aug., p. 155) implies that the National Shawmut Bank of Boston controlled Optical Scanning Corporation since they held 50.1% of our voting shares. The National Shawmut Bank of Boston holds, as custodian *without* voting rights, the shares owned by the American Research & Development Corporation. As of August 28, 1968, American Research owned 32.2% of our voting shares outstanding; these shares are physically held in a custody account at the Shawmut Bank. In the report prepared during July 1967, by the Shawmut Bank for the House Banking and Currency Committee, it was clearly indicated that the bank held Optical Scanning stock in a custody account without voting rights. The bank has no members on our Board of Directors nor do they in any way exercise control over us.

DONALD P. DENNIS
Controller
Optical Scanning Corporation
Newtown, Pennsylvania

flak

Sir:

Re Zinn's article ("Instructional Uses of Interactive Computer Systems," Sept., p. 22): I demand equal time for the Air Force. Zinn mentioned that the 1961 conference was sponsored by System Development Corporation and the Office of Naval Research. He neglected to mention that Galanter's book "Automatic Teaching" (not "Automated Teaching" as incorrectly given) reports the proceedings of a conference sponsored in December 1958 by the organization of which I have the honor of being an employee, the Air Force Office of Scientific Research. To the best of my knowledge, this was the first conference held on the subject.

HAROLD WOOSTER
AF Office of Scientific Research
Arlington, Virginia

can do

Sir:

Re "CAI Languages: Capabilities and Applications" (Sept., p. 34): As mentioned in another article in the same issue, the name FOCAL is, in fact, a trademarked name used to describe a JOSS-type language implemented by the Digital Equipment Corporation on the PDP-8 series. We have therefore renamed our language CAN (Completely Arbitrary Name). Because of the legal implications, we would be grateful if you would draw your readers' attention to this change. Although I am forced to concur with the statement about the often informal and arbitrary nature of documentation of such efforts (we often are as guilty as anyone else), a *User's Guide to CAN* is available (for $1) from our Publications Dept., which not only describes the language, but also includes sample printouts (which, incidentally, are real printouts and not simulated in any sense).

I should also like to draw your attention to two minor inaccuracies: CAN does not provide a keyword facility, but does have simple partial accu-

racy check. The language was designed for implementation on FORTRAN time-sharing systems (in our case GE-265) and has also been implemented on a PDP-10 system (with additional instructions) by others; it may soon appear on an SDS 940 system (again elsewhere). We have it running on a PDP-9 (single access).

Although CAN has every right to appear in a list of CAI languages, we feel it to be of strictly limited utility and view it as a tool for teaching *about* CAI rather than *by* CAI.

DAVID A. ENSOR
Ontario Institute for Studies in Education
Toronto, Canada

bread & circuits

Sir:

Dr. Kanner's comments ("CAI: The New Demonology?" Sept., p. 38) on the failures of earlier teaching devices to achieve results are particularly illuminating, appearing as they do in the midst of a plethora of articles which cover every aspect of CAI *except*, notably, its results.

Mr. Rogers' comments ("Current Problems in CAI," Sept., p. 28) on the difficulty of getting a computer to handle question categories like "define a concept" or "explain how something works" indicates a problem much deeper than he has considered. For if we refuse to recognize that man is in some way a different mentality than a machine, we will be shortly forcing him into the mold of these machines. After three generations of men have been taught by machines with no ability to understand concepts, man himself may no longer care to admit that a concept exists. We will have achieved the ultimate in man-machine compatibility.

All of the computer-aided education efforts seem to be based on three hypotheses:

a. That the most important factor in the development of a man's intellect is his environment; therefore, an improvement in the educational environment must improve intelligence.

b. That the stimulus-response theory of human learning is correct; which implies that a machine implementing the S-R technique must produce results.

c. That man himself is nothing other than a very complex machine; therefore that it is reasonable for one machine to teach another.

Every human civilization seems to have had its share of old wives and willingness to believe the unfounded hypotheses of such persons, and it

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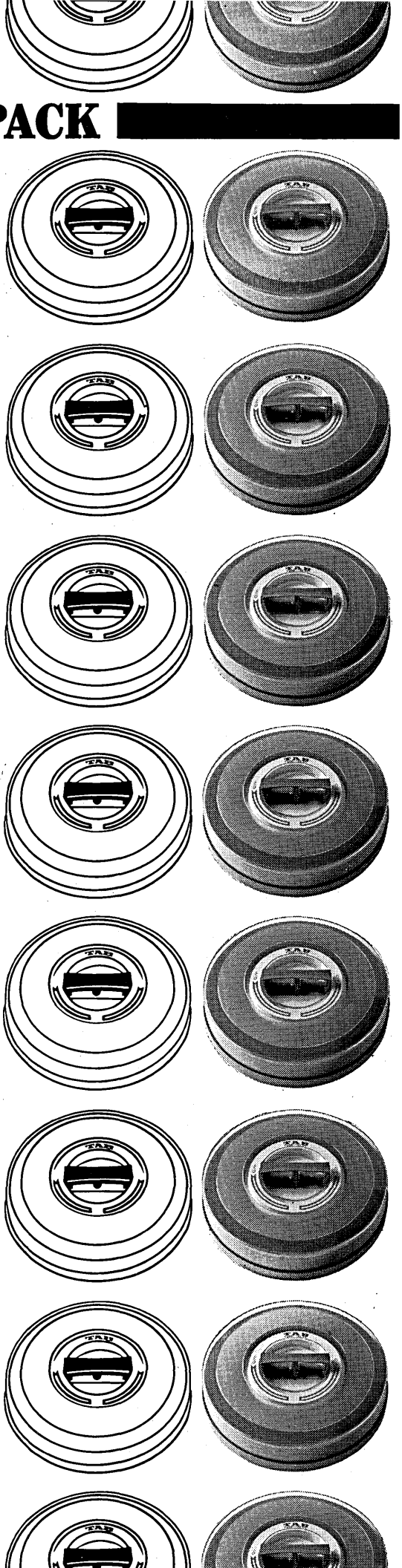

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letters

would appear that this problem has not disappeared in the 20th century. There exists no genuine proof, unfortunately, for any of the hypotheses above. They are based on nothing more solid than "common sense," leaving the entire system of machine teaching and CAI on a rather porous philosophical foundation.

MATTHEW KLANE
Cottage Grove, Wisconsin

ppb and the bpr

Sir:

We were surprised to find a notice in Washington Report (Sept., p. 157) that the Bureau of Public Roads does not plan to implement planning-programming-budgeting (PPB). Actually, we have had a program budgeting unit in our Office of Planning for nearly three years, and feel that we have made relatively good progress in implementing PPB in accordance with guidelines established by the Bureau of the Budget and the Department of Transportation.

F. C. TURNER
Director of Public Roads
U.S. Dept. of Transportation
Washington, D.C.

accredits due

Sir:

The article "Certification and Accreditation" by David E. Ross (Sept., p. 183) failed to mention an already existing certification program, viz., the CDP program of the DPMA. This has been in operation since 1962. In 1968, 1,699 passed the examinations out of a total of 2,936 applicants.

WALTER PENNEY
Greenbelt, Maryland

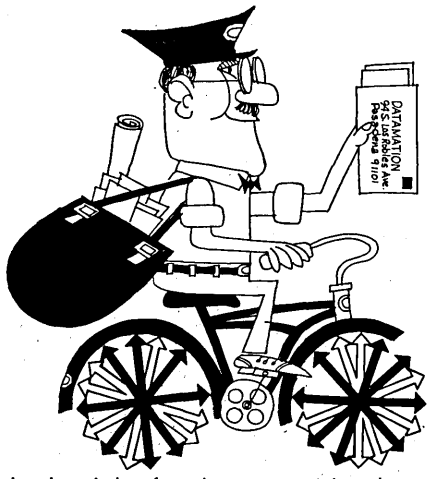
Mr. Ross replies: Mr. Penney has pointed out the existence of a certification program sponsored by the DPMA, a professional society with a strong orientation towards data processing (as compared with numerical analysis or language design). This program, within the indicated limits on its sponsor's position in information sciences, is indeed highly regarded by the profession—so highly regarded that it may be a cause for opposition among the member societies of AFIPS towards inclusion into the federation of DPMA. However, no individual society exists today which has the broad base required to set formal standards of professionalism or to obtain industrial, government, and academic compliance with such standards.

The DPMA lacks this base in that its outlook on information sciences is less than complete. The ACM and IEEE suffer from similarly narrowed viewpoints. With each society setting its own standards of certification independently of the other societies, some facets of information sciences could easily be overlooked by all societies. An organization with a universal viewpoint could coordinate the certification programs of the various societies to prevent such neglect.

Further, the DPMA lacks the required base in that its membership is too small to give it the influence to enforce a certification program. The ACM is approaching the size at which it can exercise the strength of numbers. I do not imply that enforcement is to be done through blacklists, boycotts, and strikes. Given an organization with a very large and very broad base of membership, industry and government should gladly accept certification as an end to the current chaos. Without such a base, a certification program will not encompass sufficient facets of information science to gain acceptance.

A strong point in favor of the DPMA program is that membership in the DPMA is not required for certification. Such a feature in an AFIPS-sponsored program would prevent the federation from becoming a restrictive labor union. However, for AFIPS to sponsor certification (through standards created by its constituent societies) for a facet of information science, that facet should be represented by a constituent society of AFIPS. A person should not need to join a society to be certified, but he should be allowed to join, if he wishes, and participate in creating the standards which govern his own professional standing.

Finally, neither the DPMA nor any other society of professionals or technicians in information sciences currently accredits EDP schools or computer science majors of colleges. It is accreditation which is the most urgent problem. Diploma mills cannot be distinguished from schools of excellent quality by those whose lack of knowledge will make them students; the professionals who have enough knowledge of information sciences to distinguish the good schools from the bad are removed by



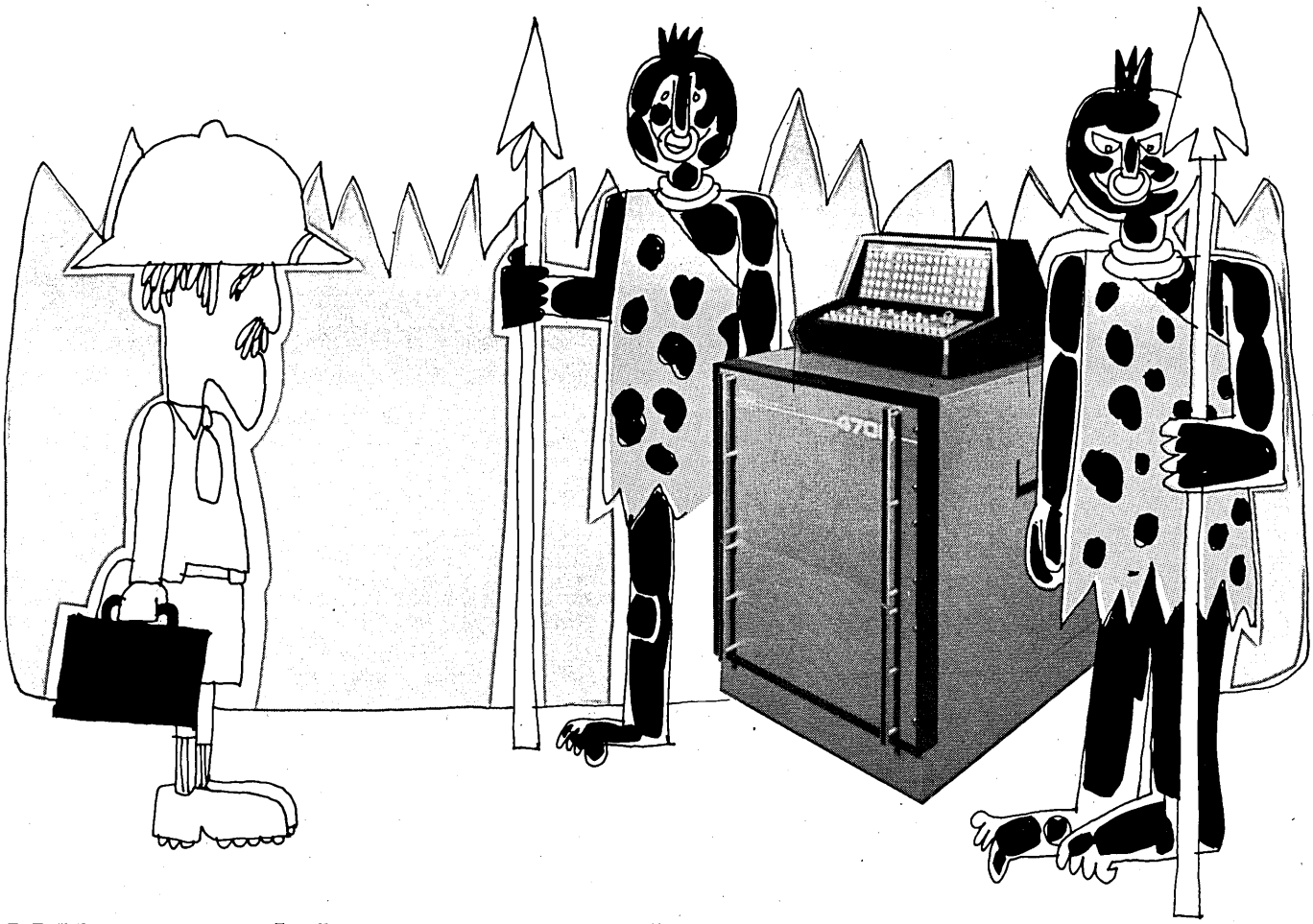
that knowledge from being potential students. These professionals have the ability to weed out the bad schools from the good, but their societies lack the inclination to act on accreditation. If the inclination existed, the lack of a broad base, which obstructs the creation of a universal certification program, would prevent action.

acm addendum

Sir:

It does seem rather superfluous to comment on the "world's longest write-up" of the "world's longest session" ("ACM Session Attacks Problem of Programming Management Economics" Oct., p. 72), but several points seem worth making.

Although the "write-up" correctly



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letters

noted that the disparity between the technical and the managerial states of the art with regard to computer programming was not effaced by the session, I am inclined to believe that the "after lunch" papers by Pietrasanta, Nelson, Sackman, and Schwartz & Cunningham were rather more meaty than one might judge them to be on the basis of your comments. I would recommend to the readers who are interested in these matters that a review of these pieces in the Conference *Proceedings* (pages 341 to 353) would give more of the flavor of what the authors have in mind. As noted in the review, the complete papers, which are substantially more detailed than the summaries which appear in the *Proceedings*, will be published in early 1969 as part of a book I am editing.

The demonstrators surrounding my home at this moment might decide to leave if you would acknowledge that the 1,300,000 employees cited for the Department of Defense ("that computer-oriented agency") represent only the civilians. There are, of course, all the military types. The total "employment" of the DOD is, I believe, on the order of 7,500,000.

In closing the session, I remarked that all of the speakers had sought to express their convictions about the very urgent problem of managing computer programs in an economic sense. They had done this not so much to convince everyone they were right (although, I suppose, they were not about to reject disciples outright, either), but to give others in the field the opportunity of formally documenting their agreements or disagreements so that a really useful—and rational—dialogue in this area might begin. This remains the basic intent of the session which you reviewed. I continue to believe it is a worthwhile objective, and I would like to encourage readers of DATAMATION to evaluate the various presentations—as they appear in the *Proceedings* and as they will appear in the book—and reply in kind.

GEORGE F. WEINWURM
Santa Monica, California

lecht motif

Sir:

Your description of my attempts to wake a Las Vegas audience at 9:00 a.m. (Oct., p. 72) is accurate in every respect but one: my "attack" on competitor Charles Lecht. I would not like your interpretation to be misinterpreted, and I therefore submit below the official report of my speech, transcribed by an independent court re-

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porter, of all references to Charles Lecht.

"For example, Charles Philip Lecht, the noted authority on programming management, notes that there are several different ways of defining the function of programming and then he does not establish a common definition and does not go on to settle his controversy, despite the fact that his work is intended to establish project management standards."

". . . except I will quote DATAMATION, a right-wing publication, in November 1965, as to how they describe author Charles Philip Lecht, whom I described earlier. 'He has been known to ride up to a bidders' conference on a motorcycle alongside competitors wearing Homburgs and driving Cadillacs.' I think that is a very good description of a typical computer programmer."

"Charles Lecht says, in fact: 'We have the airplane. What we need now is an in-flight guidance package.' I think that is very appropriate."

I do not believe that these comments can be construed as an "attack." They certainly were not intended that way; their purpose was to highlight how a noted authority in the field regarded some of our problems. I do not believe in "attacking" competition. If I did, Charles Lecht would not be my first target.

DICK H. BRANDON
Brandon Applied Systems, Inc.
New York, New York

Ed. Note: We breathlessly await identification of Mr. Brandon's first target. By the way, the Datamation reference quoted by Mr. B. is preceded by this phrase: "To emphasize proposal content and not the trappings, . . ."

the lost week

Sir:

Congratulations to Robert L. Patrick for having the guts to accept the presidency of the Los Angeles Traffic Commission. Most comments heard thus far have been negative and pessimistic: "An impossible job. He won't be able to solve it, and he'll get all the blame." Maybe, then again, maybe not . . . especially if other computer specialists pitch in and help out.

Unfortunately, almost all plans proposed thus far (1, 2, 3, 4) require mucho megamillions and radical new designs for transportation vehicles. Also, as the major cities become more and more congested due to the increase in population as well as the ac-

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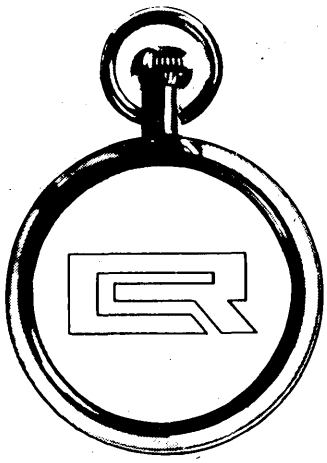


letters

celerating egression from the rural areas, any realistic plan must necessarily be complicated, expensive and long range. One such long range plan would include the construction of linear cities between major cities as proposed a few years ago by the Univ. of Chicago. . . . However, for the present I would like to make the following modest proposal as an immediate solution to the transportation problem for all major cities. Instead of costing money, it would actually save money and could be implemented immediately.

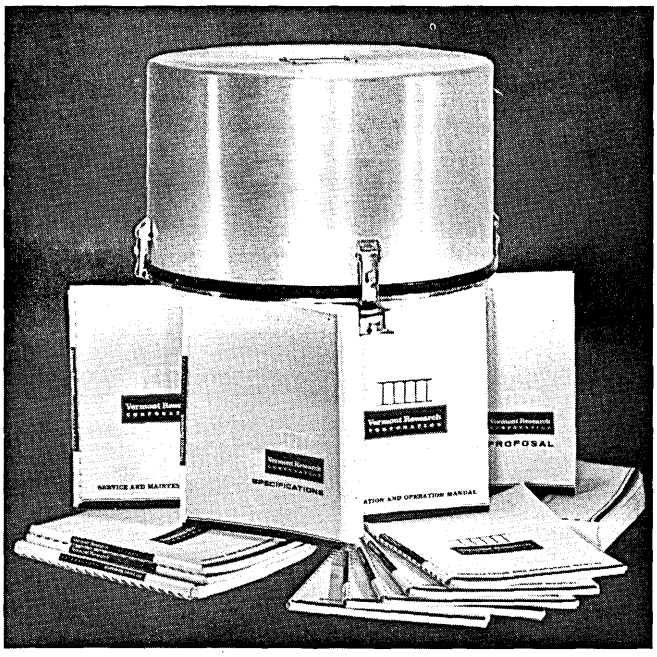
I propose that the concept of the fixed seven-day week be eliminated (in major cities) for the entire social, economic and political system in the United States (and eventually in the world). In its place, I would substitute a floating seven-day week. This would mean that all major corporations, schools, government offices, service companies, etc., would remain open seven days a week (doctors, dentists, small businesses would be excepted). However, employees would continue to work only five days a week, except that only two out of seven employees would have the same weekend.

For restaurants, recreational and entertainment media, this would provide an immediate seven day weekend (i.e., every night would be Saturday night). For schools, corporations and transportation media it would provide two extra days per week and thus delay the cost of new plants, buildings, freeways, etc., as the population increases. Churches could hold an extra service on Wednesday to accommodate those whose regular work-days fell on the conventional Saturday or Sunday. Holidays, except perhaps for Christmas and New Year's, would float the entire week, except that only one-fifth of the employees would take off on a given day. Thus, all such holidays would be three-day weekends for all employees.

I believe that the benefits would more than compensate for the problems created and that the plan would spur the economy, reduce unemployment, minimize discontinuities and peak loads in the present socio-economic system, and provide a simple transition for the eventual I-day, J-hour; T=4, 3, . . . ? J=7, 6, . . . ? society (e.g., six-day week with four-on, two-off combination).

I leave further details and problems to R. L. Patrick and his Traffic Commission. The computer can work out the scheduling. Good luck!

JAMES F. HOLT
Los Angeles, California



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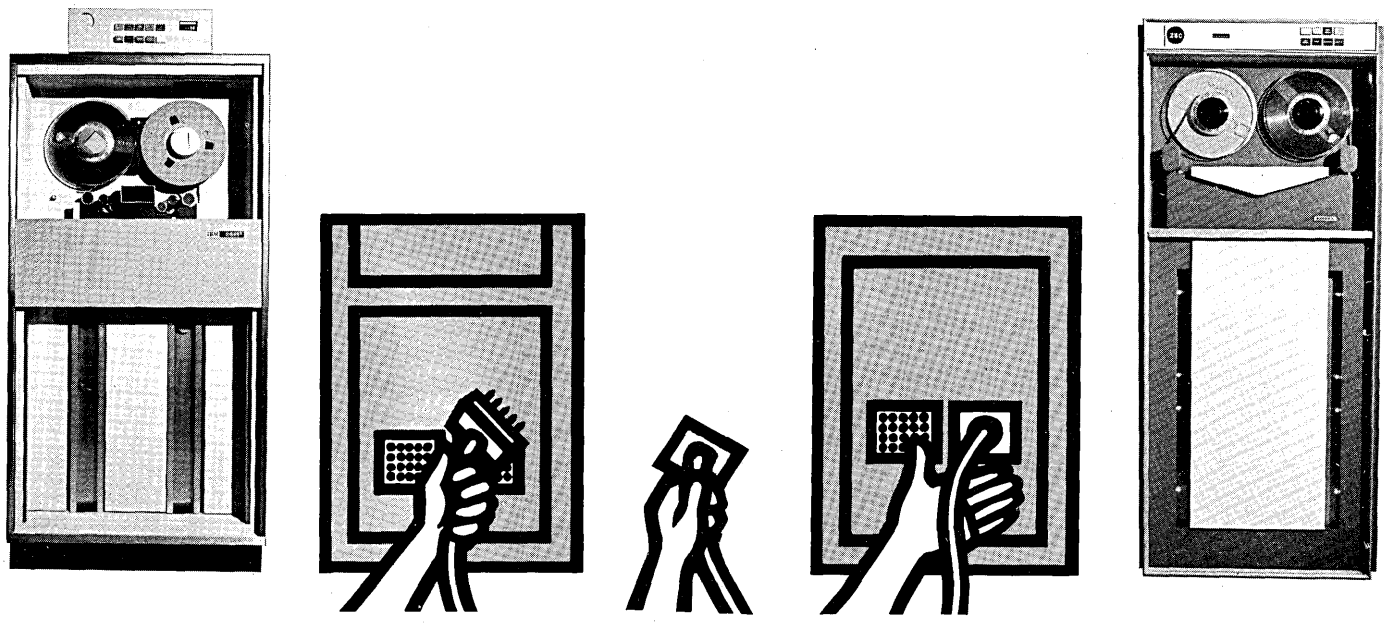

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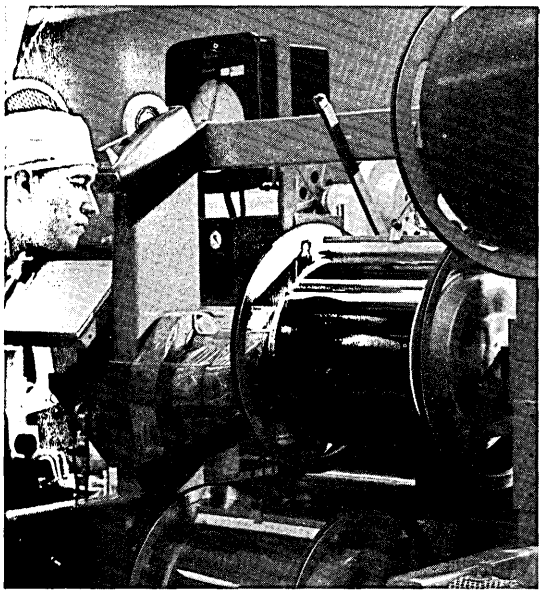

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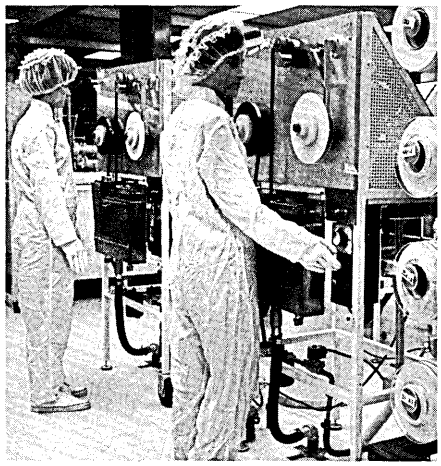

Ampex computer tape is passed through a special Supercleaning process during final wind.

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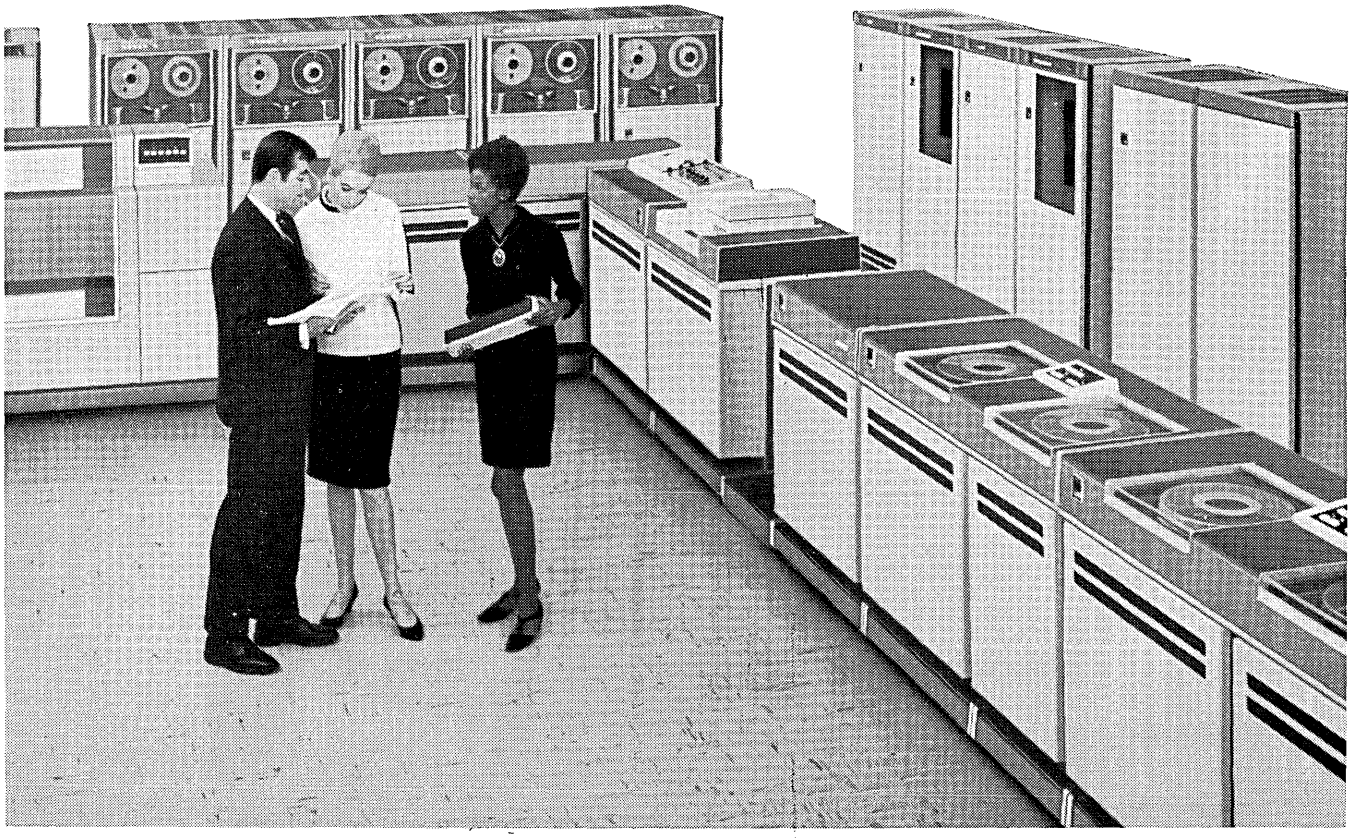

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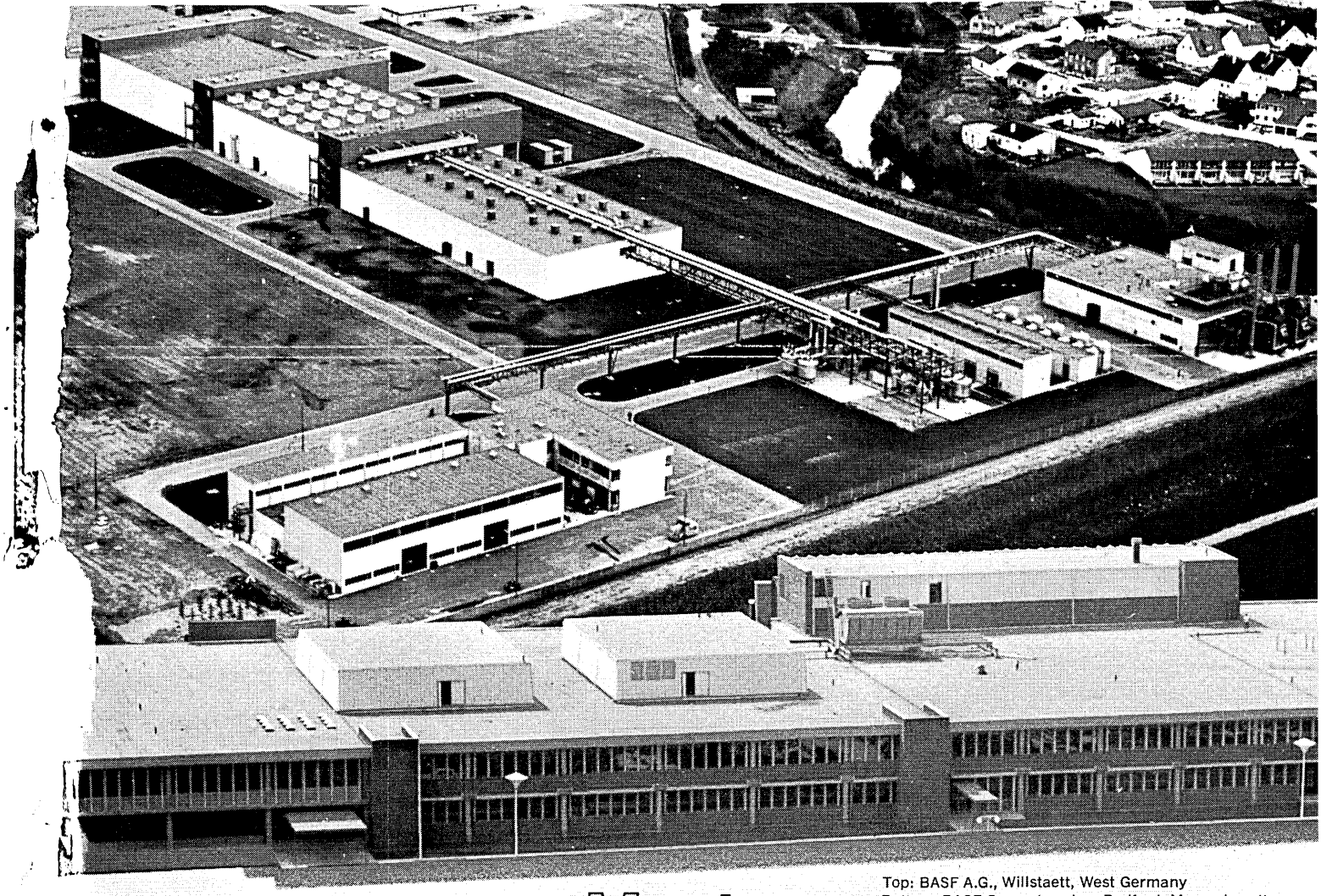

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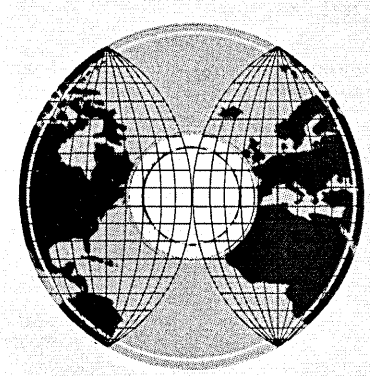

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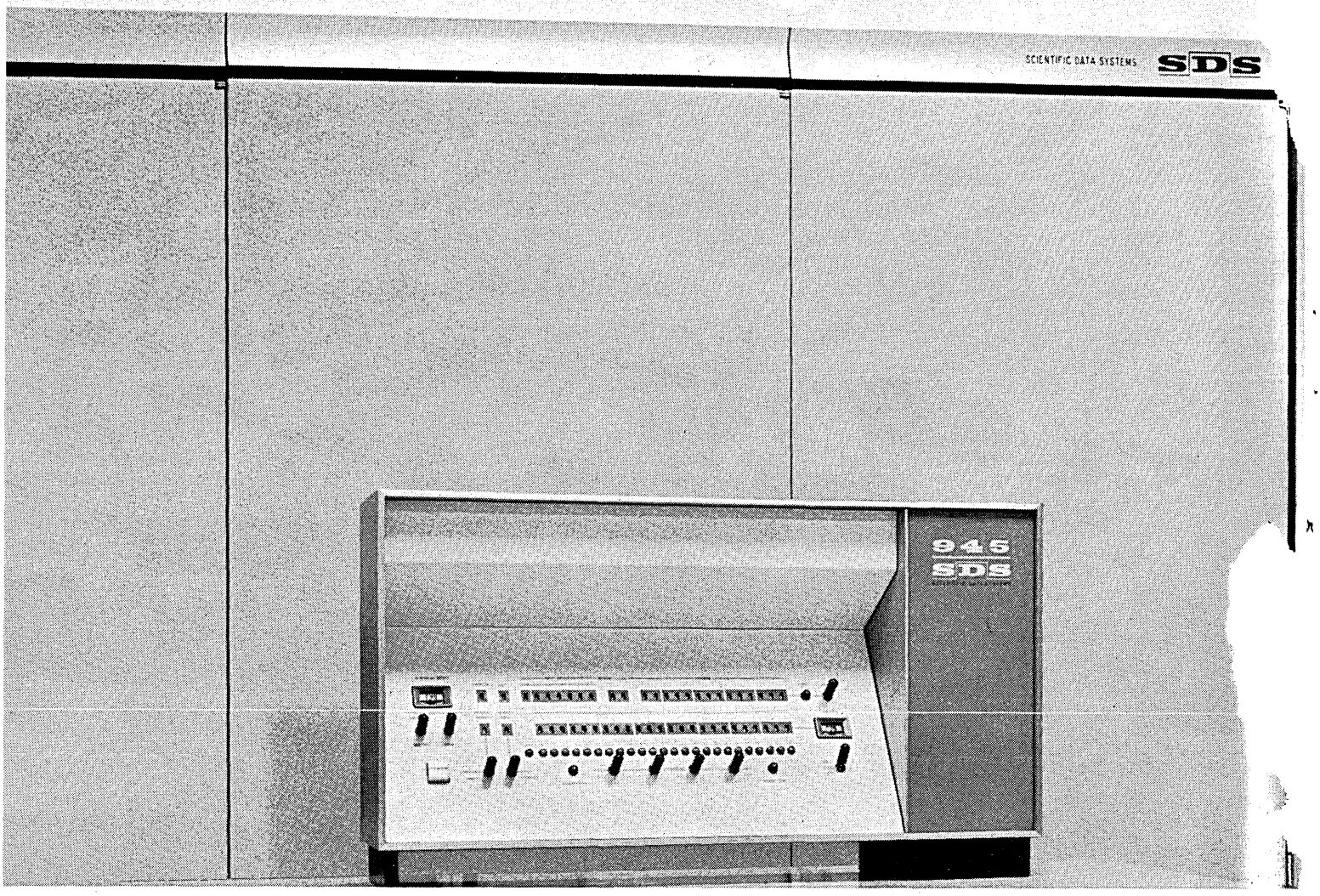

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SDS

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CIRCLE 33 ON READER CARD

editor's readout

SHOW BIZ

It's time, we fear, to gird up our loins in preparation for that annual pleasure/pain ritual known as the Fall Joint Computer Conference. While we're at it, it seems a timely time to review these rites.

In the first place, we hear that this year's Conference will feature 140 technical papers. That's a far cry from the 250 papers which graced the IFIP show last August, but then our Bay Area friends had only one year, not three, to prepare. Still, it's more than 50% over the '67 FJCC, which might suggest to some quantitative nincompoops that this year's program will be 1½ times as good as last year's.

We wonder. And we'd like to wonder in print, asking some basic questions about conferences in general which future conference leaders might like to ponder.

What are the purposes of a conference? Some that we can think of: to raise money; to report on and recognize important contributions to the technology; to inform attendants (and those who can find the courage, strength and time to read the proceedings) about important technical developments; to provide a forum for the debate of critical industry issues; to provide a place and a time for interdisciplinary cross fertilization; to offer a showplace for new equipment.

There are undoubtedly others, but they do *not* include offering a new record high number of papers. We wonder how much thought has been given to these goals, whether they've been put in order of importance, if specific measures have been taken to see that these goals are met . . . and means established to measure performance against goals.

We have a hunch that little thought has been given to the difference between papers meant to be read from a printed page . . . and those meant to be listened to. Less thought seems to have been given to the two-way nature of communications: nearly every session except certain panels is designed as a one-way, dead-end road to tedium, based upon the questionable assumption that the best way to communicate information is to have an inarticulate speaker haltingly read a highly technical paper to hundreds of people who will later read what he had to say, if what he had to say makes that seem worthwhile.

How stringent and uniform are the refereeing procedures? There is some evidence that session topics are prefabricated, and then held, whether or not there are enough good papers to make up a session. Despite general guidelines, refereeing quality varies according to the skill and diligence of individual session chairmen, over whom the program chairman seems to have ljttle control. The same goes for the length of papers and oral presentations.

We wonder how much thought is given to conference balance . . . in terms of representing critical topics, issues, subdisciplines. And we wonder if any thought has been given to matching papers and sessions to various levels of management amongst the many kinds of shops, skills, applications and interests represented by the attendees.

This is not to question the integrity or energy of those who have put on JCC's over the past several years. Twice a year, hundreds of people put in hundreds of thousands of man-hours in an attempt to put on joint computer conferences.

It's just that it's easy, even in a well-structured endeavor manned by full-time specialists, to lose sight of goals. For an effort manned by well-meaning, hard-working, seldom-meeting, part-time committee members, it's easier.

We hope that you too are wondering about conference goals and performance. And we hope that you will raise in your own mind some of the questions we have posed. We'd like you to go one step further and give us your reactions to the forthcoming Fall Joint. We'll be glad to publish the best and to forward all of them to the people who are now planning next year's JCC's.

Maybe it will lead to better conferences. We wonder. If not . . . well, that's show biz.

LOGICAL DESIGN: MEMORY ELEMENTS

by PETER L. LINDLEY

In an earlier article (DATAMATION, May, 1968), "Logical Design of Digital Computers," an introduction was given to the basics of Boolean algebra and logical design. It was pointed out that, since it is difficult and expensive to design electronic devices that can exist in more than two distinct and distinguishable states, modern computers are designed on the basis of two-valued, or binary, devices. The simplest of these binary devices are called computer logical elements.

computer logical elements

Digital computer logical elements may be divided into *decision elements* and *memory elements*. Both of these are binary devices; that is to say, any of their input and output points (electrical connections) can be at only two discrete voltage levels. These voltage levels are defined for *any* point as "high" and "low." For any *given* point, high is defined as "higher than a particular voltage V_H" and low is defined as "lower than a particular voltage V_L." In a well-designed device, V_H is always appreciably higher than V_L, the voltage region between V_L and V_H being considered a "forbidden region of operation."

A *decision element* is a binary device having one or more inputs and a single output. The voltage level at the single output is high or low, depending on the level(s) at the input(s) and on the particular type of decision element. Furthermore, the output response to the input conditions is extremely fast or, for purposes of logical design, instantaneous. Examples of decision elements are AND gates, OR gates, NAND gates, NOR gates, and inverters. The previous article concerned itself with decision elements.

A *memory element* is a binary device having one or more inputs and two outputs (although sometimes only one output may actually be used). The valuable and important characteristic of a memory element is that it *remembers*. This means that at any given time the states (voltage levels) of its outputs are a function of the states of its inputs at some earlier time. The voltage levels at the two outputs are complementary. When one is high, the other is low; when one is low, the other is high. The output response to the input(s) is, however, not instantaneous, but requires a finite amount of time. Response time is a fact of life to be considered by the logical designer. This article concerns itself with memory elements.

clock times

Most digital computers and similar systems are so-called clocked devices. That is, they are driven by a continuous sequence of precisely timed pulses, called clock pulses or timing pulses. These may be supplied from the outside or, more usually, are provided by some sort of oscillator or pulse generator within the computer. In this article we shall concern ourselves only with clocked devices and systems, because they are more common and because they are more readily analyzed.

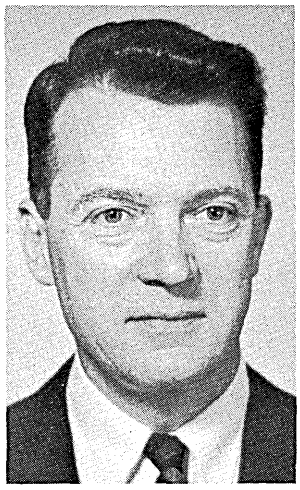
Since everything, then, is run by the clock pulses, the faster the pulse rate is, the faster will the computer be. But there is a compromise to be made: The time between two successive clock pulses must not be less than the response time of a memory element. Now, since there are variations in electronic components of the same type, and hence variations in response times of memory elements built of them, and since prudence requires adequate tolerances, clock pulse intervals are always made quite a bit longer than the expected response times of the memory elements.

In talking about clock times, one likes to identify them by sequential numbers, like t_0, t_1, t_2, . . . etc., or more generally, . . . , t_{n-2}, t_{n-1}, t_n, t_{n+1}, t_{n+2}, . . . , etc., where n is any number one may wish.

flip-flops

The memory elements most commonly used in digital computers are small transistor circuits called flip-flops. Originally, this name was a rather flippant reference to the Eccles-Jordan multivibrator circuit. The name has stuck, and it is now the universally accepted label for all transistor and vacuum-tube computer circuits which perform the function of high-speed memory elements. In fact, memory elements which function like flip-flops – even though they may not even be electronic devices – are sometimes called by the same name. So, from here on, we will use the term "flip-flop" to denote any memory element, concerning ourselves only with its functional characteristics and not at all with its actual circuit or mechanization.

A flip-flop has two complementary outputs: The "0" output and the "1" output. When the flip-flop is "set," the "1"



Mr. Lindley is a senior engineer in the Telecommunications Div., Jet Propulsion Laboratory, where he works on digital ground communications equipment for tracking spacecraft. He has a BA from Ohio Wesleyan Univ. and an MS from Purdue Univ.

output is "high" and the "0" output is "low"; when it is "reset," the "0" output is "high" and the "1" output is "low." A basic requirement for a flip-flop in a clocked system is that any input pulse must arrive exactly at a clock time. This is usually accomplished by passing the input-condition signals through an AND gate together with a clock pulse.

There are five different functional types of flip-flops, as follows:

1. The R-S (or reset-set) flip-flop, which would have been better named S-R (for set-reset),
2. the T (or trigger) flip-flop, sometimes called C (for complementing),
3. the J-K (or special R-S) flip-flop, in which the letters J and K were arbitrarily assigned years ago and don't stand for anything,
4. the D (or delay) flip-flop, and
5. the R-S-T flip-flop, which is a combination R-S flip-flop and T flip-flop.

In the following, we shall discuss each of these types in turn, except for the last one which really is not a different functional type at all.

The R-S flip-flop has two inputs, designated "set" and "reset." Pulses may arrive at either of these inputs, but they must never arrive at both inputs simultaneously. (The circuit designer has been absolved of all responsibility for what may happen to the flip-flop if the logical designer ignores this requirement.) The R-S flip-flop operates as follows:

Set: If at any time t_n a pulse arrives at the set input, the flip-flop will have been set by the next clock time t_{n+1}. That is, its 1 output will then be high, and its 0 output low. The flip-flop will remain in that condition until there is another input.

Reset: If at any time t_n a pulse arrives at the reset input, the flip-flop will have been reset by the next clock time t_{n+1}. That is, its 0 output will then be high, and its 1 output low. The flip-flop will remain in that condition until there is another input.

Thus, by observing or sensing either output of an R-S flip-flop at any clock time, one can tell for certain whether the most recent input had been a set pulse or a reset pulse.

A good illustration of an R-S flip-flop function is a lamp operated by separate on and off pushbuttons. If you push the on button, the lamp will light and stay lit. If you push the off button, the lamp will extinguish and stay extinguished. If you simultaneously push both buttons, there is no telling what may happen, since this is against the rules of the device.

The T flip-flop has only one input, designated "trigger." Again, input pulses which arrive at this point must be in time-synchronism with clock timing pulses. The operation of a T flip-flop is as follows:

If at any clock time t_n a trigger pulse arrives, then by the next clock time t_{n+1} the flip-flop will have changed states. That is, if it was in the reset state it will now be set, if it was in the set state it will now be reset. The flip-flop will remain in the resultant state until another trigger input pulse arrives.

An illustration of a T flip-flop is a typical ball-point pen: When the button on the back is pushed, the ball point will go out if it was in, and in if it was out. Some authors refer to T flip-flops as C (or Complementing) flip-flops.

The J-K flip-flop basically is just like the R-S flip-flop; a J input causes it to set, and a K input to reset. The difference is that, with a J-K flip-flop, it is permissible to have simultaneous J and K inputs. When this occurs, the flip-flop will trigger, i.e., change from one state to the other just like a T flip-flop. Again, the J-K flip-flop will remain in whatever state it has attained until another input pulse arrives.

An admittedly far-fetched illustration of a J-K flip-flop is a little boy: If he is given a cookie, he will smile. If he is spanked, he will cry. If he is given a cookie along with a spanking, he will (probably!) smile if he was only spanked before, and cry if he had only been given cookies before.

The D flip-flop has only one input, designated "delay." An input pulse at clock time t_n will cause the flip-flop to be in the set state by time t_{n+1}. However, unlike other flip-flop types, the D flip-flop will reset automatically by time t_{n+2}, unless another input pulse at t_{n+1} causes it to be set at t_{n+2} also. In that case it will reset by t_{n+3}, etc.

A nickel half-hour parking meter might illustrate the function of a D flip-flop: If you drop in a nickel you can park for half an hour. You can park for several hours, but you must come back every half hour to drop another nickel.

the general application equation

Let us consider a flip-flop, any flip-flop, in an application, any application. Let us not be concerned with the type of flip-flop that it may be, but only with what it will do in response to quite generalized input conditions. If we let the flip-flop be called Q, then we can use the shorthand notation that $[Q]^{n+1}$ means that, at time t_{n+1}, it is in the set state and $[\overline{Q}]^{n+1}$ means that, at time t_{n+1}, it is in the reset state.

Now we know that whether the flip-flop is set at time t_{n+1} depends only on its state at time t_n and on the inputs, if any, at that time. We say that it is a *function* of the conditions at t_n and express it with the so-called difference equation

$$[Q]^{n+1} = f\,[Q, \text{inputs}]^n.$$

A difference equation is one that deals with conditions at two different times, the time to the left of the = sign being one clock time later than that on the right.

Now it turns out to be convenient to assume that the flip-flop will be set only if we see to it, and that it will be reset otherwise. To this end we assume two generalized input functions, namely g (the "get set" function) which can set the flip-flop if it is reset ($\overline{Q}$), and h (the "hold set" function) which can keep the flip-flop set if it is set already (Q). And we also stipulate that neither g nor h are in any way dependent on Q itself, but only on outside influences and conditions. Then we have eight possible combinations of the three independent binary variables Q, g, and h at time t_n, which will determine whether, at t_{n+1}, the flip-flop will be set or reset.

These eight combinations and their results can be tabulated in what is called a truth table, in which 1 indicates that the particular binary variable (say, h) is true (h), and 0 indicates that it is false ($\overline{h}$).

$[Q$	g	$h]^n$	$[Q]^{n+1}$	
0	0	0	0	Row 0
0	0	1	0	Row 1
0	1	0	1	Row 2
0	1	1	1	Row 3
1	0	0	0	Row 4
1	0	1	1	Row 5
1	1	0	0	Row 6
1	1	1	1	Row 7

The truth table shows, in neat form, that at time t_{n+1} the flip-flop will be set if, at time t_n, it was reset and had a "get set" input (rows 2 and 3), or was set and had a "hold set" input (rows 5 and 7). In other words, $[Q]^{n+1}$ is true in rows 2, 3, 5, and 7, for the input combinations $[\overline{Q}\ g\ \overline{h}]^n$, $[\overline{Q}\ g\ h]^n$, $[Q\ \overline{g}\ h]^n$, and $[Q\ g\ h]^n$. We can restate these truths in the Boolean difference equation:

$$[Q]^{n+1} = [\overline{Q}\ g\ \overline{h} + \overline{Q}\ g\ h + Q\ \overline{g}\ h + Q\ g\ h]^n.$$

We can also plot it on a minimap (Fig. 1, p. 44) and read it back in minimized form

$$[Q]^{n+1} = [g\ \overline{Q} + h\ Q]^n.$$

(Continued on page 44)

This is the General Application Equation for flip-flops of any type.

characteristic equations

The characteristic equation of a particular flip-flop type is the relationship that defines its characteristic function. Just as the general application equation is not concerned with the *type* of flip-flop used (such as R-S, T, etc.), a given

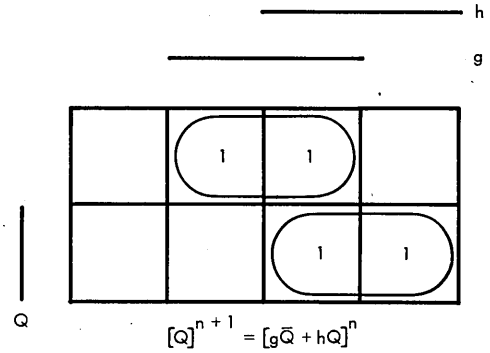


Fig. 1 Minimap for the general application equation.

characteristic equation is not concerned with the *application* to which the flip-flop may be put (such as a counter, shift register, etc.). The characteristic equation contains these variables:

$[Q]^n$	the state of the flip-flop at time t_n,
$[R, S, T, J, K, D]^n$	the inputs at time t_n, and
$[Q]^{n+1}$	the resultant state of the flip-flop at time t_{n+1}.

To obtain the characteristic equation of a flip-flop, one lists in a truth table all the possible initial conditions and the resultant flip-flop states one clock time later. One then collects together those initial conditions that will produce a "true" or "1" resultant state.

r-s flip-flop

$[Q$	S	$R]^n$	$[Q]^{n+1}$	
0	0	0	0	Row 0
0	0	1	0	Row 1
0	1	0	1	Row 2
0	1	1	X	Row 3
1	0	0	1	Row 4
1	0	1	0	Row 5
1	1	0	1	Row 6
1	1	1	X	Row 7

You will remember that in this type of flip-flop $[Q]^{n+1}$ will be 1 if $[Q]^n$ was either 0 or 1 and there was a set input (rows 2 and 6), or if $[Q]^n$ was 1 and there was no reset (rows 4 and 6). Also, that it is forbidden to have a simultaneous set and reset input. Rows 3 and 7 have, therefore, been marked X. This designates a "don't care" situation and means, in effect, "never mind if it comes out 0 or 1 because the logical designer will see to it that this case will never come up."

The function $[Q]^{n+1}$ can now be plotted on a minimap (Fig. 2) and read back in minimized form:

$$[Q]^{n+1} = [S + \overline{R}\,Q]^n.$$

This is the characteristic equation for the R-S flip-flop.

t flip-flop

You will remember that in this type of flip-flop the state of the flip-flop will change whenever there is an input of a trigger pulse, and will remain constant otherwise. The following truth table then applies:

$[Q$	$T]^n$	$[Q]^{n+1}$	
0	0	0	Row 0
0	1	1	Row 1
1	0	1	Row 2
1	1	0	Row 3

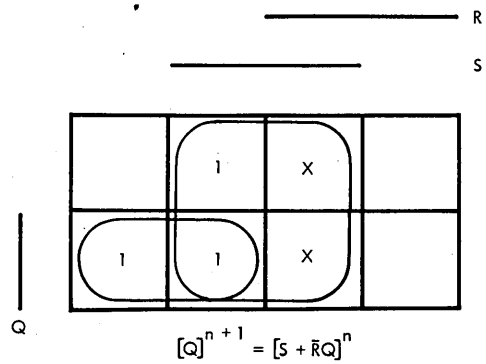


Fig. 2 Minimap for the R-S flip-flop characteristic equation.

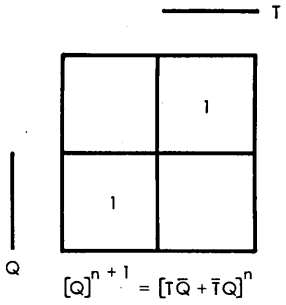


Fig. 3 Minimap for the T flip-flop characteristic equation.

The function $[Q]^{n+1}$ can then be plotted on a minimap (Fig. 3) to see whether it can be minimized, which it can't, and written:

$$[Q]^{n+1} = [T\,\overline{Q} + \overline{T}\,Q]^n.$$

This is the characteristic equation for the T flip-flop.

j-k flip-flop

You will remember that in this type of flip-flop the result of a sole J or K input is identical to the result of an S or R input with an R-S flip-flop, and that the result of a simultaneous input of J and K is identical to the result of a T input with a T flip-flop. The following truth table then applies:

$[Q$	J	$K]^n$	$[Q]^{n+1}$	
0	0	0	0	Row 0
0	0	1	0	Row 1
0	1	0	1	Row 2
0	1	1	1	Row 3
1	0	0	1	Row 4
1	0	1	0	Row 5
1	1	0	1	Row 6
1	1	1	0	Row 7

In this case the function $[Q]^{n+1}$ for the flip-flop is a combination of rows 2, 3, 4, and 6. It can be plotted on a minimap (Fig. 4, p. 45) and thus minimized to read:

$$[Q]^{n+1} = [J\,\overline{Q} + \overline{K}\,Q]^n.$$

This is the characteristic equation for the J-K flip-flop.

d flip-flop

You will remember that in this type of flip-flop the state at time t_{n+1} is a function only of the input at time t_n. With this insight, one might write down the characteristic equation without any further ado. But for the sake of consistency

and in order not to assume too much insight, we shall go through the same procedure as we did for the other flip-flop types. We get the following truth table:

$[Q$	$D]^n$	$[Q]^{n+1}$	
0	0	0	Row 0
0	1	1	Row 1
1	0	0	Row 2
1	1	1	Row 3

The function $[Q]^{n+1}$ can be plotted on a minimap (Fig. 5) and read back in minimized form:

$$[Q]^{n+1} = [D]^n.$$

This is the characteristic equation for the D flip-flop.

characteristic application equations

We previously developed the general application equation for any flip-flop application. It can now be said that any application we may think of (for any type of flip-flop)

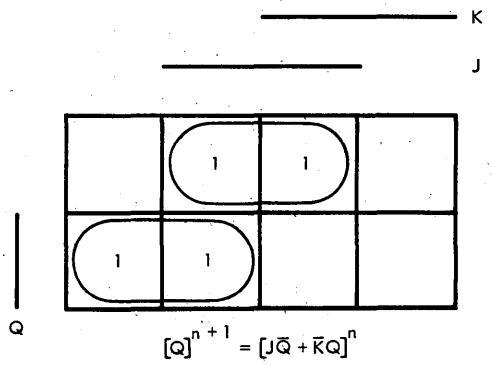


Fig. 4 Minimap for the J-K flip-flop characteristic equation.

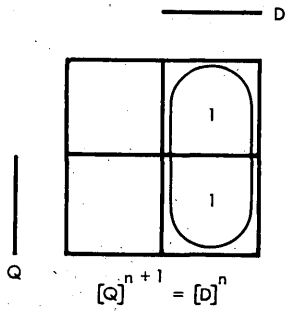


Fig. 5 Minimap for the D flip-flop characteristic equation.

can be expressed in the form of the general application equation; one application will differ from another merely by the respective expressions for g and h. We have also developed the characteristic equation for each of the four basic flip-flop types.

If we now combine the general application equation with each of the four characteristic equations in turn, we will have the characteristic application equations for the four flip-flop types. And what will that buy us? Given any particular application for a flip-flop and the constraint to use a particular type, we will quickly know how to connect it into the system. Alternatively, not being constrained to a particular type, we can try each type on paper and thus determine the simplest and cheapest implementation of the four possibilities, each of which will do the job required.

The procedure to follow in deriving each of the four characteristic application equations is now given. We construct a "dual truth table," listing on the left the eight possible combinations of the variables $[Q, g, \text{and } h]^n$. In the middle we list the resultant states $[Q]^{n+1}$ in accordance with the general application equation $[Q]^{n+1} = [g\ \overline{Q} + h\ Q]^n$. On the right we list the inputs for the particular flip-flop which, applied with $[Q]^n$ at time t_n, will cause the respective states $[Q]^{n+1}$. By means of minimaps we then solve for each input in terms of Q, g, and h.

r-s flip-flop

$[Q$	g	$h]^n$	$[Q]^{n+1}$	$[S$	$R]^n$	
0	0	0	0	0	X	Row 0
0	0	1	0	0	X	Row 1
0	1	0	1	1	0	Row 2
0	1	1	1	1	0	Row 3
1	0	0	0	0	1	Row 4
1	0	1	1	X	0	Row 5
1	1	0	0	0	1	Row 6
1	1	1	1	X	0	Row 7

In the above dual truth table let's explain how the S and R columns got marked as they did.

Rows 0 and 1: $[Q]^n = 0$ and $[Q]^{n+1} = 0$; hence there could not have been a set input, and S = 0. But there may or may not have been a reset input; hence R = X.

Rows 2 and 3: $[Q]^n = 0$ and $[Q]^{n+1} = 1$; hence there must have been a set input, and S = 1. And since there cannot be simultaneous set and reset inputs, therefore R = 0.

Rows 4 and 6: $[Q]^n = 1$ and $[Q]^{n+1} = 0$; hence there must have been a reset input, and R = 1. And since there cannot be simultaneous set and reset inputs, therefore S = 0.

Rows 5 and 7: $[Q]^n = 1$ and $[Q]^{n+1} = 1$; hence there could not have been a reset input, and R = 0. But there may or may not have been a set input; hence S = X.

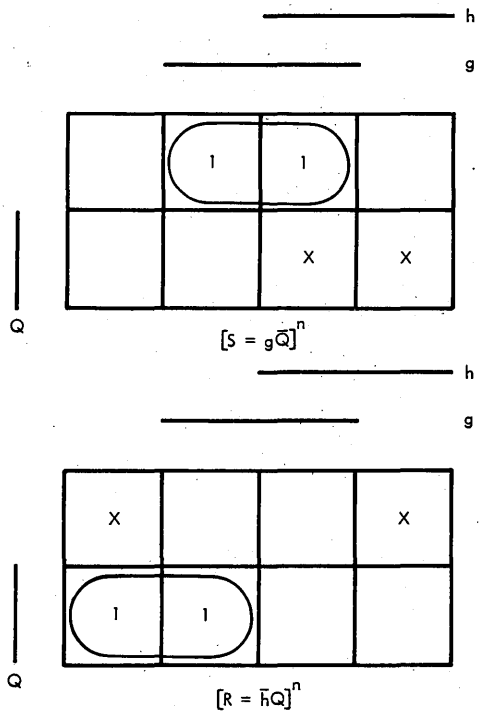


Fig. 6 Minimaps for the R-S flip-flop characteristic application equations.

We can then draw minimaps (Fig. 6) for the functions of S and R, from which we can read the functions in minimized form.

$$[S = g\ \overline{Q}]^n \qquad [R = \bar{h}\ Q]^n$$

These are the characteristic application equations for the R-S flip-flop.

One more simplification can be made *under certain conditions*. Since these conditions occur frequently, the simplification is worth keeping in mind. The condition is that, in a given application, we must be certain that $g\ \bar{h}$ will

never be true. That makes g $\bar{h}$ a "don't care" case, and X marks can be placed in the second column from the left in both minimaps of Fig. 6. (See Fig. 7)

The modified characteristic application equations for the R-S flip-flop will then be:

$[S = g]^n \quad [R = \bar{h}]^n \quad$ (provided $g\bar{h} = 0$)

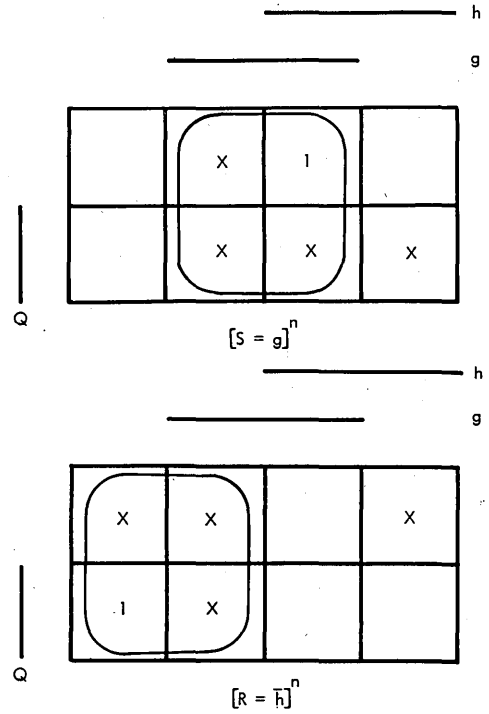


Fig. 7 Minimaps for the R-S flip-flop characteristic application equations (special case).

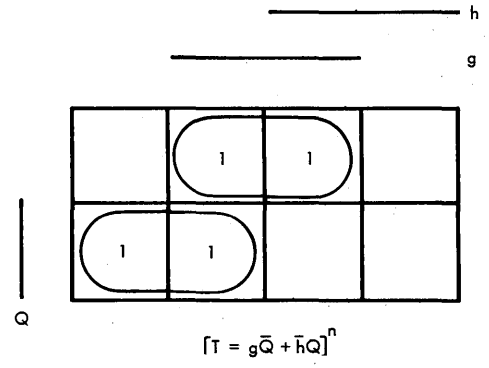


Fig. 8 Minimap for the T flip-flop characteristic application equation.

t flip-flop

[Q	g	h]^n	[Q]$^{n+1}$	[T]^n	
0	0	0	0	0	Row 0
0	0	1	0	0	Row 1
0	1	0	1	1	Row 2
0	1	1	1	1	Row 3
1	0	0	0	1	Row 4
1	0	1	1	0	Row 5
1	1	0	0	1	Row 6
1	1	1	1	0	Row 7

In the above dual truth table, the first four columns are marked the same as they were in the preceding case. Let us now see how the T column was marked. If [Q]$^{n+1}$ is the same as [Q]^n, then there could not have been a trigger input, and T = 0 (Rows 0, 1, 5, and 7). If [Q]$^{n+1}$ differs from [Q]^n, then there must have been a trigger pulse input, and T = 1 (Rows 2, 3, 4, and 6).

A minimap for the function T is then drawn (Fig. 8) and the function is read out in minimized form as

$$[T = g\,\overline{Q} + \bar{h}\,Q]^n.$$

This is the characteristic application equation for the T flip-flop.

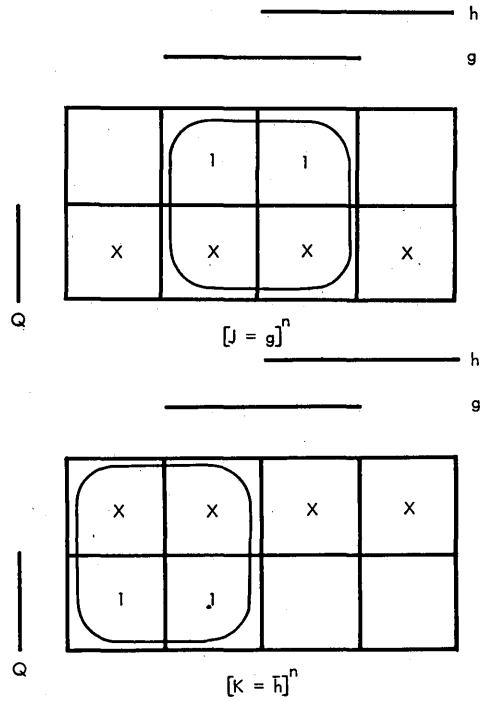


Fig. 9 Minimaps for the J-K flip-flop characteristic application equations.

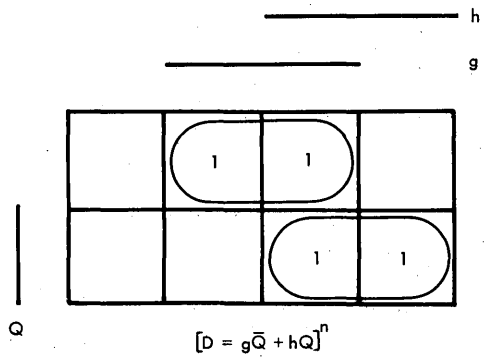


Fig. 10 Minimap for the D flip-flop characteristic application equation.

j-k flip-flop

[Q	g	h]^n	[Q]$^{n+1}$	[J	K]^n	
0	0	0	0	0	X	Row 0
0	0	1	0	0	X	Row 1
0	1	0	1	1	X	Row 2
0	1	1	1	1	X	Row 3
1	0	0	0	X	1	Row 4
1	0	1	1	X	0	Row 5
1	1	0	0	X	1	Row 6
1	1	1	1	X	0	Row 7

In the above dual truth table, again the first four columns were marked as before. Criteria on marking the J and K columns were as follows:

Rows 0 and 1: The flip-flop was and remains off. It cannot have had a J input, but may or may not have had a K

input. Hence, J = 0, K = X.

Rows 5 and 7: The flip-flop was and remains on. It cannot have had a K input, but may or may not have had a J input. Hence, K = 0, J = X.

Rows 2 and 3: The off flip-flop was turned on, either by a J input which would do just that, or by simultaneous J and K inputs which would trigger it with the same result. Hence, J = 1, K = X.

Rows 4 and 6: The on flip-flop was turned off, either by a K input which would do just that, or by simultaneous K and J inputs which would trigger it with the same result. Hence, K = 1, J = X.

Again we can draw minimaps of the functions J and K (Fig. 9), from which we can read the functions in minimized form:

$$[J = g]^n \qquad [K = \overline{h}]^n$$

These are the characteristic application equations for the J-K flip-flop.

d flip-flop

[Q	g	h]^n	[Q]$^{n+1}$	[D]^n	
0	0	0	0	0	Row 0
0	0	1	0	0	Row 1
0	1	0	1	1	Row 2
0	1	1	1	1	Row 3
1	0	0	0	0	Row 4
1	0	1	1	1	Row 5
1	1	0	0	0	Row 6
1	1	1	1	1	Row 7

In the above dual truth table, again the first four columns were marked as before. Since it is known that the only thing that will make [Q]$^{n+1}$ = 1 is [D]^n = 1, we can readily mark the fifth column identical with the fourth. Plotting (Fig. 10) and minimizing the function for D, then, we get

$$[D = g\,\overline{Q} + h\,Q]^n.$$

This is the characteristic application equation for the D flip-flop.

summary

Now that we have derived the various equations that are to be useful in logical design, we owe ourselves two things: (1) to list them in a handy table for ready reference now and forever, and (2) to forget the derivations which we won't need anymore, unless we intend to teach this stuff to others. While you proceed with the second item (if you have not already accomplished it), I shall take care of the first, below:

General application equation . . . . . $[Q]^{n+1} = [g\,\overline{Q} + h\,Q]^n$

Characteristic application equation(s)

For R-S flip-flop . . . . . $[S = g\,\overline{Q}]^n \quad [R = \overline{h}\,Q]^n$

or, provided $g\,\overline{h} = 0$, ... $[S = g]^n \quad [R = \overline{h}]^n$

For T flip-flop . . . . . $[T = g\,\overline{Q} + \overline{h}\,Q]^n$

For J-K flip-flop . . . . . $[J = g]^n \quad [K = \overline{h}]^n$

For D flip-flop . . . . . $[D = g\,\overline{Q} + h\,Q]^n$

practical applications

To satisfy practical needs (and what other worthwhile purposes are there?) the procedure for each flip-flop to be used is as follows:

Step 1: Analyze the problem to see what the flip-flop must do.

Step 2: Write the specific application equation for the flip-flop in the form of the general application equation.

Step 3: Determine g and h for the flip-flop in the application.

Step 4: Substitute for g and h in the characteristic application equation(s) for the flip-flop type chosen.

Step 5: Draw the completed schematic, or wire up the system, or both.

For example, let it be desired to design a device that will, at clock rate, represent the binary values equivalent to 3, 7, 2, 4, 0, 3, 7, 2, 4, 0, etc., in sequence.

Step 1: Problem Analysis. We must represent five different states with our device. Hence, we shall require three flip-flops, since $2^3 = 8 \geqslant 5$. Let us label the flip-flops A, B, and C, and let them represent the binary equivalents of the required values.

Three flip-flops (binary variables) can jointly exist in $2^3 = 8$ distinct states. We now prepare a truth table showing

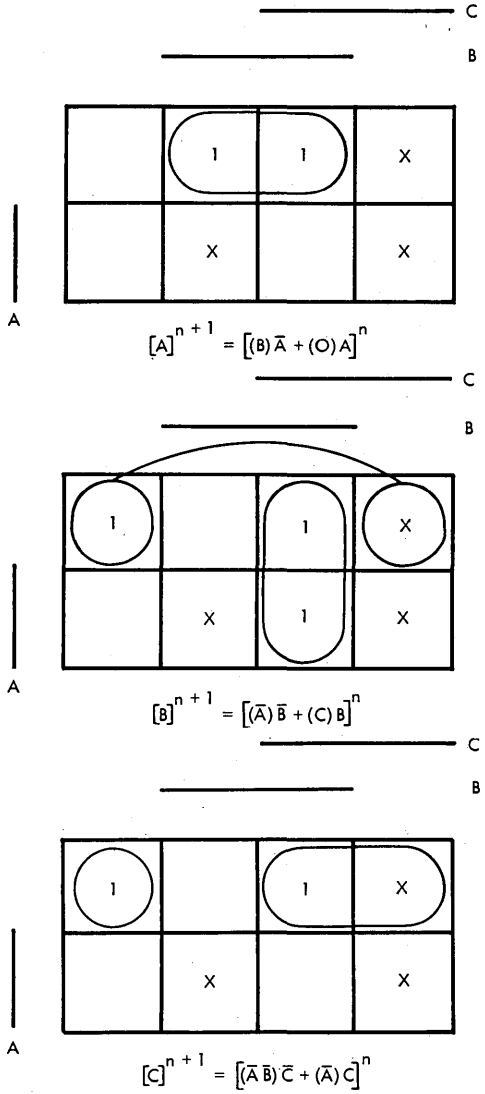


Fig. 11 Minimaps for the application of flip-flops A, B and C.

these eight states as possibilities at time t_n, the new states which will be true at t_{n+1} in five of these cases, and the fact that the other three states will never occur, and can therefore be treated as "don't care" situations.

[A	B	C]^n	[A	B	C]$^{n+1}$	Notes
0	0	0	0	1	1	From 0 go to 3
0	0	1	X	X	X	1 will never occur
0	1	0	1	0	0	From 2 go to 4
0	1	1	1	1	1	From 3 go to 7
1	0	0	0	0	0	From 4 go to 0
1	0	1	X	X	X	5 will never occur
1	1	0	X	X	X	6 will never occur
1	1	1	0	1	0	From 7 go to 2

(Continued on page 48)

Step 2: Specific Application Equations. The best way to get at the specific application equation for each of the three flip-flops is to mark appropriate minimaps (Fig. 11) from the information given in the above table. Now, in this case we are not interested primarily in reading the individual functions out in the most minimized form; we want them in the form of the general application equation which, for the hypothetical flip-flop Q, reads: $[Q]^{n+1} = [(g)\ \overline{Q} + (h)\ Q]^n$. Bearing this in mind, and with a bit of care, we shall get these specific application equations:

$$[A]^{n+1} = [(B)\ \overline{A} + (O)\ A]^n$$
$$[B]^{n+1} = [(\overline{A})\ \overline{B} + (C)\ B]^n$$
$$[C]^{n+1} = [(\overline{A}\ \overline{B})\ \overline{C} + (\overline{A})\ C]^n$$

Step 3: Determination of g and h. Inspection of the above equations will show that:

$$g_A = B \quad \text{and } h_A = 0$$
$$g_B = \overline{A} \quad \text{and } h_B = C$$
$$g_C = \overline{A}\ \overline{B} \text{ and } h_C = \overline{A}$$

Step 4: Implementation of Specific Flip-Flop Types. In many practical cases we will be told with what type of flip-flops to implement the application; e.g., it may be the only type available. However, to be quite general, let us assume that we have complete freedom of choice or, stated differently, that we wish to determine the simplest and therefore best implementation. This, of course, requires four times as much design work—but what good man will not work a little extra to save some equipment?

Flip-Flop A (See Fig. 12 for resultant schematics).

R-S IMPLEMENTATION

Special test: $g_A\ \overline{h}_A = B\ (1) = B \neq 0$; hence, cannot use special simplification.

$$S_A = g_A\ \overline{A} = B\ \overline{A} = \overline{A}\ B \qquad R_A = \overline{h}_A\ A = (1)\ A = A$$

T IMPLEMENTATION

$$T_A = g_A\ \overline{A} + \overline{h}_A\ A = B\ \overline{A} + (1)\ A = \overline{A}\ B + A = A + B$$

Note: If you plot $\overline{A}\ B + A$ on a minimap, you will see that it minimizes to $A + B$, as given above.

J-K IMPLEMENTATION

$$J_A = g_A = B \qquad K_A = \overline{h}_A = 1$$

D IMPLEMENTATION

$$D_A = g_A\ \overline{A} + h_A\ A = B\ \overline{A} + (0)\ A = \overline{A}\ B$$

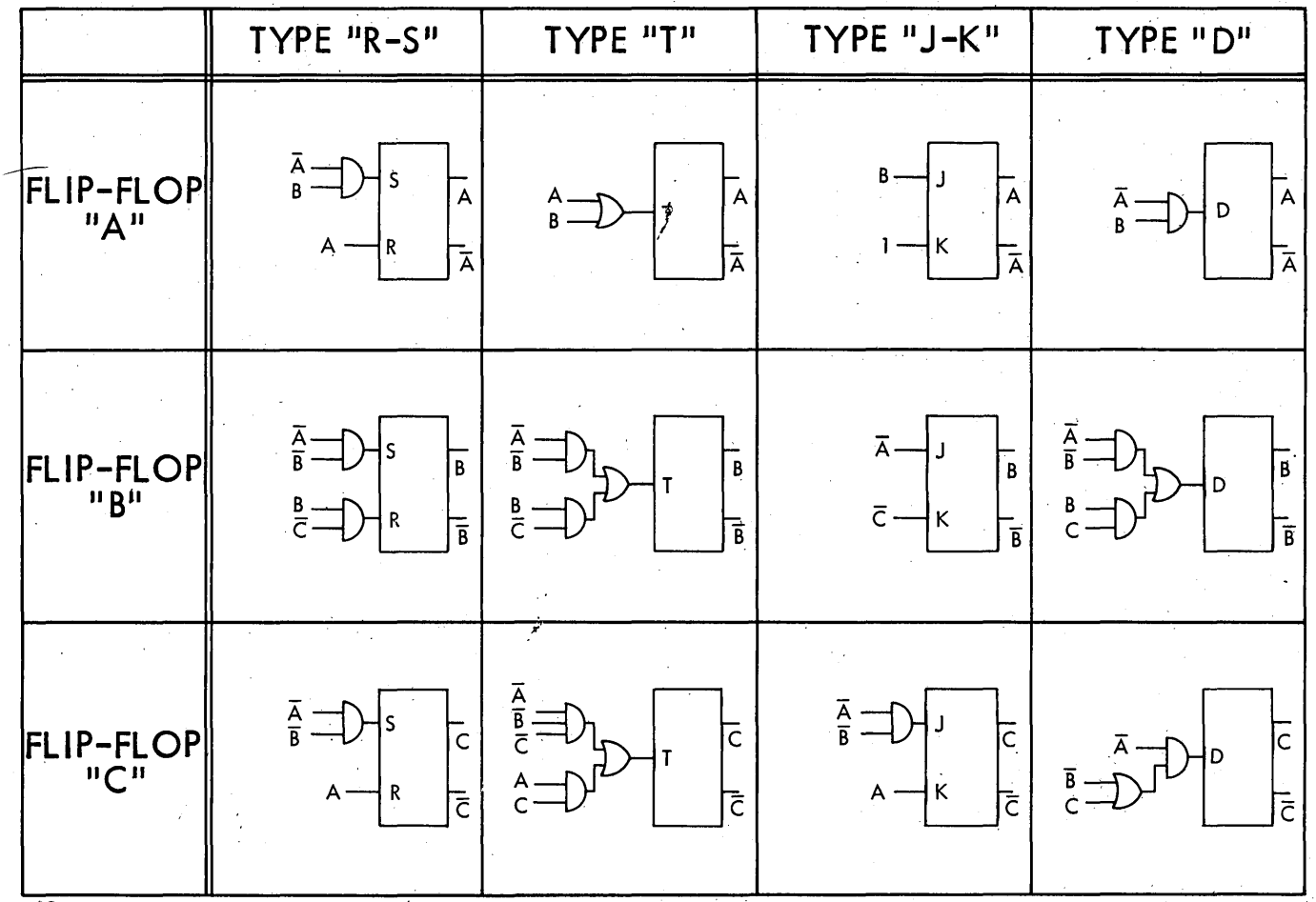
Flip-Flop B (See Fig. 12 for resultant schematics).

R-S IMPLEMENTATION

Special test: $g_B\ \overline{h}_B = \overline{A}\ \overline{C} \neq 0$; hence, cannot use special simplification.

$$S_B = g_B\ \overline{B} = \overline{A}\ \overline{B} \qquad R_B = \overline{h}_B\ B = \overline{C}\ B = B\ \overline{C}$$

Fig. 12 *(below).* Schematics for A, B and C Implemented with different flip-flop types.



T IMPLEMENTATION

$$T_B = g_B \overline{B} + \overline{h}_B B$$
$$= \overline{A}\ \overline{B} + \overline{C}\ B$$
$$= \overline{A}\ \overline{B} + B\ \overline{C}$$

J-K IMPLEMENTATION

$$J_B = g_B = \overline{A} \qquad K_B = \overline{h}_B = \overline{C}$$

D IMPLEMENTATION

$$D_B = g_B \overline{B} + h_B B$$
$$= \overline{A}\ \overline{B} + C\ B$$
$$= \overline{A}\ \overline{B} + B\ C$$

Flip-Flop C (See Fig. 12 for resultant schematics).

R-S IMPLEMENTATION

Special test: $g_C \overline{h}_C = \overline{A}\ \overline{B}\ A = 0$; hence, can use special simplification.

$$S_C = g_C = \overline{A}\ \overline{B} \qquad R_C = \overline{h}_C = A$$

T IMPLEMENTATION

$$T_C = g_C \overline{C} + \overline{h}_C C$$
$$= \overline{A}\ \overline{B}\ \overline{C} + A\ C$$

J-K IMPLEMENTATION

$$J_C = g_C = \overline{A}\ \overline{B} \qquad K_C = \overline{h}_C = A$$

D IMPLEMENTATION

$$D_C = g_C \overline{C} + h_C C$$
$$= \overline{A}\ \overline{B}\ \overline{C} + \overline{A}\ C$$
$$= \overline{A}\ \overline{B} + \overline{A}\ C$$
$$= \overline{A}\ (\overline{B} + C)$$

Note: If you plot $\overline{A}\ \overline{B}\ \overline{C} + \overline{A}\ C$ on a minimap, you will see that it minimizes to $\overline{A}\ \overline{B} + \overline{A}\ C$ in minterm form, requiring 6 diodes. Further, in maxterm form, this equals $\overline{A}\ (\overline{B} + C)$, requiring only 4 diodes.

Now that we have done a paper design of flip-flops A, B, and C, each implemented as an R-S, T, J-K, and D flip-flop, let us tabulate the necessary diode count and make a choice.

Application	No. of Diodes Needed to Implement with Type . .				Best Choice
	R-S	T	J-K	D	
A	2	2	0	2	Type J-K
B	4	6	0	6	Type J-K
C	2	7	2	4	Type R-S or J-K

So let us complete the design, using all J-K flip-flops, at a total cost in logic gating of only two diodes. Note that had we chosen, say, T flip-flops for this application, it would have required 15 diodes. But note also, that the choice of flip-flop type depends entirely on the application. There are many cases where another type, such as T, would turn out to be the best and most economical choice.

Step 5: Logical Schematic. One may now draw the logical schematic of the device as required, using flip-flop types as decided upon (Fig. 13).

Two things want pointing out in this particular schematic. One is the K input to flip-flop A, which our design indicates must be "1," or always true. This is indicated by the notation that it be connected to a permanently true, or positive, voltage source or reference. The other is, that we have not shown any connections for the clock pulses which have been stipulated. There are many commercial flip-flops which have a separate input for these clock pulses, which are then automatically gated inside the flip-flop with the other input signal(s). However, lacking such a built-in clocking provision, we would be required to provide the clock-pulse gating externally. The complete schematic (Fig. 14) would then, of course, look somewhat more complicated and require additional diodes to do the additional job. ■

Fig. 13 *(below).* Logical schematic for required device, using three J-K flip-flops.

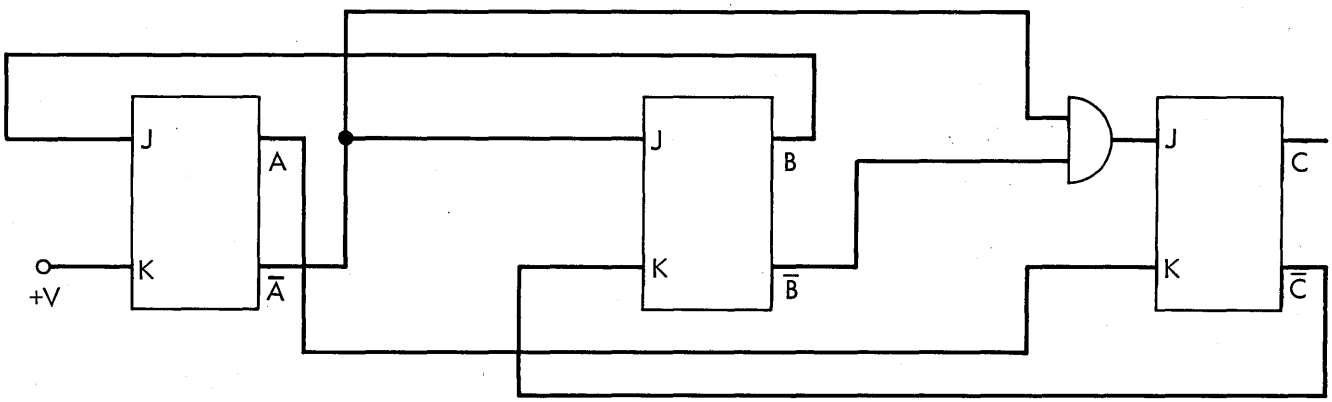
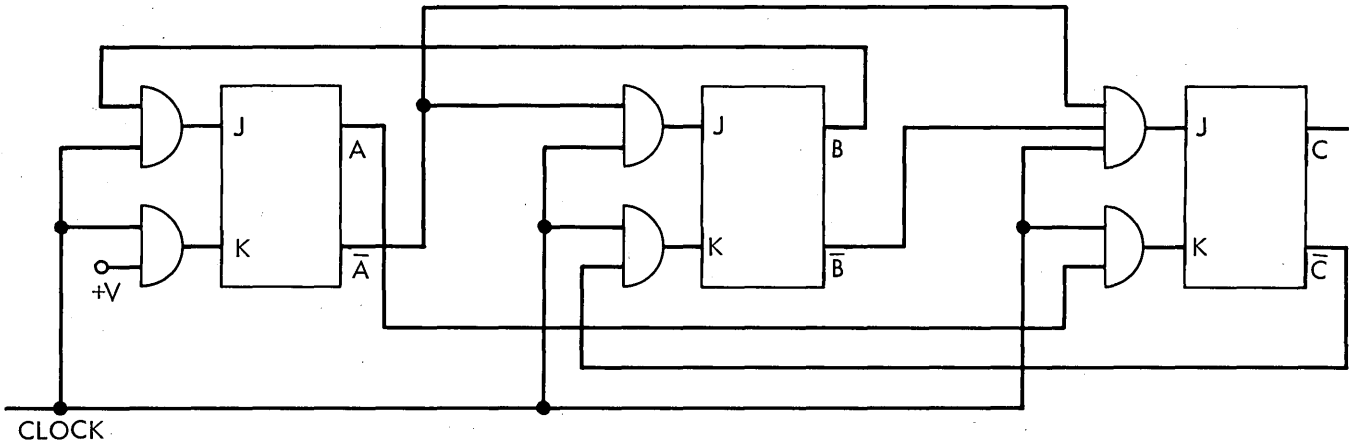


Fig. 14 *(below).* Logical schematic as in Fig. 13, but providing clock inputs.



THE TIME-SHARING MARKET: ASSETS AND LIABILITIES

by HERBERT S. KLEIMAN

For the typical non-computer user, time-sharing has limited attractiveness; indeed, he probably has never heard of the concept. The new market that time-sharing may open—not variations of old markets—will sign on slowly and only with substantial sales effort.

This is one of the conclusions resulting from a recent study of the time-sharing market in a large midwestern city. The study was performed for a local group contemplating the formation of a time-sharing service; my task was to recommend whether such a business venture should be pursued. The major contribution derived from a survey—questionnaire and interview—of the area in question. (Also, several on-line time-sharing centers throughout the country were visited.) Contrary to the implications gained from reading the trade press, time-sharing is not the panacea depicted by its proponents nor does it offer instant success for its vendors. Even with the sharp increase in time-sharing centers and expanding use, time-sharing appears to offer serious limitations for the potential user and vendor.

background

Basically, the study raised four questions:

1. What is the extent of familiarity with the time-sharing concept?
2. What is the interest in time-sharing?
3. What is the level of computer usage of *any* kind?
4. What is the potential market for time-sharing?

The city in question boasts a population of nearly 600,000 with another 350,000 for the metropolitan area. It is the state capital with no major industrial corporate headquarters but with the state's largest university in its midst. Half of its total employment is evenly divided between wholesale/retail and manufacturing activities; over 96% of the manufacturing firms employ less than 500 employees. The survey obtained a reading from a broad cross-section of business and professional groups. Of the 750 questionnaires mailed, 354 (47%) responded. Here are the highlights:

familiarity with time-sharing

Familiarity with the time-sharing concept (not an interest to obtain a terminal or the like) was surprisingly low. I estimate that less than 30% of those solicited had *any* acquaintance with the idea. (This ran counter to my prejudgment on the subject.) A number of interviewees confused time-sharing with the service bureau concept, i.e., the sharing idea dominated. Some statistics:

1. Of the 87 questionnaires returned from the professional group (accountants, architects, attorneys, dentists, and physicians), 46% professed no familiarity with time-sharing and only 5%—all accountants—claimed extensive knowledge of the concept. Subsequent sample interviews within this group confirmed this finding.
2. The group with the greatest familiarity was, as might be expected, the engineers: about 30% claimed extensive time-sharing knowledge. Repeatedly, first-hand contact reinforced the widely-held thesis that time-sharing is a superb tool for engineering applications—those problems with a mathematical base.
3. The familiarity of the business community (manufacturing, wholesale, retail) lies between the engineering and professional groups but much closer to the latter; about 10% had extensive familiarity.

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The present use of computers for *any* application showed the following results:

Group	Yes	No
	(Percent)	
Professional	10	90
Engineering	59	41
Business	34	66
Government	53	47
Education	70	30

Over-all, about two-thirds responded "no." For most small businesses and professional activities, no dialogue has *ever* transpired between them and the computer vendor—service or hardware.

time-sharing applicability

Each questionnaire respondent and interviewee was asked to assess the applicability of time-sharing to his own work. The results, based upon 332 questionnaire returns and 68 interviews:

	Yes	No	Don't Know
Before Interview	77	131	124
After Interview	68	247	17

The changes result from the application of interview inputs to the total questionnaire population. For instance, many persons originally were unsure of the appropriateness of time-sharing to their situation; based upon the interview, most could not or would not use time-sharing. The emphasis was short term; if time-sharing economies and technology changed drastically (as well they might), the circumstances could be greatly modified.

Based upon the survey and other inputs from the study, these conclusions result:

Time-Sharing Familiarity. Despite the publicity and apparent tidal wave of enthusiasm, time-sharing is not universally recognized and understood. Many in the business and professional worlds have never heard of the concept. To these persons, time-sharing is an unknown and any marketing campaigns directed at them must be predicated upon the basis of familiarization, education, and customized application. Offering the "plug-in-the-wall" alone is wholly impractical.

This realization is fundamental to subsequent thinking. It dictates that the marketing approaches for, for instance, a real estate broker and an engineer must differ radically. The latter, especially if he is part of a large aggressive organization, is probably deluged with time-sharing information and beset by time-sharing marketeers; quite the contrary for the broker who has probably (happily?) had neither. Extensive time-sharing familiarity gravitates to those persons and organizations with previous computer knowledge.

Time-Sharing Interest. There are pockets of enthusiastic interest for time-sharing—engineering, education. In general, however, disinterest or a hard-nosed "show-me-how-it-can-help-me" attitude was more typical:

A one-man accounting office is interested but skeptical. He never heard of time-sharing and has had no experience with computers.

A real-estate management service is experimenting with a service bureau. Readout format is critical; chance for time-sharing is slight.

An architect/teacher states that the architecture profession and the computer industry have had slight dialogue. He is receptive to new ideas but skeptical of time-sharing.

A small one-man retail operation has no knowledge or interest in time-sharing. Owner controls all aspects of the business: no time-sharing potential.

A paint manufacturer and distributor is just beginning to consider computer usage; to date, no aspect of the operation employs a computer: no consideration of time-sharing.

Only for the engineer was the interest level high. For the others, to varying degrees, the interest ran from total indifference—the interviewee could not conceive how time-sharing would ever be applicable to his work—to an interest highly qualified with cost, volume, readout, and speed considerations. Many said "I'm willing to listen but I must see how it (time-sharing) can help me with my business."

There are many professions and work areas on which the computer has had little or no effect:

One dentist after subscribing to a computer billing service for several months gave it up in disgust. The number of errors and lack of improvements had completely disenchanted him on using the computer for anything.

An attorney with a small law firm can see *no* computer application—time-sharing or otherwise—for his work.

Although time-sharing offers attributes not available via traditional batch-process operations, it is a child within the computer family. The marketing task varies, both in kind and degree, when the sale is aimed at someone already familiar with computer applications rather than the individual with no previous computer experience. For the small and medium-sized business and the typical professional firm, the use of computers and dialogue with members of the computer community has often been negligible or non-existent. This hardly makes for fertile ground in the time-sharing cause.

time-sharing market

In perspective, time-sharing will offer a new dimension to the computer capability but something less than its advocates suggest. Some time-sharing users will be new to the computer while others will be transfers from traditional computer operations; already, pirating *within* the time-sharing clan is an accepted practice.

The potential time-sharing user considers:

Application. Can time-sharing perform *any* useful service for him?

Volume. Would he use the time-sharing terminal for repetitive operations or for one-shot complex problems?

Response Time. Is fast turnaround time a critical consideration?

Cost. All factors evaluated, does he feel the cost justifies the utility received?

Organization. Does the organizational setup allow for external time-sharing? (A critical factor when dealing with a government agency or companies with existing computer facilities.)

final comment

Time-sharing appears to be on a rising growth curve and the expanding market has already attracted many vendors. For the foreseeable future, the activity level should be even more brisk. As the user base expands, prices will drop and service and performance will improve, thereby generating even increased demand. As with the traditional computer market, rising sales are *not* synonymous with rising profits. To date, the time-sharing vendor has picked off the cream of the crop—those easily attainable with a minimum of marketing effort and resultant cost. The vast potential user base is still untouched and will remain so unless the marketing effort is specifically geared to this "uninformed" market. For most business applications, especially of the housekeeping variety (payroll, accounts receivable), time-sharing offers limited attractiveness: storage is costly, readout is constrained, programs are inadequate. Marketing efforts to entice these users must expend large investments and exhibit continued patience, often an incompatible combination. ■

DYNAMIC MULTIPROGRAMMING AT DOUGLAS

for $8 million a year

by CLIFFORD H. JENKINS

For the Douglas Aircraft Division of the McDonnell Douglas Corp., computer efficiency is considerably more than a matter of academic discussion. The workload at the computer center of this division is in excess of 5,000 jobs a week, exclusive of unit record or peripheral operations. The 1968 expenditure for computers and all support hardware to process these jobs is in excess of $8 million.

This workload of our computer center in Long Beach, Calif., combines commercial applications such as purchasing, production control and spare parts provisioning with engineering applications such as N/C machine-tool programs, simulations, and structural analysis.

Many of the business applications involve sorting 400,000 records (done on disc) and processing master files of up to 15 reels of magnetic tape. Evolution of this work profile has caused us to develop an operating philosophy that consists of three main points:

1. Completely centralized operations, which includes the integration of all engineering and commercial requirements, so we can realize the economies inherent in large-scale computer operations.
2. Large-scale, stand-alone configurations, which provide both the maximum amount of computing power per dollar and backup protection.
3. Advanced but operationally practical equipment and programming support. Since our division objective is to be a leader in aircraft manufacturing, rather than in data processing, we cannot justify any investment in computer resources that have not already been developed to the point where they can perform reliably on a large-scale production basis.

During the last eight months of 1967, this philosophy led us to replace 7094's with IBM System/360 Model 65's and then move from serial operation under the Primary Control Program (PCP) option of Operating System/360 to dynamic multiprogramming under the Multiprogramming with a Variable number of Tasks (MVT) option. The move from the 7094's to the serially operated 360/65 configurations increased our throughput approximately 50%. The move from serial processing to dynamic multiprogramming promises to further improve performance by at least another 200%.

equipment and programming configuration

In keeping with our philosophy, the three Model 65 configurations now installed are large and almost identical. As shown in Fig. 1, each is built around one million bytes of core and contains three 2314 disc units, two 2303 drums, 16 tape drives, two card read-punch units, and three 1403 printers. The only difference among the three is that one has a 2250 graphic terminal for structural design applications.

Our use of large configurations to get maximum computing power per dollar is reflected not only in the choice of a large-scale cpu, but also in the use of large core capacity, high-speed drum storage, large capacity disc files, and extensive input/output facilities.

The programming configuration for the system is shown in Fig. 2. Most of the time-critical facilities of the MVT operating system, of course, are core resident during operation.

Core is divided into two areas: fixed and dynamic. The link pack, master scheduler, system queue and nucleus are in the fixed area.

1. The link pack, which is capable of storing re-enterable modules from the link and supervisor control (SVC) libraries currently contains most of the data management routines and directories to the COBOL compiler and SVC library.
2. The master scheduler handles all communications between the operator and processing programs.
3. The system queue space is used for the control blocks and queueing elements necessary for job, task, and data management functions.
4. The nucleus contains the usual core resident elements of the control program. It has the facilities to keep track of up to 200 I/O requests simultaneously. In addition, it has twelve transient areas, each 1,024 bytes in size, for the execution of non-resident supervisor control functions.

The dynamic area of core is split between:

1. Reader-interpreters which convert input job streams into work-queue control blocks and disc resident data sets.
2. Output writers, which are used to write the data sets

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created by the processing programs.

3. Initiators, which compile, link edit and execute jobs one step at a time.

The utilization of the dynamic area can be varied by the operator according to the size and operational characteristics of the workload. We generally run four output writers and one reader-interpreter, leaving approximately 664K bytes of core to be allocated dynamically to the steps of three or more jobs running concurrently.

The rest of the operating system, plus supporting programming packages, is stored on drums and discs. Those elements used most often—the system link library (including a 300K FORTRAN compiler, 150K COBOL compiler, 100K link editor, and other processors), and subroutine libraries for FORTRAN, COBOL, sort/merge, and assembler are stored on the high-speed drums. The drum was chosen for storing these elements because of its significantly faster access time (8.6 msec. compared with 75 msec. for the 2314). Copies of these data sets are also stored on disc for backup purposes. The SVC and procedures libraries, job queue, and three systems logs (for accounting information, operator comments, and hardware errors) are on disc.

Disc units are used for the supplementary link library, CSMP (Continuous Systems Modeling Program) and GPSS (General Purpose System Simulator), assemblers, the GPAK subroutines for the 2250 graphic terminal, and a number of packages used for systems development work.

operating system functions

The MVT option of the operating system maximizes use of the total computer resources, including cpu, core, and I/O devices. A general functional MVT diagram is shown in Fig. 2. System functions, reader-interpreters and writers are managed as individual tasks and compete with processing tasks (jobs) on a priority basis. An OS MVT job may consist of several tasks operating concurrently or of several steps being executed sequentially. Each step may consist of one or more concurrent tasks.

At the job management level, MVT permits multiple jobs to be run concurrently, by priority, in regions of core allocated dynamically for each job step. Each job may be assigned a priority by the programmer. If no priority is assigned externally, a default priority will be given the job as it is read into the system. The priority can be modified by the operator while the job is in the input queue awaiting selection for execution. We use a priority range from 0 to 14, with 14 being the highest level priority. The lowest level, 0, is used as the default system priority.

A key feature is the arrangement for the operator to create a system function called the "initiator-terminator," which, as the name implies, is responsible for starting and ending jobs. Up to 15 of these functions can be created and operating in the system at the same time. We generally run three to six concurrently.

Actually, what each initiator-terminator does is select a job from the work queue by high priority, set up the first step of the job, turn control over to the processing program, and then come back when the program is completed to terminate the step and set up the next one. Once it starts on a job it stays with it through all the processing steps, returning to the work queue for another job only when the current job is completed.

The operation of an initiator-terminator begins with establishing availability of data sets needed and acquiring whatever amount of core is needed for the processing step. The initiator-terminator then allocates I/O devices and data sets. Control then passes to a supervisory routine in the link pack area to load the processing program into the region.

When processing is finished, the terminate code is brought into the core region. Termination consists, essentially, of releasing the devices used and performing required disposition of all the data sets.

At the task-management level, a job-step can attach other programs of the job that are not sequence dependent and have them run as subtasks. These subtasks run in the same region as the main task but compete for cpu resource independently of it and of each other. This task-switching function is performed by the task supervisor. Control is passed from one task to another according to a priority based on the priority of the task, at the time of its creation. The relative priority of a created task can be changed by the use of a macro instruction.

Each processing region is provided a unique storage protect key to prevent any inter-region interference. Protection against intra-region interference, where multiple tasks are

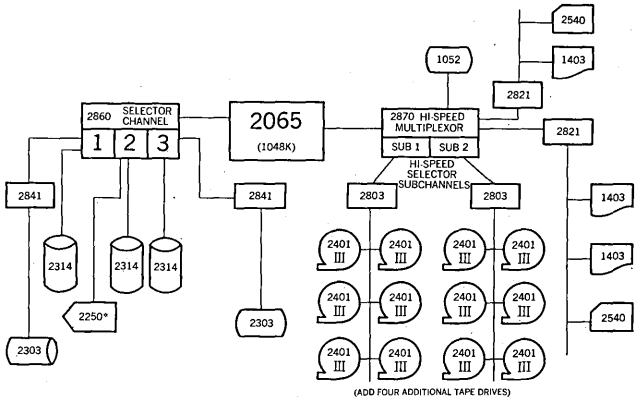

Fig. 3

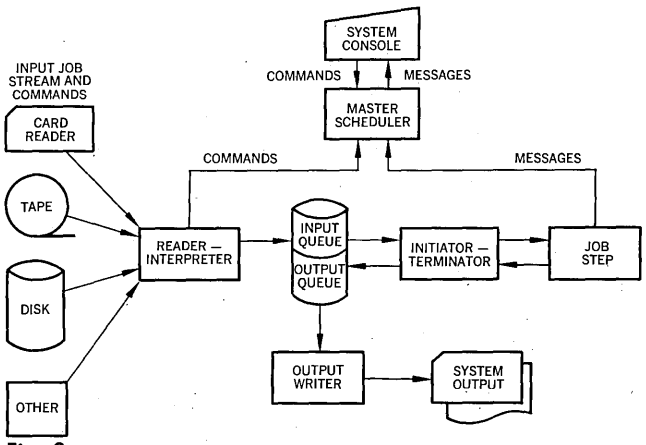

Fig. 2

operating within the same region, and therefore with the same storage protect key, is provided by using the concept of subpools. With subpooling, the programmer can request core storage when needed within the region assigned and free that storage when the need ceases to exist. He can also request space within any of the 255 subpools possible, realizing protection from other subtasks within the same region. These are logical subdivisions of regions that are allocated, as the regions themselves, on a dynamic basis. Besides being used to isolate tasks running within the same region, the subpools can also be used to share specified areas between subtasks.

evolutionary implementation

The implementation project was designed around two basic policy decisions. We decided to avoid 7094 emulation completely and to build up to our final equipment and programming configurations in orderly steps starting with a single 512K cpu operating in a serial mode. We realized that the decision to forego 7094 emulation meant it would

take us longer to fully utilize the 360. However, we believed, from past experience, that the machine efficiency gained by running in native mode from the very beginning would more than compensate for this delay. Furthermore, we felt that the decision to build up to the final configuration from a relatively simple base would give us the system experience needed to implement advanced, large-scale systems.

Implementation began in April, 1967, with the installation of the first cpu operating under the sequential control program (PCP). In May, we upgraded the software to Multiprogramming with a Fixed number of Tasks (MFT) and added a graphics terminal to the hardware configuration. Soon after that we implemented automatic spooling to gain experience in overlapping input/output operations with sequential job processing.

A second cpu was installed in October and operated from the beginning under MFT with spooling. A month later the core capacity of both cpu's was increased to 1024K bytes. Implementation of MVT began in the middle of December. MVT operation began on the prime shift. It was preceded by an extensive training program for prime shift operators. All of them attended IBM courses on Operating System/360, MVT philosophy, job control language, and console operation. During the initial stages of implementation, we maintained close liaison between our operators and systems programmers.

Our initial plan called for MVT to be implemented on the second and third shifts in successive months, with each set of operators going through the same formal training program. After a week of MVT experience, the operators and operations management were so impressed with the increase in productivity that they pressed for quicker implementation on the second and third shifts.

We bypassed the formal two-week training course by paying the first-shift operators overtime to train the others on the job. Thirty days after MVT went into operation on the first shift it was operating on all shifts. When our third 1024K byte 360/65 was installed in April, 1968, it also was operated under MVT.

impact

The impact of dynamic multiprogramming on our operations is demonstrated by such things as being able to run three medium-sized business sorts and three engineering jobs concurrently, and being able to run a 2½ hour engineering job at the same time as a five-hour commercial job. Exactly how much productivity has improved is hard to measure in a simple, definitive way because of the different operational environments necessitated by the inherent design philosophy of 7094 IBSYS system and OS/360 MVT system. There are, however, a number of general patterns and a few hard statistics that indicate that the degree of improvement has been substantial.

1. Prime shift time used to be devoted exclusively to engineering jobs; now we are able to run commercial jobs in with them. The very large commercial jobs—such as monthly reports on spare-parts provisioning that took 40 to 50 hours of 7094 time and cost-ledger accounting that involves processing over 900,000 records in just one section—used to be run only on weekends, but now can be worked during the week.
2. With the 7094's all peripheral processing had to be handled off-line; now we are running peripheral processing on-line for all engineering jobs and commercial program checkouts. Only the peripheral processing of commercial production jobs is being handled off-line, and some of that is planned to be on-line within the next few months. On-line peripheral processing eliminates queueing for two steps at processors previously devoted to this work. It also eliminates tape drive requirements on the large processor.
3. When we went from serial processing on the 360/65's to multiprogramming under MFT, the number of hours registered on the cpu meter increased approximately 10%; they increased another 10% when we moved to MVT. Not only has cpu utilization per hour of use increased, but also total weekly metered use has increased from an average of 105 hours per week to 130 hours per week.
4. With the 7094 configurations a backlog of 9-10 hours work was considered good; now we keep our backlog, including checkout jobs, close to zero.
5. We used to run 40-50 jobs per shift on the 7094's. Under MVT we are up to 120 jobs per shift.

operational environment

Dynamic multiprogramming creates an entirely new operational environment, one that takes some time to learn to manage effectively.

When there are three or four jobs running concurrently under a single operating system and a like number being concurrently processed for output, the previous standards for both operator and system productivity become useless for measuring operational efficiency. Even the materials handling procedures for getting jobs into and out of the computer facility had to be revised to fit the more dynamic environment.

One of the biggest operations changes took place in personnel. The change was both quantitative and qualitative. While we ran the 7094 systems with one or two per system, plus a lead operator responsible for four systems, our present configurations require a crew of five to seven for each system and a supervisor for the three crews.

The increase in people is related directly to the increase in system productivity. With several jobs running concurrently, the amount of operator-system interaction has increased to the point where one operator must be responsive to system requests at all times. Additional personnel are used to service the system input/output demands. Finally, a lead operator is assigned for each MVT system and is responsible for its operation and performance.

tuning up the system

We feel our configurations are now running at a reasonable level of effectiveness. Considerably more, however, can and is being done to improve the performance of the total system as it relates to our installation requirements.

1. Job procedures and programs are being added to resident libraries to reduce the percentage of total job time required for input operations.
2. Program modifications are being made so we can run the peripheral phases of commercial production programs on-line. In other words, historically, commercial production jobs produced a multitude of report tapes which were subsequently processed (printed) off-line by a smaller stand-alone peripheral processor. Today we are replacing the stand-alone peripheral processors with slave printers, card readers and card punches which are used asynchronously by the main central processing facility as a means of getting work in and out of the system. Since the large processing system is able to service these devices (printers, card readers, etc.) with little or no degradation to its main computing tasks, we have effectively saved a large part of the cost of a stand-alone peripheral processor.
3. We are studying the effect of different job mixes on

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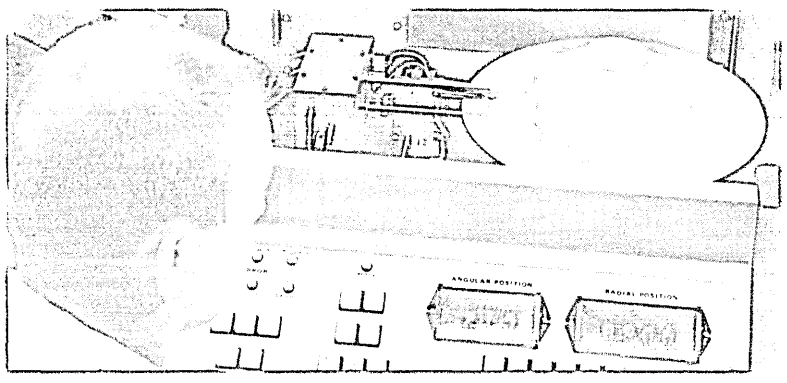

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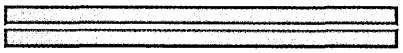
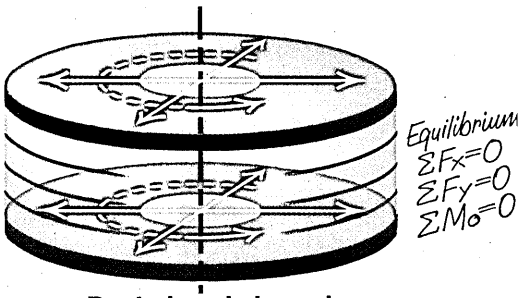


Uniform coating

6. The surface waviness of the substrate and the coating thickness on "Scotch" Brand 906 Disk Packs are held to minute tolerances to assure consistent flying altitude of heads and minimize undesirable signal modulation.

7. "Scotch" Brand 906 Disk Packs are finished by a process that assures radial as well as circumferential smoothness. In many finishing processes, to assure that the finishing marks are parallel with the recording track geometry, radial surface smoothness is often sacrificed.



Dual-plane balanced

8. "Scotch" Brand 906 Disk Packs are dual-plane balanced. Dual-plane balancing produces conditions of equilibrium within each pack that eliminates the problems of vibration and wobble possible with less sophisticated, single-plane balancing systems.

9. The rigid center mounting in "Scotch" Brand 906 Disk Packs is engineered to prevent shifting of disks from their balanced position, thereby avoiding wobble or vibration in subsequent use.

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11. "Scotch" Brand 906 Disk Packs are available for sale or lease.

For more information on "Scotch" Brand Disk Packs, see your 3M representative, or write: Market Services Department, Magnetic Products Division, 3M Company, 3M Center, St. Paul, Minn. 55101.

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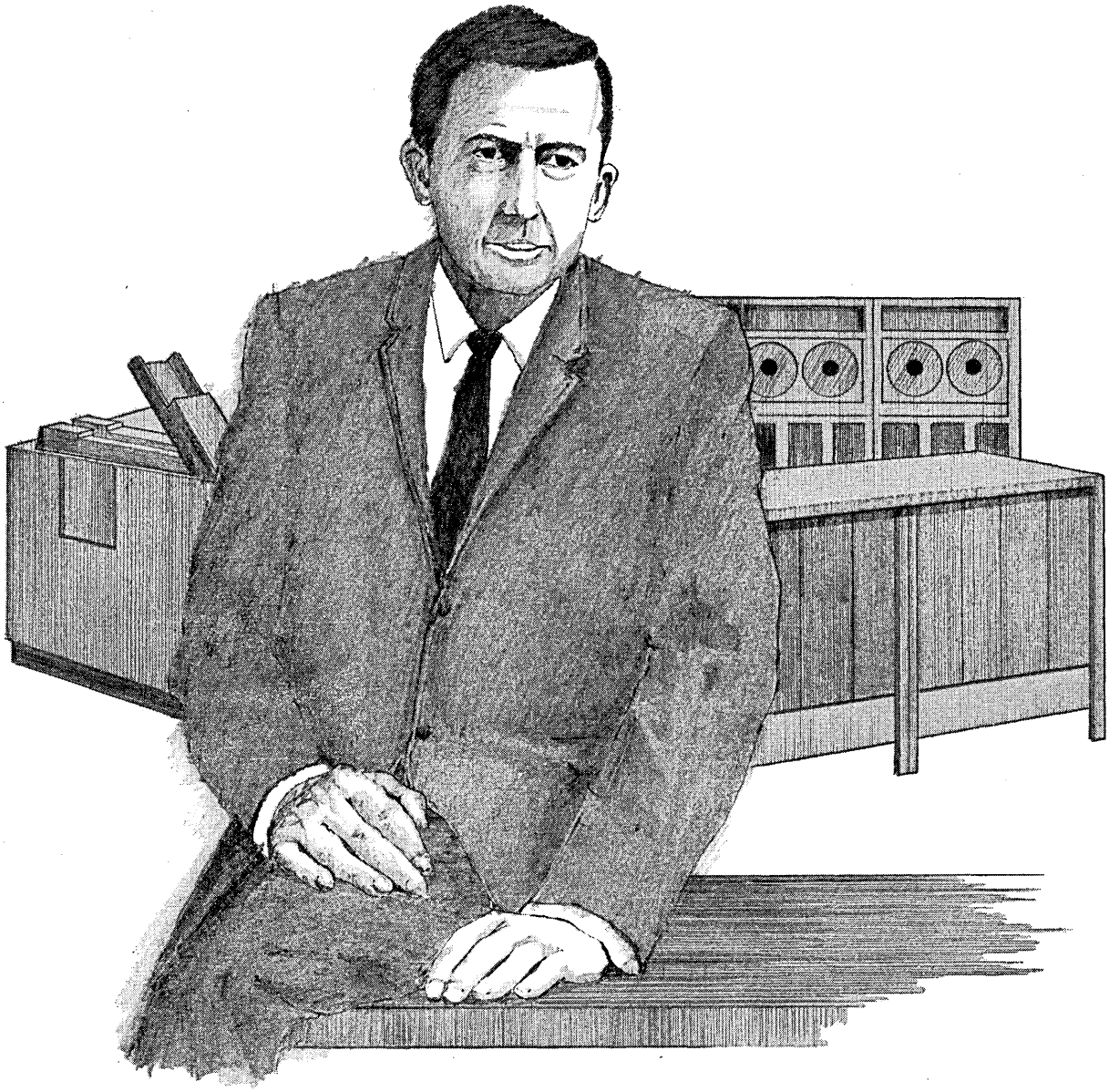

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productivity to develop some guidelines that will enable us to allocate system resources in a more effective manner. For example, many jobs require large amounts of direct access storage for data set storage, temporary work areas, queue space for the slave printers, readers, etc. We must establish the amount of different I/O data channels and direct access facilities along with solving the problem of allocation of these resources. In a multiprogramming environment, a single program no longer has 100% of the system resources at its disposal. One must be concerned with the systematic minimization of contention for system resources between jobs. We expect to alter the configuration of our systems as we establish the characteristics of the work load processed by our facility.

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How much of a productivity increase we will realize when the system is finally tuned to peak efficiency is still a matter of constant evaluation. However, on the basis of what we have seen so far it seems likely that our expectations of a 200% increase over serial processing on a Model 65 will turn out to be on the conservative side. From what we've seen so far, however, I think we've just begun to experience the impact that third-generation hardware and software will have on our operations. ■

get involved

A PRESIDENT'S VIEW OF MIS

by TERRANCE HANOLD

Today the world of electronic data processing presents such a vast and various and evanescent scene that unless we come to it with a viewpoint there is no point to the view. Without it, this welter of electronic wonders is all confusion—the realm of Chaos and Old Night. But with it, amidst all these pieces of machinery and methodology, there lies the potential for many interpretations of the interplay between management and the information systems designed to serve it.

Let me state my frame of reference. While the concept of an information system has come to massive dimensions, clearly such a system is nothing in itself. It has existence and use only as a function in a total system, as in a business firm, an agency of government, an association for a public purpose. For me the needs and purposes of my company provide the context, the perspective, and the value tests which give meaning to a computerized environment.

Having stated my approach to the subject, let me make an entry into it by a summary of the things which have been accomplished, and of the things which are being attempted in the management-oriented information systems field. When we have completed this essay, we shall be able

to attack the further question: whether the management-oriented information system will bring into being an information-oriented management system. Then, perhaps, we may inquire into the essential nature of an information-oriented management system.

basis for action

At any specific moment, management is inclined to act only on the simplest motivation conceivable in the existing environment. This is a sound rule of selection because motivation brings action only through communication. Logically, the simplest motivation will be most clearly communicated. Hopefully, that is the communication most likely to bring action in accord with management's intent. As a rule, the simplest motivation, and the one most easily expressed and understood, is the purpose to reduce costs. And this has been the motivation which management has consistently expressed as it has moved by steps into the information systems environment.

In the interest of efficiency we replaced clerical routines with first-generation edp equipment. With the object of cutting costs we utilized communications computers to concentrate branch edp operations at corporate centers. Then, to avoid the expense of repetitive handling of data at ascending levels in the administrative pyramid, our second-generation computers were used to chain the vertical links into a continuous processing system.

Next, to the sound of trumpets, came the announcement of the third-generation computers. These were to knit every application, whether in being or in conception or beyond present imagination, into a real-time multi-processed, random-accessed, remote-inquiry, machine-managed total information system. This description leaves me as breathless as did the announcement itself. For I was totally compatible with the pitch. Obviously, a total information system would achieve a total saving of all general and administrative costs, always excepting the expense of the edp department and the executive office.

Four years have passed and the trumpets are strangely muted. Much of the promised gear never arrived. And of the missing items many are no longer promised. So today the equipment array is at many points out of phase or out of balance. Compatibility is still our ideal in computers as in wedlock, and as likely of attainment. After all this while, the truth becomes clear that each business firm is unique and its total information system must also be unique.

These are things to give a man pause. And this pause is prolonged by a just doubt respecting the equipment manufacturers' capability to create a total information system suitable to the environment of each separate business.

solutions now, problems later

For 15 years, the computer industry has followed a random path with serendipity for its guide, confident that it would always find a salable use for any of its chance discoveries. Fascinated by the looking-glass land through which this path led, business has cheerfully followed, hopeful that a problem could be invented to utilize whatever hardware this profligate industry might spawn.

Through the past decade the course of invention has twisted and turned upon itself so often that the industry is terribly tangled in the maze of its own creation. Confused and frustrated, the computer industry finds itself without a clear road to the main objectives which the third-generation machines were intended to serve. Shaken by the revelation that it is unable to design the total information schemes which its upper-range models were intended to support, the hardware manufacturers are left to advertise their integrated circuitry while avoiding all references to integrated systems.

Not only are the machine suppliers now incapable of producing the total information systems that their clients yearn for, we may doubt whether today they are able to produce the operating software which would support total system programming. One or two have tried and ingloriously failed. At least none has yet signally succeeded. This state of affairs is affirmed by the emphasis the full-line manufacturers place upon their low-end machines, some of which produce almost the throughput of the second-generation models they are supposed to replace. It is further indicated by the reluctant offer, after so many previous withdrawals, which accompanied the recent introduction of IBM's newest dragon: "Model 85 is not for everyone."

So, in machine design we have reached a pause in the change from the gigantic to the colossal, while the engineers struggle with the myriad of unanticipated problems flowing from the size and complexity of their new creations, and while the software sages strive to elaborate operating systems that would efficiently utilize the varied and concurrent capabilities of these immense machines. Until these phases of development are substantially advanced, the customer has no firm footing on which to program his long-desired total information system. While this condition continues, most users can only refine and extend the applications which they presently process. And in this pursuit the manufacturers happily encourage us.

The essential meaning behind the tangle of verbiage thrown around the large-scale third-generation system is discovering itself. It is that the supplier will deliver the hardware as he invents it—sometimes in advance of its invention. He will deliver the operating software in its primal state and will debug it on your premises. But the information system the supplier will not touch. That is the customer's problem.

For the future the customer must take the lead in systems design and creation. He must define his own business, draft his own information blueprint, and build at his own hazard. There is no mail-order solution.

So much for the consequences of the cost-cutting motive.

In the course of this simple pursuit of immediate ends, we have accomplished less than we desired and more than we intended. Somehow, the total savings projected were never quite obtained and the substitute data values which the equipment suppliers suggested after the fact to assuage our disappointment were never convincingly measured.

Mr. Hanold is president of The Pillsbury Co. He has a law degree from the Univ. of Minnesota and joined the Pillsbury legal department in 1946. Since then he has served as assistant secretary/treasurer, treasurer and administrative controller, executive vice president and general manager of international operations.

While these results are central to the cost-cutting viewpoint, they are of subsidiary importance to the other developments which accompanied our passage from tab to tube to transistor. These other matters are basic to the new viewpoint we must adopt as we design our third-generation systems.

steps to the present

First, business data was converted from an exclusive property of the accounting department to a resource more universally available to each who had a claim upon it.

Next, it created in and around the edp department a new area of competence within the corporation, staffed by a rapidly growing group of people of advanced skills of high order. Their entry into the corporate body fostered the entry or expansion of other personnel with advanced academic, technical and professional qualifications.

Third, these developments were accompanied by the rapid introduction of ever more, ever larger, and ever more sophisticated machinery to handle the rapidly expanding data and decisional processing framework which supported these new groups.

Fourth, to improve the cost-value ratio of the vast data files which these systems accumulated, management learned to submit to the use of linear and simulative programming techniques which recover so much fine gold from the dross of data. Having been so persuaded that there are values as well as costs in real data, the experts are now trying to persuade management of the usefulness of assumed data. But management is so far hesitant about losing itself in a Bayesian forest of decision trees.

To date, then, we have succeeded in our aim of diminishing to a limited degree the primary levels of salaried employees within the corporation, and we succeeded in our objective of severely curtailing the administrative side of middle management. And we have been vastly successful, without at all intending it, in expanding both the analytical and executive functions and the absolute numbers of middle management. This latter fact has not been sufficiently described, and no attempt has been made to measure the rate at which this trend is continuing. Certainly, there has been no speculation respecting the future effect of this phenomenon upon the business corporation and its management.

The rate of advance of middle management people in our firm has been marked. Since 1960 their proportion of salaried personnel has increased from about 22.5% to about 30.5%. Just as radical has been their change in function. Their activity has totally shifted from the supervision of other employees to the management of the business.

This review of the past discloses that after much time and long travail we have traveled only to the point of indecision. How we proceed from here depends upon our analysis of the evidence I have just recited.

To begin, our pursuit of simple ends has led not to a state of simplicity but to a system of increasing complexity. Because of its intricacy the burden of redesigning that system to deal with the future falls not upon the supplier but the user. The test of the new system is not data cost but data value. The proof of data value is no longer found in the reduction of administrative personnel, but in the profitable utilization of increasing numbers of highly qualified middle management people. Profitable data utilization by management depends on its forward application, while administrative use is usually evidenced by its backward petrification.

Let me repeat myself. The design and development of this new data system must serve value creation first and cost reduction later. For both the creation of these values and their measurement, the executive management is altogether dependent upon its newly sophisticated middle management. And this middle management is increasingly managed and motivated by the information system itself rather than by the executive group.

The corporate presidency has never been a comfortable spot. Its status under these conditions of employment can only worsen.

design for management

So long as the cost cutting motive was dominant, the design of an information system was governed by administrative concerns, with lately some overlays to serve a scatter of management needs. For the future there must be a reversal of emphasis. A management orientation must prevail in systems design and the administrative plumbing will have to be taken care of in the substructure.

The one purpose of an administrative information system is to absorb the accounting and related routines which occupy a general office force. These are matters of inventories, invoicing, receivables, payables, payrolls, taxes, sales statistics, cost analysis, and so forth. It is concerned almost entirely with the interior operations of the firm.

By contrast let me suggest some of the benchmarks of a management-oriented information system. Such a system emphasizes data describing the external universe in which the firm functions. The most profitable address of the resources of the firm against the opportunities and perils of the market in which it offers its wares is the essential objective of business management.

The data processed through the administrative information system is secondary to that purpose. Of primary importance is data respecting the markets in which the firm buys the goods and services it needs, the nature and availability of its capital, the capabilities and organization of its personnel, current knowledge respecting its industry, its competitors, its customers, activities in the market where it sells, transportation, advertising media, and all the other things which vitally affect the market and the firm's market potential.

Clearly this calls for a considerable expansion of data input stations, of data sensing and sending equipment, and of data files. Critically, it demands an integrated data management system which will economically store and efficiently recover data for use in high-speed processors. Finally, it requires an extensive complement of analytical and simulative programs which will develop from the data the alternative courses of action and their relative risk, which have value to procurement, manufacturing distribution, sales, marketing and general management.

The suppliers can sell you the storage and retrieval hardware you need, but the design and implementation of the system are up to you. In its definition a management-oriented information system is clean and straightforward. In its accomplishment things tend to get messy. There is a tendency to gloss over this fact of life by emphasizing the glamorous modes in which recreated data can be displayed. That is all well enough but the real trick is to get the data through the system to the point of display.

Obviously, a large-scale computer is the heart of the system. The third-generation machine hides within its classic form and clean externals a spirit both malevolent and deceitful. Equipment that complex placed in a total systems environment develops problems in number, size, and complexity that exceed anticipation and very nearly defy solution. Computers may not yet have innate intelligence, but demonstrably they have emotional capability. It is beyond doubt in our shop that a computer may become neurotic, and so may its programmer.

These radical conditions may call for extreme remedies. A resident psychiatrist may be needed as well as a site engineer. The last contingent sent to exorcise our installation of its evil spirits included a geologist, a seismologist, an ecologist, and a cosmologist as well as the usual binary and

octal types. But the solution was not found until there was added to the party a dowser with a divining rod.

At this juncture it is the fashion for edp people to declaim that they are eager to plunge into the creation of a management information system, but that "they"—the management—won't state what "they" want. So, the question follows, how can edp possibly get on with the job?

The right answer is a short one: *You are management.*

the change in status

Ten years ago the head of our edp department reported to the head of the systems department, who reported to the assistant controller. Today the head of edp is corporate vice president—information systems. He has that title because he is part of top management, and because his job is to involve all levels of management in the management information system.

Today you can no longer excuse yourselves from doing the job. If in your company the head of information systems is not yet part of top management, then he had better get on with the job and earn the title.

Now let me suggest in short order some numbers and trends that I think show how critically important it is to your companies that you get this job done.

At the average growth rates prevailing in the U.S. since 1960, by 1975 GNP will grow from $785 billion to $1.3 trillion or 65%. Consumer income will grow at the same rate. Population will grow but 10%, so obviously family income will increase substantially. But the spending pattern of this great increase in income will shift strongly. This is shown by the projection that the production of consumer goods will rise 40%, but the consumption of consumer services will go up 75%.

So it is reasonable that you make these assumptions about the prospects of your firm over the next eight years. You will add 15% to your personnel. You will add 40% to your investment in plant, and your physical output of goods and services will rise proportionately. Their value will probably rise more than proportionately and your line of products and mix of products will shift radically.

The habits of life are changing with unprecedented speed today. And as people increase in number, as they become predominantly urban, and as their disposable income vastly increases, they put increasing stress upon individuality. So the variety of products demanded rises faster than the volume and the life span of new products shrinks faster than belief. In the grocery store, for instance, the physical volume handled seems to rise about 2.5% a year, but the number of items stocked goes up about 5% a year, and the number of items displaced is nearly 10% a year.

It is sufficiently apparent then that the need for creative change in product design—and in production, distribution and marketing—will more than double over the next eight years. This can only mean a further increase in the proportion that middle management represents in the total salaried staff of your firm. For that is the area where the capacity to innovate and the capability to execute must reside if your firm is to hold the pace in this era of accelerating change.

Your senior management has been too often singed to risk loss of more fur. Only the still cool cats take the creative chances. Only if your firm has a management-oriented information system will your middle management have the essential insights into the firm and into the market. Only with these insights can middle management mend your lines to mate with market changes—in time, that is, to meet competition. Only with such information systems will corporate management be able to measure middle management performance—again, in time.

There is one other condition to success in 1975—that is an information-oriented management system. Management is always avid for information. But the quality and relevance of information are data values which it often fails to measure. And management often fails to act on information because it has no quantum test of the sufficiency of the data on hand.

Historically, management is fact minded rather than information oriented. It deals comfortably with today's problem in the light of yesterday's results. Tomorrow it delegates to the planning department. This posture was appropriate to a day when the structure of the firm and of the market was settled, and change came gradually, and problems presented themselves consecutively.

Today we deal with dynamics, not structure. We have for analysis not fixed facts but data flows. We find no plain answer, but arrayed alternatives, derived from feedforward and feedback, with varying assessments of risk. By accident, if not by intent, our enterprises cross a dozen industry lines and the plain trend of the near future shows that our competitive status will be progressively more involved.

We have attempted to reduce complexity by sorting the business into divisions. But this solution is temporary. Divisions become complex for the same reasons that the firm first became complex. Then because of market shifts and technology the divisions overlap. Next we have complexity charged with conflict.

In the beginning the firm is a straightforward business managed by a president. Now it is a complex managed by divisional managers coordinated by a chief executive. We are arriving at a point where the complex becomes a perplex. Management power is widely diffused among many energetic and individualistic middle managers. They demand meaningful work—that means range for their intelligence and intelligent freedom of decision. At this stage a corporation can no longer be effectively directed by a chain of command. Its action teams can be integrated with the executive office only through a nerve network equivalent.

The only system pervasive and responsive enough to serve the need is a management-oriented information system working with a information-oriented management.

This requires a further shift in management mentality. Your management has always sought "facts" which would yield "certainty." The very volume of the data in our information systems proves the absence of absolute facts; but that data displays the substance of insight, of judgment, and of decision. Change is the product of a change in the system of information, says Kenneth Boulding. So a change in your information system will bring the needed shift in management's use of information.

The painter Matisse is credited with saying that "L'exactitude n'est pas la verité." We shall have to learn in business as in art that truth lies not in precision but in perception. Perception is the product of a system of inquiry, not of a method for identifying a fact.

To gain perception of the right course of action, the manager must involve himself in the information system. How he accomplishes that involvement is a matter of individual determination.

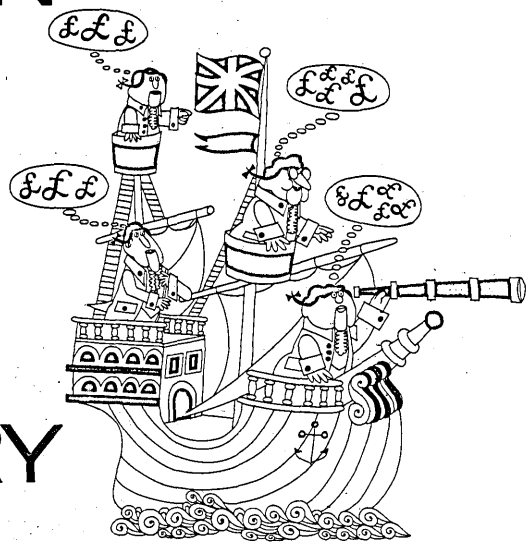
In our firm we find the most effective method of involvement comes from the use of a direct access console. Togetherness is time-sharing!

But, by this means or another, he must ally the informational faculties of the system with his own intellectual faculties to achieve the levels of perception which the pace and perplexity of our day obscure.

Only by these means can he manage confidently in the firm of tomorrow.

And tomorrow is almost today. ■

INFORMATION SYSTEMS: A BRIEF LOOK INTO HISTORY



by DAVID M. SAGE

The term "systems" has many meanings both within the present-day computer profession and within industry in general. Whether computer science itself has been responsible for the proliferation of the term among disciplines is difficult to say. What is definite, however, is that both industry and education are enamored with the need to apply the term to every conceivable area of study. General systems theory—that is, a general systems approach applicable to broad spectrums of activities—is now a required avenue of study in graduate schools of business and engineering. In business, "systems" has long been applied on a micro-level to office procedures, more recently on an intermediate level to procedures involving the computer, and most recently on a macro-level to the business as a whole. Information systems are now as important a topic to the computer professional as the hardware itself was ten years ago. However, they are much less understood.

In order to begin to understand the nature of an information system it is first necessary to place it in a proper relationship to the business itself. It is necessary to differentiate between the business system itself and the information system of the business. James G. Miller relates these two types of systems by defining two terms: the matter-energy processing system and the information processing system.[1] For the most part a business has as its main function to be a matter-energy processing system. The business brings in or "ingests" raw materials, it preprocesses these raw materials or "decomposes" them to make them suitable for further use. Next it assembles these raw materials into finished products and sells them ("extrudes") through its channels of distribution to its customers.

An information processing system, on the other hand, translates information both from the environment and from within its own components as its input. It stores this information and associates it with previously stored information in order to provide a frame of reference for the next and vital step, that of making a decision. Its decisions are then transmitted to its components or to its parent system.

Defined in this manner, the information system contains far more components than the present day computer staff, facilities and so-called systems of a business. Although this is true, present day myopia tends to discount the importance or need of understanding information systems in their entirety. This would include, in addition to the processing components, the channels of input and the channels of output.

Perhaps the recent and rapid rise of the computer has nurtured the narrow viewpoints often taken of information systems. Many people feel, I think, that "systems" existed only infrequently and systems theory was never really applicable prior to the time when it became possible to use a computer. This could not be farther from the truth. Information systems are evident as far back as history has been

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[1] James G. Miller, "Living Systems: Basic Concepts", *Behavioral Science*, Vol. 10, No. 3 (July, 1965), 193.

recorded. General systems theory is as applicable to these early examples as it is to those of today. Let us look at some of these early information systems and see if there are not at least a few lessons which can be applied to our times.

early information systems

From 2000 B.C., the period when the Code of Hammurabi was drawn up, to the present businessmen have been interested in obtaining information on the status of their businesses. This information gathering has rarely in the past been defined explicitly as a science as we do today. Regardless of whether it has been called accounting or communication or a code, it still constitutes an information system. Hammurabi said, "If the merchant has given to the agent corn, wool, oil or any sort of goods to traffic with, the agent shall write down the price and hand over to the merchant; the agent shall take a sealed memorandum of the price which he shall give to the merchant.

"If an agent has forgotten and has not taken a sealed memorandum of the money he has given to the merchant, money that is not sealed for he shall not put in his accounts."[2]

Surely this law indicates and prescribes a method for collecting information. Once the agent had written down the price and handed it over to the merchant and other agents had done the same thing, surely the merchant would sit down at the end of the month and tabulate what he had taken in from whom and who had bought the most and who the least. The merchant was processing the information then and he undoubtedly made some interesting decisions because of it. In this case the information that had been recorded for the business as a form of record keeping was also used as a planning and control tool.

Hammurabi was King of Babylonia, a country whose civilization was one of the oldest in the world. Its known history goes back to 4000 B.C. Many of the documents of Hammurabi's time have been found and have been deciphered. Because of his strict code every purchase of any importance and all lawsuits, wills, marriage settlements, etc. had to be recorded. Since they were recorded by pressing cuneiform characters into cylinders of clay, many have survived the years quite well.

In addition to clay tablets, the ancient Babylonians used the scales and the seal. Furthermore, since the ability to write using the cuneiform characters was difficult to achieve, the clerks who did the record keeping held respected positions and were in heavy demand. Special schools were even established to train these clerks for both government and commercial positions. Does not this foretell of our shortage of trained programmers today? Clerks are now in abundance because, for one reason, the techniques of writing using the present day alphabet are far simpler than writing using cuneiform characters. Does this suggest that programmers will be abundant in the future because of the decreasing complexities of programming languages? I think that it does.

A fantastically detailed view into the business system of the sixteenth century is provided us by Jost Amman, who produced in six engravings his 30-by-46-inch print "Allegory of Trade."[3] The print from this engraving is a " . . . veritable potpourri . . . " of information. On it Amman shows the symbols of business and pictures of mercantile activity. He shows a panorama of the leading trade center of the world at that time, Antwerp, and throughout the design he intersperses symbolic representations of those qualities which make for business success. Even the information systems of the day are depicted and their importance illustrated. The scales, the account book and the journal are shown as central hubs of the system. A messenger about to deliver a letter is quoted as saying:

"I travel into the country with letters
The contents of which I do not know
But often I make my master jovial with them
And also cross and weak."[4]

The weighing house, the conference room and the counting house are shown, all in full swing. The importance of information even to this early business system is evident in many ways throughout the allegory.

In 1494, Luca Pacioli, a famous man of the time, wrote a treatise on double entry bookkeeping.[5] In it he states that, following the need for cash, the two most necessary things in business are (1) to be both good bookkeeper and mathematician and (2) "to arrange all the transactions in such a systematic way that one may understand each one of them at a glance." Pacioli then describes in 36 chapters a complete method for recording every type of accounting transaction including "How To Take Out One or More Entries Which by Mistake You Might Have Entered in a Different Place than the Right One, which May Happen Through Absentmindedness."

Early businessmen were even interested in information that accounting did not provide. The only way that an enterprise could succeed—then as now—was by moving faster and more surely than its competitors. This requires information.

Jacob Fugger was the head of the great German house of Fugger centered in Augsburg. This house had acquired by the middle 1500's interests ranging from China to Peru. The Fugger enterprise was immense and its varied and critical financial transactions strained the resources of the firm to the utmost. In this present day and age a firm of the size and complexity of Fugger would command a massive system of information collection and communication devices. These would be necessary not only to forge ahead of its competitors but merely to keep its place. These complex systems Fugger did not have, yet he did have a highly developed information gathering network at work in all parts of the globe. Remembering that the low rates of speed affected all in those days and that the length of time between communications did not require the pace of today, then his network was truly revolutionary. Laboriously handwritten letters and sketches would find their way to Augsburg from London, Paris, Antwerp and Venice. Each foreign agent was required to regularly report the trends and happenings in his area and was in turn kept informed of those developments elsewhere affecting himself. Much of the information conveyed was top secret, the knowledge of which by certain politicians would possibly have changed history. Fugger's newsletters are the forerunners of our present market newsletters with the one major difference being their highly secret nature. The difference shows the progress of business through the centuries. Telegraphy, newspapers, news services, radio and fast presses have broken down the secrecy. Competitive enterprise has broken monopoly. Business news is out in the open, available to everyone.

These are examples of early information systems. Obviously information systems of the present are on an entirely different plateau of complexity. However, business systems themselves are also at a much higher level of complexity than they were 400 years ago. It is well to point out at this

[2] Hammurabi, *The Oldest Code of Laws in the World*, translated by C. H. W. Johns and T. Clark, Edinburgh, 1903, Laws 104, 105, p. 18.
[3] Donald T. Clark, "Jost Amman's Allegory of Trade—or, The World of Business in the Sixteenth Century," *The World of Business*, Vol. IV, p. 1954.
[4] *Ibid.*, IV, p. 1967.
[5] Luca Pacioli, *Ancient Double-Entry Bookkeeping*, translated by John B. Geijsbeck, published by John B. Geijsbeck, Denver, Colorado, 1914, pp. 33-51 (abridged).

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time the major reasons for this increased complexity and the accompanying increase in the need for information.

In my opinion, there are five major reasons for the vast increase in the complexity of the business system (and the increase in productive efficiency). These reasons are: (1) division of labor, (2) automation, (3) capitalism, (4)

transportation and (5) communication. There may be more reasons that have contributed to this complex result than I have included but nevertheless I do not feel that there can be any dispute as to the importance of these five.

Alexander Hamilton said in his *Report on the Subject of Manufacturers* that "It has justly been observed, that there is scarcely anything of greater moment in the economy of a nation, than the proper division of labor. The separation of occupations, causes each to be carried to a much greater perfection, than it could possibly acquire if they were blended." Indeed, even in the middle ages, the guilds heralded the reign of the specialists. There were sword polishers and there were sword pommel makers, there were leather dressers and chamois dressers, there were cooks and mustard makers and bakers and confectioners.

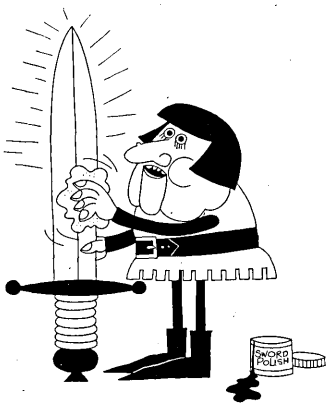
Automation is closely allied with the division of labor concept. Automation, however, is within itself a reason for the increased complexity of business. As automation is implemented further and further, productive efficiency increases even more in proportion. This is the reason for the automation. However, as efficiency increases the output of one man or one process or one machine becomes more and more critical. The reason for this is that because of the increased efficiency of each productive unit we now have less of these units and the loss of any one or its degradation of performance poses a greater threat to the system. Each one, therefore, has to be monitored more closely.

This monitoring brings out some additional factors leading to more complex information systems. The problem now arises as to what information variables have to be collected in order to monitor the automated production unit. It becomes necessary not only to measure its productive output but also its quality of production and its economy of production. For example, in a machining center in a present day factory, we maintain a count on the pieces produced and the hours worked by the machinist. In addition, however, we measure the time and material spent in setting up the machine for each different part to be manufactured, we measure and maintain a record of the quality of each produced part, and we maintain a schedule and record of preventive maintenance for that machine.

This increase in emphasis on the monitoring of machines has not been without its benefits to the worker. Automation has pointed out the need for care of machines. This care has since been (not without the help of the labor unions) carried over and applied to the human beings who man the machines.[6] More information inputs are therefore introduced into the system, and this is information of a most complex sort; it is information pertaining to and about people.

The increase in business size and complexity is due no less to another major reason, capitalism. None of the other causes would be possible in any degree of magnitude if it were not for the capital provided by the investors in these businesses. This, however, has created an obligation on the business to provide the investor with information. In this day and age the investor has the ability and the legal right to inquire into the financial and operational records of a company in which he desires to invest. This is possible because of the regulations of the Securities and Exchange Commission requiring companies having publicly-owned stock to make known to the public certain pertinent information. In addition, the ability to investigate all the information pertaining to a particular investment is enhanced by the services offered by many stock brokerage houses. Business for the most part has tried to exceed the minimum requirements in providing this information as this creates good will and better public relations. An example of this at the present is the increasing tendency for annual reports to show earnings per share of common stock both before and after dilution by rights and conversions.

This openness of business to scrutiny has not always been true; in fact, it is only within the last 35 years in this country that government and market regulations have required it. Even in Europe today the philosophy is that only the managers are entitled to know, not the stockholders. And these stockholders theoretically have a higher position than the managers; they are the owners.

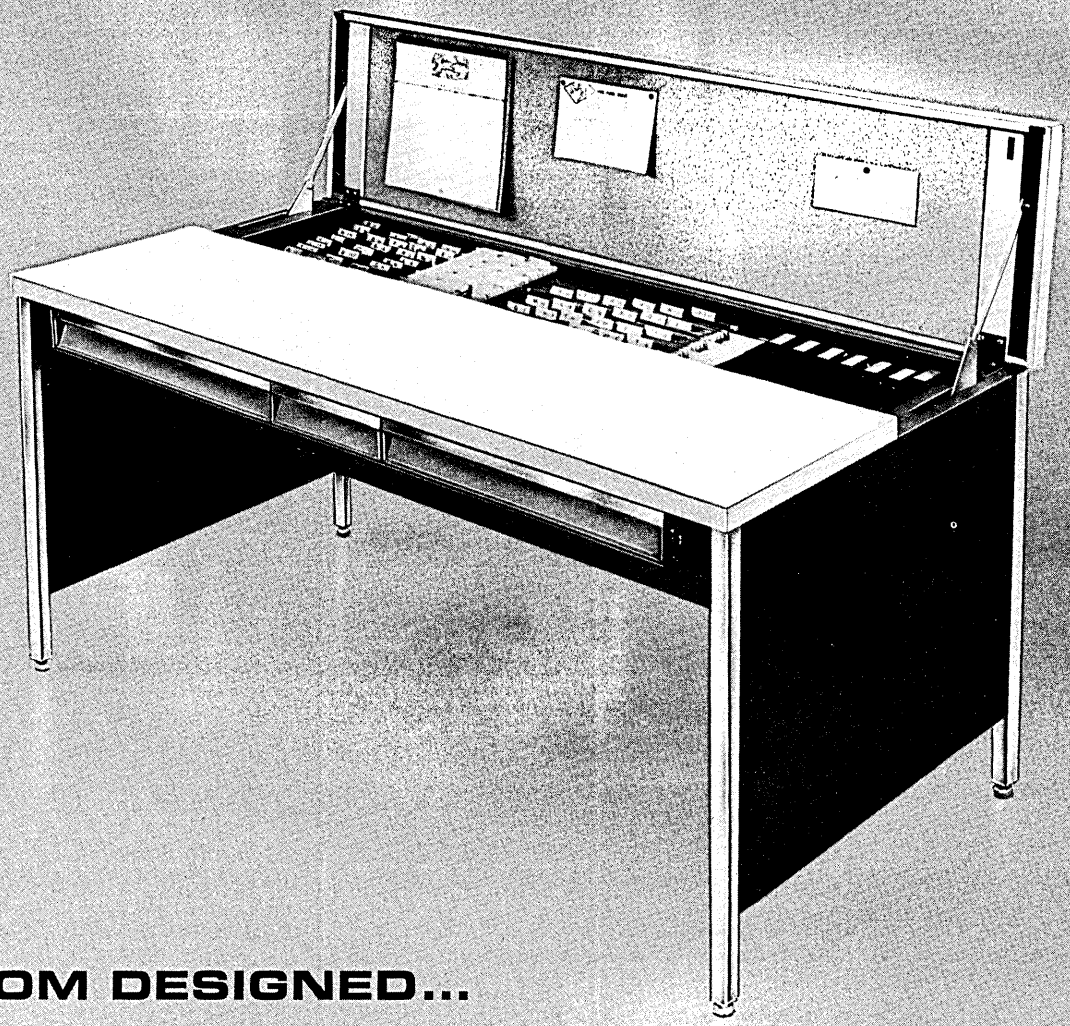


an information shortage

The most notorious example of a lack of information (and mass hysteria) about an investment situation was "The South Sea Bubble" in England in the early 1700's.[7] The South Sea Company was formed in 1711 for the purpose of trade with South America. In its first six years of

[6] Robert Owen, *A New View of Society or Essays on the Principle of the Formation of the Human Character and the Application of the Principle of Practice*, Taylor, Printer's Court, Shoe Lane, 1813, pp. 3-9.

[7] Charles Mackay, "The South Sea Bubble," in *Extraordinary Popular Delusions and the Madness of Crowds*, L. C. Page & Co., Boston, copyright 1932, pp. 46-85 (abridged). First published 1841.



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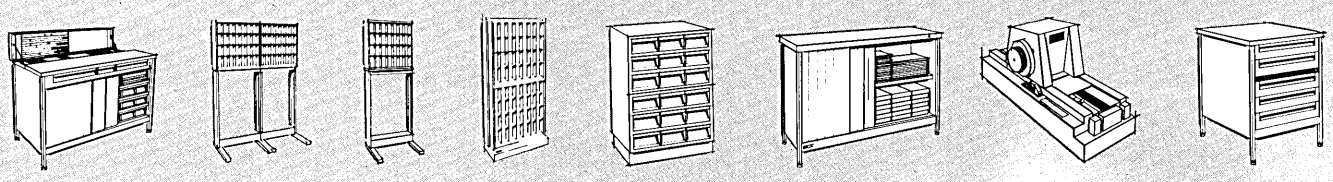

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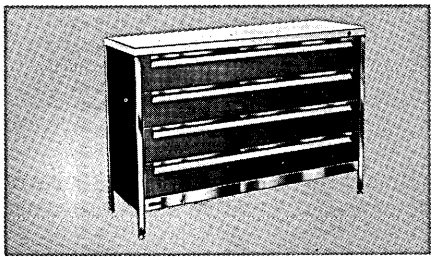

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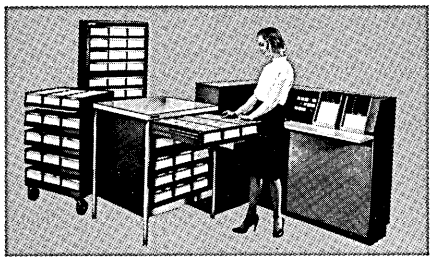

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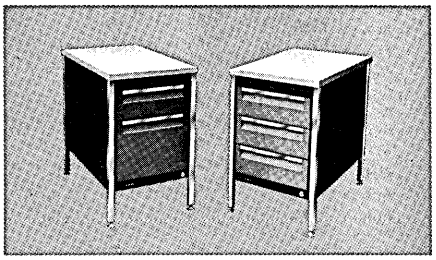

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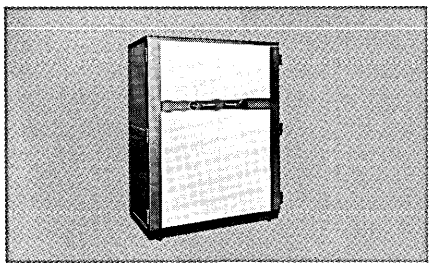

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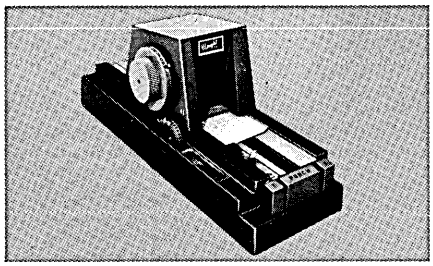

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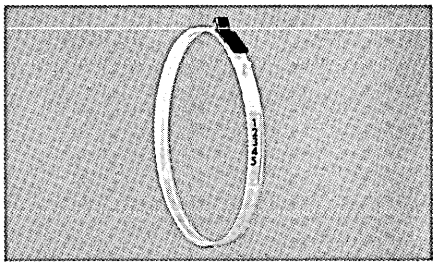

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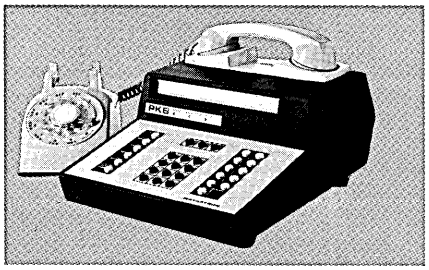

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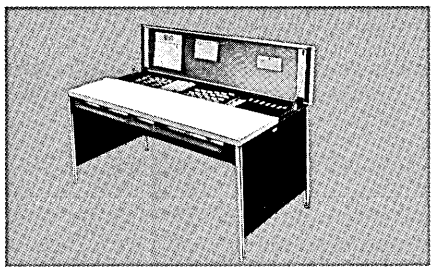

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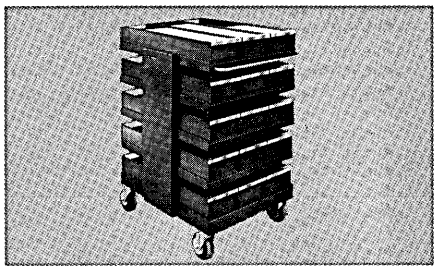

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existence only one ship actually made its way to South America and that on only one voyage. Nevertheless, due to constant happy rumors solicited by the firm's directors, the public never lost confidence. In 1717 Parliament, faced

with a huge national debt, voted to allow the South Sea Company to increase its public subscription by two million shares in return for which Parliament would be granted a huge loan. With the publicity of this before the public, the directors began in earnest to circulate rumors about the future trade possibilities of the company. The new shares were vastly oversubscribed. Exchange Alley was in a fever of excitement. The stock rose to 300, then to 400, then 550. In five days it went to 890. In the short span of weeks other corporations, even more precarious, sprang up and were oversubscribed. One was for a "wheel of perpetual motion." One was "A company for carrying on an undertaking of great advantage, but nobody to know what it is." And nobody cared. Obviously the bubble had to burst and it did and many people were reduced to beggary by the inevitable climax. The fall of the South Sea Company shook more than the unwary speculators though; it shook the Parliament itself. Even some of the members of Parliament were found to have been involved. The memory alone of this tremendous fraud was all that was necessary to inhibit private investment in Europe for years to come.

Transportation is an obvious reason for the increase in complexity of business information systems and communication is closely allied with it. Good transportation has allowed components of a business system to reside at great distances from each other and therefore has increased the necessity for information with which to control these components. Good communication has enabled this information to be transmitted to and from the deciding element of the system, its managers, so that the actions of the various components can be interpreted and controlled. It is possible today to order a repair part in Los Angeles that is stocked only in Boston and have it the next morning. It is possible for a computer in Chicago to control the issuance of an airline ticket in Houston. There are very few things in either of the fields of transportation or communication that are impossible to imagine.

All this has not always been so, as we are well aware. It is not too very long ago that it would have been impossible even to do the imagining. Probably Alexander Botts would never have sold a tractor if his boss had been able just 40 years ago to keep tabs on his salesmen as we are able to do now.[8]

Few people, I think, realize that the travels of Marco Polo to the Orient took 25 years. The information which he supplied the western world about China is remarkable in that he was six centuries ahead of any other such traveler. Compare, though, how much business information passes from a British manufacturing company to its Hong Kong subsidiary in a 24-hour period today.

Some may say that Marco Polo was better off. But a company that would have benefited by better communication and transportation to the extent of saving itself from bankruptcy was "The Societas of the Sons of Bonsignore."[9] This "societas" or partnership in Siena, Italy, in 1298 was forced into bankruptcy because all of its creditors chose simultaneously to make a run on it for payment of debts. The societas had adequate assets to cover its liabilities, however " . . . it must first recover in different parts of the world from kings, counts, barons, and from other societates and individuals." Recovery was in that day impossible in less than months due to lack of good communication and lack of fast transportation and so the firm failed.

conclusion

These early information systems have much in common with those we study and in which we participate today. The most common thread is the concept that information is a source of power. We now use the term control but we are really only being more precise in interpreting the basis behind power. Power necessitates control. Fugger's information gave him the power to outmaneuver his competitors and enemies. A modern firm's market research system gives it the power to do the same thing. In Jost Amman's allegory the majority of the activities are involved in control. The power to dominate one's competitors or to push back frontiers of science cannot be efficiently exercised today unless the business is in control. In fact, a business system is even powerless to survive if it does not have access to the information necessary to control its own operations.

The prime goal of any information system, whether modern or medieval, must be to keep the business system of which it is a component in or near a steady state. This is control. Steady state does not mean a status-quo relationship. It does, however, imply a relationship where the business system will be supplied information so that it can adjust to external and internal change. These examples of early information systems which have been outlined were all striving to maintain a form of steady state that would allow them to adjust to stress without it disintegrating the system.

We now have complex computerized information systems to provide this control. The vast increase in the number of variables in our modern business systems over their historical counterparts has necessitated more complex information systems. The goals of these systems, however, have not changed perceptibly from the past. The insights which we can garner from a study of these historical examples of information systems can be as meaningful to modern analysts as the study of political history is to the politician or the history of warfare to a general. ■

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[8] William Hazlett Upson, "I'm a Natural Born Salesman," *The Saturday Evening Post*, from *The Best of Botts*, David McKay Co., New York, 1961.

[9] Robert S. Lopez and Irvin W. Raymond, eds. and trans., "Joint Liability: The Ruin of a Great Merchant Company," in *Medieval Trade in the Mediterranean World*, Columbia University Press, New York, 1955, pp. 298-302.

A new Ampex computer tape drive for $3500.* Wow!

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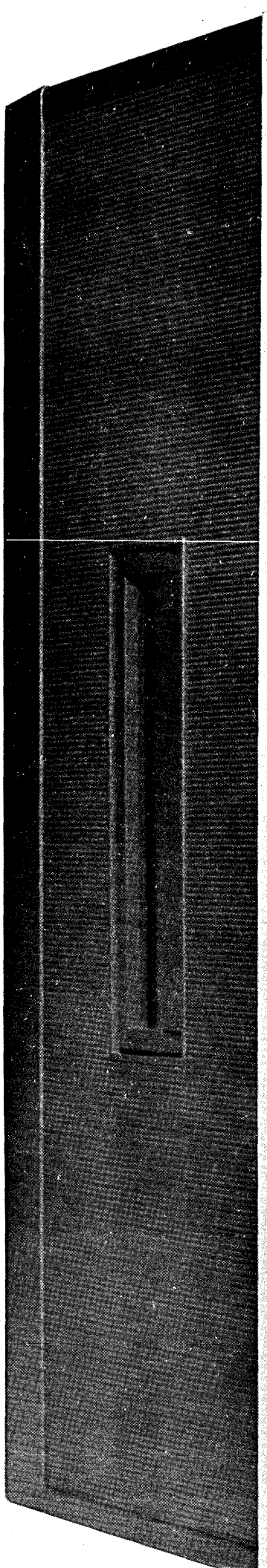

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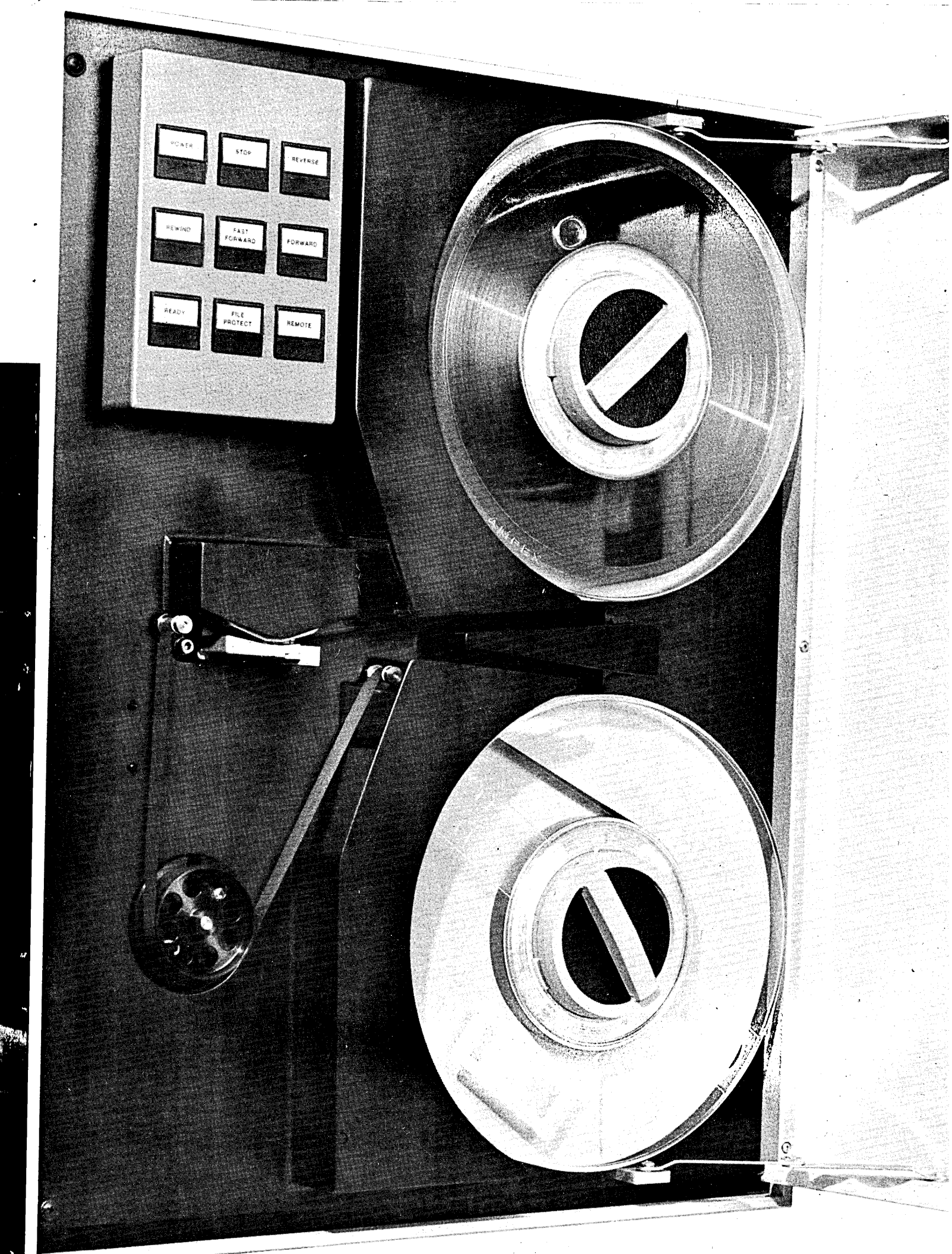
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FIVE NEW COMPUTERS

LOCKHEED'S MAC 16

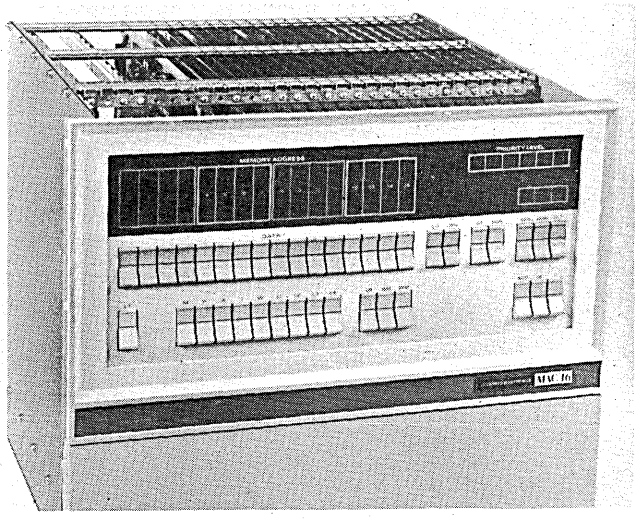
From the smog-cloaked Los Angeles factory suburb of Commerce came the report this month that the Lockheed Electronics Co. is entering the computer market with the MAC 16 (Multi-Application Computer), a machine named to be a buddy that Lockheed is sure will fly high in competition with Varian's 520i, DEC's PDP/8i and others. Lockheed Electronics' Data Products Div. has long manufactured ferrite core memories and printed circuits for other computer companies and MAC seems a natural step for the firm to take. The move is calculated to help increase parent Lockheed Corp.'s commercial volume (vs. governmental) to the desired 50%, and the machine is the first of a family intended for OEM. The division is adding 18 people to the marketing staff, which is under the direction of William Sewalk, for MAC. Lockheed Electronics, under pres. Alan J. Grant, employs 1,200 and is financing the effort from its own revenue.

what it is

MAC is a 16-bit parallel word IC machine with a 1 usec cycle time, 2 usec add time, and a 4K word memory expandable to 65 K. It was designed for a real-time multiprogramming environment with such applications as data acquisition, communication, instrumentation, process control and automatic test systems. The basic system includes a programmed data channel (PDC) that can provide communication to and from up to 255 external devices, with four true-nested priority interrupt levels that automatically store the machine state upon interrupt and can be expanded to 64 levels. The interrupt response time is less than 5 usec. In the basic MAC system, the multiplexed data channel (MDC) is an optional device that controls data communication between memory and up to 16 device controllers independently of programmed operations. Interface to the PDC and MDC buses is identical, allowing device controllers to be connected to either.

absentee software

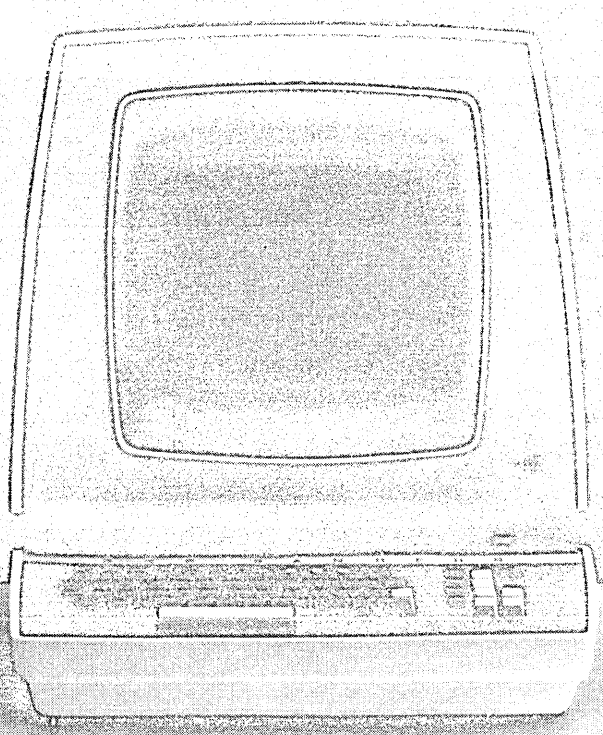
The software for MAC was developed by Lockheed Electronics and includes the LEAP (Lockheed Electronics Assembly Program) symbolic assembler with macro capabilities, debug and editor programs, math library, I/O driver,



hardware diagnostics and a program loader that features relocation, linking and automatic depaging. A standard FORTRAN IV compiler will be available for an 8K memory MAC using paper tape or card peripherals. The LEAP assembler and MACSIM, a simulator program, will also be provided in FORTRAN IV and will operate on large systems such as 360/50 and above and the 1108, enabling a user to de-

(Continued on page 76)

If you just know Sanders for display terminals



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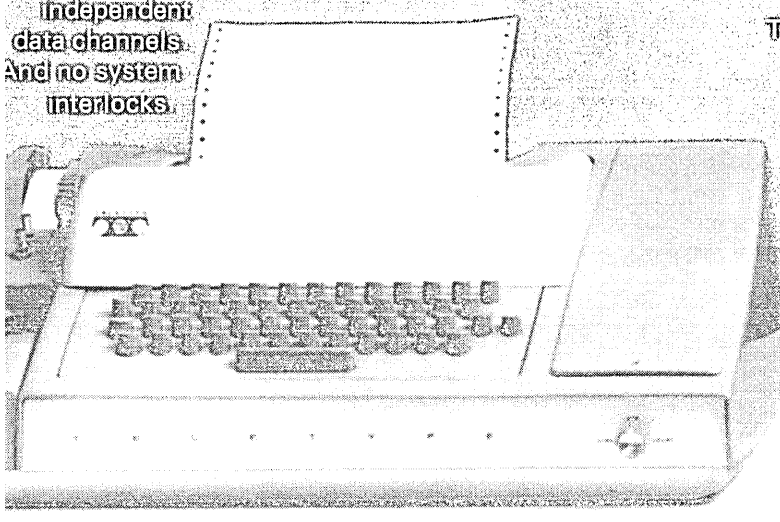

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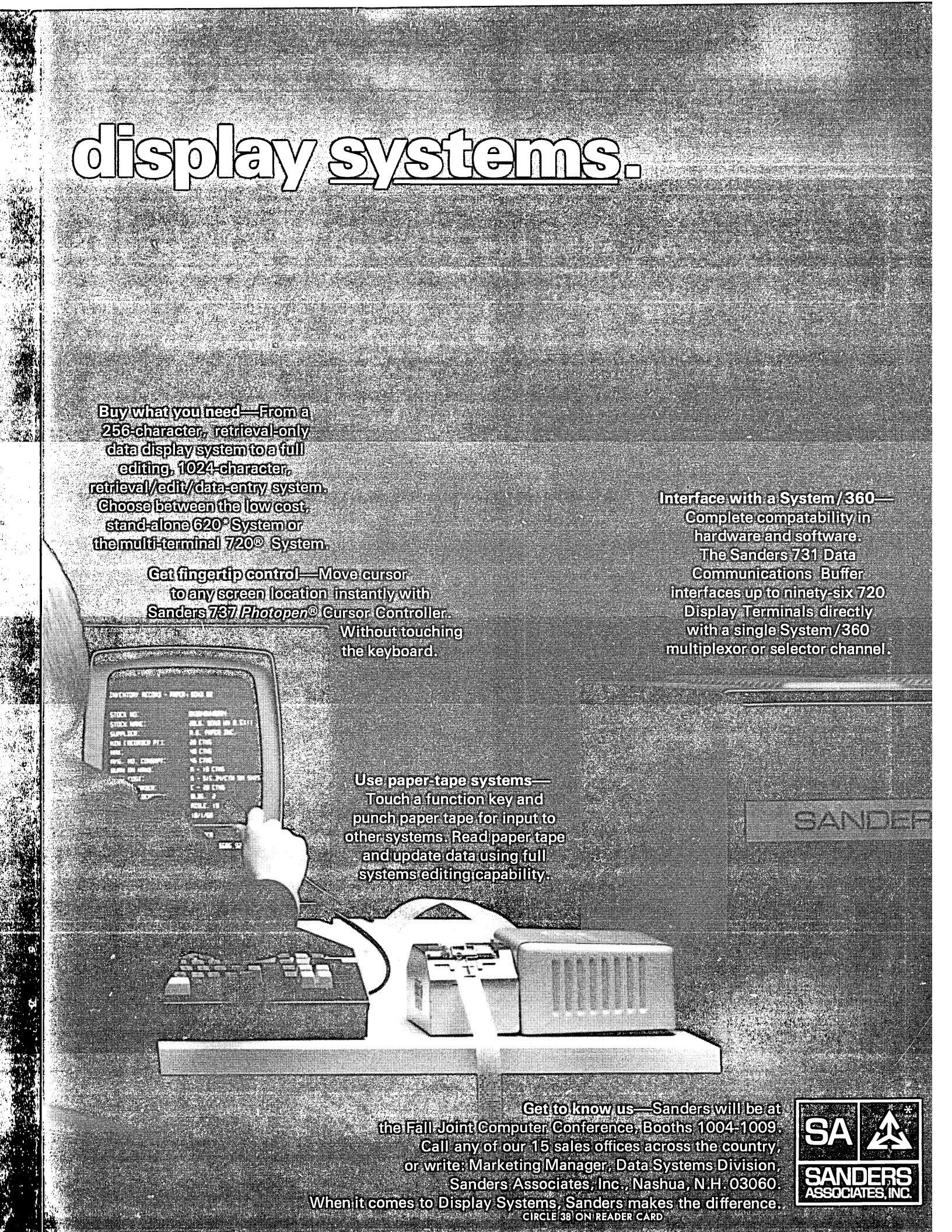

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CIRCLE 38 ON READER CARD

velop software independent of MAC's availability.

The machine has 86 instructions in the basic repertoire with multiply/divide available as options, and address features include 512 word pages, fixed and floating point base page, up to 8 base pages, a 16-bit index register per program level, and bi-level indirect indexed addressing.

The unit weighs less than 50 lbs. and its dimensions are 17½" x 19" x 19". Power requirements are 105-120 v, single phase, 45-440 Hz, with power dissipation of 930 watts.

how much

The basic MAC 16 includes a 4K memory (an 8K memory can also be contained within the mainframe), power supply, a line printer, a paper tape reader/punch, an operator control panel and an ASR Teletype keyboard. It is priced at $11,950 in single-unit quantities. An 8K sells for $15,900. The first showing of the machine will be at the Fall Joint Computer Conference and initial deliveries are scheduled for March '69. The computer will be manufactured in the company's 330K square foot facility in lovely downtown Commerce where the memories and PC boards are also made. For information:

CIRCLE 171 ON READER CARD

DATA GENERAL'S NOVA

Data General Corp., a company just started four months ago in Hudson, Mass., has announced NOVA—billed as the first small-scale gp computer with multi-accumulator organization.

The 16-bit NOVA uses "medium-scale integration" and is a real midget; the basic package will fit a standard 19" rack and is only 5¼" high. The central processor takes up two 15" × 15" boards, and one board the same size holds a 4,096 word core memory. Another of these boards will accommodate eight I/O devices and there is room left over for several more boards of additional I/O or memory. Thus, the flat packaging could have 16K or, in a 10½" version, 32K. A read-only memory with 2.6 usec cycle time is included and the company will wire it when the customer has his programs debugged.

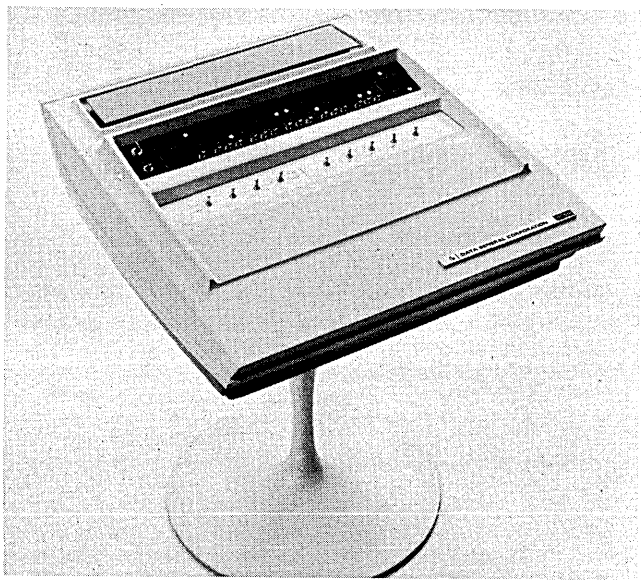
Options will include memory in 1, 2 or 4K units; Teletypes, paper tape, plotter, card reader, printer, crt, real-time clock, disc, converters, and Dataphone interface.

Data General says it will have complete hardware diagnostics in its available software; also utility routines, math routines, an assembler, context-oriented text editor, and multiple-breakpoint debugger. It's suggested that the OEM user may want to just insert a memory card holding the debugger when he's working out a program and take it out when the program is ready to go.

The company was founded by a group from Digital Equipment Corp. and Herbert Richman, formerly eastern sales manager from Fairchild. The DEC escapees and their previous jobs are Edson de Castro, head of small computer design; Henry Burkhardt III, head of small computer applications programming; and Richard Sogge, head of memory and circuit development. They have since added Allen Kluchman as marketing director; he was DEC's advertising and sales promotion manager. President of Data General is Frederick Adler.

To build the NOVA and others later, the new company is busily putting up a new plant in Southboro, Mass., of 10,000 square feet on a 15-acre site. So production won't get started until December.

Competition for the new machine will be from DEC (of

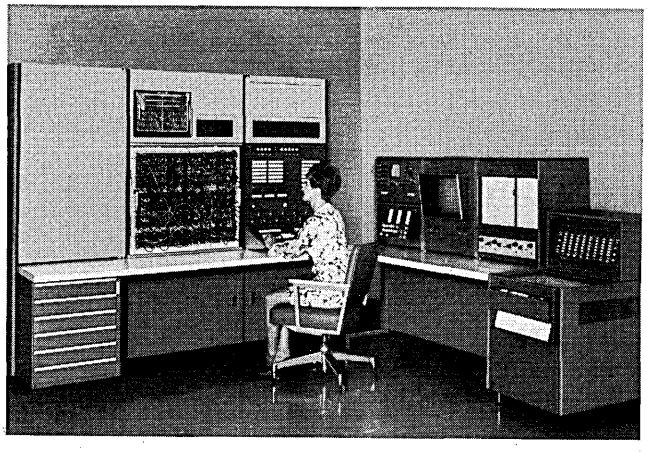


course), Hewlett-Packard, and Varian—plus the many others blossoming out with low-cost units. A basic 4K, rack-mount version with Teletype interface will sell for $7,950. For information:

CIRCLE 172 ON READER CARD

EAI'S ANALOG/HYBRID 7800

Electronic Associates, Inc. has added another machine to its family of analog/hybrid computers. The 7800 is a 100-volt large-scale computer system designed for engineering and scientific applications. The system offers 30–294 operational amplifiers, expandable as needed. The basic console is wired for a minimum configuration, but may be expanded



by adding plug-in modules. The console also has centralized master control and monitoring, central overload-indicator panel and automatic program hold. Computing components include a five-digit digital voltmeter, two-input electronic comparators, digitally controlled attenuators, gp registers and gp logic gates (AND, NAND, OR and NOR).

Peripheral equipment available with the 7800 includes a

four-channel rep-op display score with electronic grid generation, a four-channel memory scope for storing and photographing high-speed solutions, two x-y plotters and two eight-channel recorders.

At the Fall Joint Computer Conference, the 7800 system will be demonstrated in its hybrid configuration, using an EAI 640 digital computer for problem set-up and control. The 640, announced in 1966, has been used as the digital processor in other EAI hybrid systems, such as the 680 and 8800. It is a 1.65 usec 16-bit machine with a core memory expandable from 4K-32K words.

EAI, in announcing the 7800, stated that the system, with "its simplicity of operation, its conventional patching and a broad range of peripheral equipment for data reduction, readout and recording, make it a machine with a high degree of open-shop orientation."

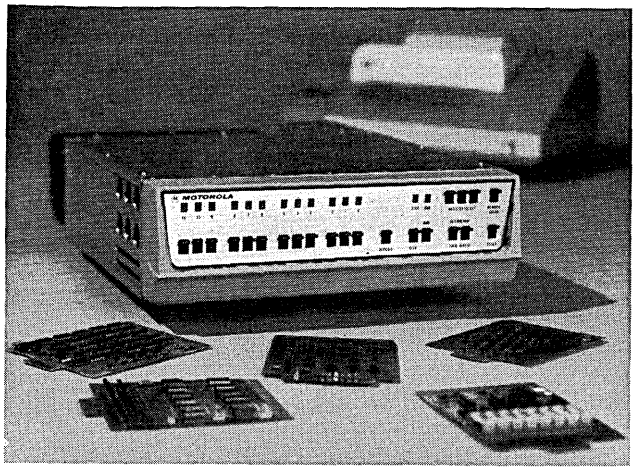
The basic configuration is priced at $160K; deliveries are scheduled to begin in March '69. For information:

CIRCLE 173 ON READER CARD

MOTOROLA MAKES THE MINI SCENE

As predicted in DATAMATION (Sept., p. 19), Motorola Instrumentation and Control, Inc. in Phoenix, has thrown in its lot in with the burgeoning small computer market. Motorola's entry is the MDP-1000, a 4K (8-bit) word memory (expandable to 16K) and 12-bit register words to provide, according to the company, greater programming power. Cycle time is 2.16 usec. Truly a small machine, the i.c. 1000 holds a data processor, power supply and TTY interface in a 5" x 17" x 21" unit.

Software available with the system includes an assembler, debugging and utility routines and a math package. Because the MDP-1000 is logic-oriented rather than computation-oriented, Motorola expects the unit to find primary



application in the field of communications control, as a message concentrator, a relay center controller, or as a multiplexer for peripheral devices (e.g., the recently announced MDR-1000 card reader). With the basic configuration is included a line of interface modules, and initially, the computer will be marketed as a system component for data communication terminals. The company suggests that the computer can also be used in such applications as supervi-

sory control, automated fleet and bulk terminal loading, and data logging systems.

The basic system is priced at $8,400; deliveries, which the company candidly admits are "subject to change," are now stated at 90 days ARO. For information:

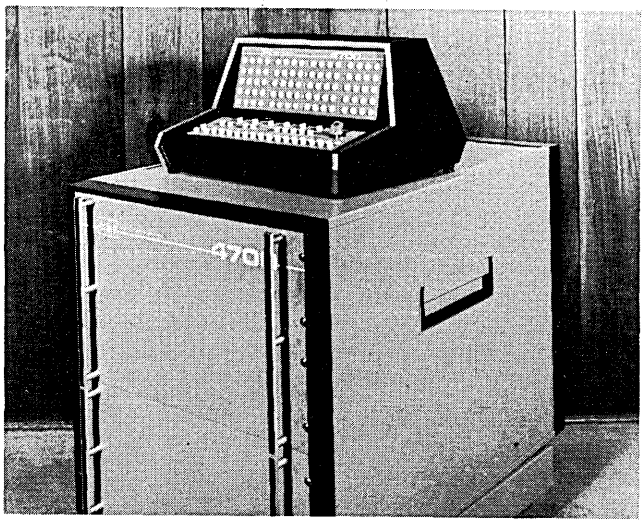
CIRCLE 174 ON READER CARD

SCC ENTERS 16-BIT COMPUTER MARKET

The SCC 4700 16-bit, 920 nsec computer is the newest thing in SCC's line, but is not expected to be the "newest" for long. They are reportedly about to receive a big block of funds from University Computing, which, if it occurs, should spur them to more new releases.

John Baird, president, claims that the 4700, pegged at $15K for the cpu and 4K, "offers a price/performance ratio unequalled by any 16- or 18-bit computer." The memory map and program protection features of this machine, coupled with a real time monitor, allow for a foreground/background processing environment. Job swapping makes multiprogramming possible, and prepares for the eventual addition of t-s. At present, programs may be compiled, assembled, and debugged in the "foreground" while real time activity such as data acquisition or message switching is carried on in the "background."

The designers have made use of a bit slice arrangement whereby four bits of each register (plus gating) appear on one circuit card; obviously, this makes four cards necessary for a processor section. From this arrangement, they realize card standardization, ease of maintenance (in tracking bit



bugs), and speed—high speed transfers are made over card paths, not wires. In addition they get to use bussing for gating terms.

Other design features incorporated in the 4700 include: a hardware multiply/divide; double precision and floating point arithmetic packages; 32 full duplex lines per channel; one or two multiplexer channels that can handle 64 devices per channel operating simultaneously in a block transfer mode; up to three high speed selector channels, which will handle 64 devices per channel; and microprogramming to implement optional instructions. Memory is expandable to 65K. For information:

CIRCLE 175 ON READER CARD

A VISIT TO JAPANESE COMPUTER CENTERS

with hostesses

by T. TAMARU

In the December, 1967 issue of DATAMATION, an article titled "Computers in Japan" by Mr. G. B. Levine, discussing the computer market and usage in Japan, interested me greatly since I was planning a trip to Japan the following April. I therefore adjusted my travel plans to include visits to several Japanese companies and government agencies that have been using computers in their operations.

My itinerary consisted of visits to four organizations; two were public agencies and two were private companies. The public agencies were the Tokyo Metropolitan Government Computer Center, and the Tokyo Metropolitan "Keishicho" (Police Department). The private companies were the Tokyo branch of the Sumitomo Bank, and the headquarters of Honda Motors. Japanese protocol and tradition, unlike our informal western mode, calls for proper introductions and references in advance of any contemplated visit. This is necessary, especially, if you hope to see the people at the management levels of the organization.

metropolitan government computer center

Through proper letters of introduction from Mayor Sam Yorty of the City of Los Angeles, Governor Minobe's chief of protocol made arrangements for me to visit the Metropolitan Government Computer Center which is under the direction of Mr. Soichi Sase. Mr. Sase is chief of the primary computer center within the Tokyo metropolitan government structure. There are also several other centers of a functional nature within the government. The basic applications and the percentage of time they utilize in the center is: income, property, and business tax (30.8%); motor vehicle tax (18.1%); payroll and personnel records (21.0%); test and debug (23.1%); and various types of governmental statistics (7.0%). These applications apply to a metropolitan government which is servicing approximately 12 million people. The payroll itself is for approximately 200,000 employees.

This workload is currently done on HITAC 3010 domestic hardware manufactured by Hitachi Ltd. under a license

Mr. Tamaru is general manager, department of data services, City of Los Angeles, and a part-time member of the faculty at USC's school of public administration. He is also a member of the governor's board on intergovernmental edp and chairman of that board's technical advisory committee. He has a BS in industrial engineering from UC Berkeley and an MBA from USC.

agreement with RCA. Three HITAC 3010's, each with four to six tape drives, printer, and card read/punch devices, including several paper tape readers and punch, make up the center's configuration. The computers are used one shift, six days, with some overtime. Organizationally, the center consists of approximately 61 people, functionally separated into general affairs, research, planning, operations, I/O control, and keypunch. The management consists of a chief and a deputy chief, and the center was established five years ago.

In reviewing some of the policy documentation of the center, it was interesting to note that goals and objectives were similar to those set forth by the Intergovernmental Board of Electronic Data Processing, State of California. Here are some excerpts from the policy documents:

"The improvement of welfare of people residing in its area, and its administration is requested to have the greatest effects with the minimum expense . . ." ". . . further, how to supply an effective administration with limited personnel and financial resources . . ." "The Metropolitan-Information-Exchange system is to be developed, and thus a rational and uniform system to deal with information is to be established . . ." "An intense utilization of computers for Information Retrieval, Operations Research, and Simulation is becoming one of the most reliable measures in the field of scientific management of business, and the application of such measures to the governmental administration will be an inevitable matter in the future."

To one acquainted with the Japanese bureaucratic culture, these statements of policy certainly indicate that space-age Japan is rapidly becoming a major user of computer technology.

computer usage in the "keishicho"

Through the efforts of Dr. Paul Whisenand of the School of Criminology, California State College at Long Beach, I visited the Keishicho, where deputy superintendent Teiichi Azeyanagi, chief Takahara, and deputy chief Itonaga of the computer section welcomed me and exhibited great eagerness to exchange information with American counterparts in the fast-growing field of computer use in law enforcement.

The Tokyo Metropolitan Police Department is responsible for maintaining law and order over an area of approximately 625 square miles consisting of 23 wards (Ku's), and 12 million inhabitants. The department has an authorized personnel strength of 36,336, of which 3,050 are civilians, to accomplish its responsibilities.

The computer section of the Keishicho is headed by Azeyanagi and Itonaga. Computer technology in this department is only three years old. However, despite the recent entry into the automation field, the Keishicho compares quite favorably with its counterparts in American cities with the exception, perhaps, of the larger and more sophisticated U.S. installations. The hardware is a domestic, NEAC-2206, which is a Honeywell H-2200 manufactured in Japan. The configuration consists of six tape drives, photo paper tape readers, one high-speed printer, and one card reader/punch. Other peripherals include IBM 024, 029, and 056 card punch/verifiers, 15 Japanese Teletype paper tape punchers, and several transceivers. All software is written in assembly level coding and is a domestic product. A total of 62 personnel in the center are organized as follows: programming section (6), operations (7), keypunching (32), operations research (4), and clerical and management (13). The computer center operates 10 hours per day, six days per week. The applications existing as of April, 1968 totaled 19, including personnel data, examinations, payroll, crime analysis, modus operandi, stolen articles, analysis of traffic accidents, and incident forecasts. One of the unique applications was crime analysis, which consists of some 26 to 30 computer produced matrix type reports on various types of crime. It was interesting to see that one of these analyses was on "group violence."

All applications were card or tape file oriented and processed in batch mode. No rapid access mass storage devices, or on-line, real-time capabilities existed. These approaches were being planned for the future.

sumitomo bank—olrt

Through the auspices of Mr. Robert Kikuchi of the Los Angeles office of Sumitomo Bank, arrangements were made for me to meet with Mr. Iwan Nagano of the bank's foreign relation department, and Mr. Fuji, manager of the Sumitomo Bank computer center in Tokyo. Clearly, this is one of the most advanced and sophisticated computer installations in Japan. It uses four NCR 315 RMC, 120K core main frames with 24 CRAM units on-line in real-time through a national data communication network of domestic T.P. devices. The Tokyo center is the smaller of the two computer centers operated nationwide by Sumitomo. The headquarters center is located in Osaka and employs the same concept. The Tokyo center services 58 branches; 48 of them are on-line for savings, time deposits, checking, and demand deposit accounting using NCR terminals. An NCR Check Sorter/Reader is also used. In addition, banks of paper tape Japanese teleprinters are used for I/O to the system for inquiries and off-line applications. The domestic teleprinters print in Japanese characters and numbers with some versions printing in English alpha and digits. Interfaced with the four NCR 315 RMC's, through a domestic "black box," are two NEAC-2200 systems, each with two high-speed drums, four tape drives, printer, and paper tape reader to print out certain records in Japanese "Kana" (characters), instead of English.

Approximately 100 people, mostly programmers, report to Mr. Fuji at the Tokyo center. The Tokyo center does no keypunching. It is all done at the Osaka home office with approximately 40 girls employed.

Despite the fact that this was basically second generation hardware, this writer was impressed with the Sumitomo operation, especially the data communication system.

honda motors

The headquarters office of Honda Motors located in Yaesu, Chuo-Ku, Tokyo was operating one IBM System/360, Model 40 with 128K memory, four tape drives, eight 2311 disc drives, a printer, and a card reader/punch. The operating system in use was DOS, and COBOL was the primary language. Three IBM 1050's with paper tape I/O and card reader were used in a teleprocessing network to the branch offices for sales order and analysis. Teletypewriters were also employed in this network, which was off-line to the computer.

This operation consists of approximately 50 personnel, of which 20 are keypunch personnel. The center operates two shifts, five to six days per week.

In addition, Honda Motors has—at decentralized locations—one IBM 1401 system, basically for maintaining the company parts inventory, one NCR Electronic Bookkeeping Computer dedicated for payroll processing and one CDC computer for engineering and research.

Although the IBM 360/40 is used, the application approach was of second-generation vintage. Mr. Nakahara, the assistant manager of the center, indicated future plans called for addition of IBM 2314 DASD and on-line teleprocessing operations.

After visiting only four centers, I realize that any general-

ization is risky. However, I am going to make a few general comments about my observations of the Japanese computer centers.

The first thing one notes at each of the computer centers is that they are clean, neat and tidy. Since most computer centers use raised flooring, it is necessary to step up into the center. It might be a hangover of Japanese tradition, but everyone who enters a computer center (including the operating employees) takes off his street shoes and wears slippers that are furnished at the entrance. The floors of the centers are, therefore, immaculately clean. However, the operators shuffling along because of the slippers give the impression they are on skates.

Traditional Japanese formality to visitors was evident on all visits. Upon being properly introduced to the ranking person, tea is served in a separate room where small talk is engaged in for perhaps an hour or so before we get down to the specifics of finding out what the hardware configuration is, what the specific applications are, and other "bits" and "bytes." Traditionally, the Japanese do not like to rush into the problem or discussion without some preliminary conversation and tea (very good tea, incidentally, and served by very polite hostesses). Another interesting point was that at each installation I was first met by a management level staff member who acted as an intermediary with the computer center manager, with whom I wished to speak.

The actual operation of the computer center itself and the organizational practices were interesting in some respects. In all of the installations, many of the programmers who wrote and implemented the programs stayed with that job and operated the computer to run the job on a production basis long after the job had been checked out for production. This smacks of the first generation "650 days" when each programmer ran his jobs on the IBM 650. Computer operators as a distinct specialization are just coming into being, at least in the four installations I visited. Even in Japan, programmers are in short supply and therefore command relatively high salaries in comparison to other professions. I suppose the use of programmers as operators could be rationalized as a result of the extreme difficulties most installations have had in getting jobs and applications flying on a scheduled production basis. One installation took one year from the time it received its hardware to get an application running, and this was not considered unusual. Use of programmers who know the job appears to give management a sense of security that the job will run when programmers operate the computers. Again, because of different business ethics, an employee seldom leaves the employ of his first employer and this loyalty makes labor turnover rates almost nil. "Head hunting" and "pirating" of skilled personnel appears to be unknown, at least to this writer.

From the discussions held in the four installations, most computer centers in Japan are using second-generation hardware with a one-for-one job approach. System integration and management information systems concepts are just coming to the forefront among the more advanced units. Governmental installations seemed to be handicapped somewhat in hardware and software capability due to the predominant use of domestic computers in these agencies. The combination of budgetary constraints and government urging towards use of domestic edp products precludes many public agencies from using U.S. computers such as IBM, RCA, Burroughs, Univac, etc.

Admittedly, this was a rather impromptu look at a few Japanese computer centers. However, with the emergence of Japan recently as the third ranking user of computers in the free world (the U.S. and West Germany being the first two), it is this writer's opinion that the U.S. edp industry can play a much heavier role in this far eastern industrial/commercial empire. It will be interesting to see who has the last "banzai." ■

THE U.S.A. STANDARD-COBOL

The last six years of work of the USASI Working Group X3.4.4, Processor Specifications and COBOL, was climaxed on Aug. 23, 1968, by the approval of the USA Standard on COBOL, officially referred to as the USA Standard X3.23—COBOL.

This report is intended to serve as an introduction to the structure and content of the COBOL Standard. Further, a discussion is provided of the modifications X3.4.4 made to the proposed USA Standard COBOL, which was published as COBOL Information Bulletin #9, by the Association for Computing Machinery, Special Interest Committee on Programming Languages (SICPLAN) in the SICPLAN Notices.

structure of the cobol standard

The historical presentation of the COBOL specifications—that is, Identification Division, Environment Division, Data Division, and Procedure Division—has been revised within the Standard in order to present more effectively the uses for which COBOL has been designed. The new organization is oriented around a functional processing module concept. A nucleus and seven functional processing modules are defined. These functional processing modules are Table Handling, Sequential Access, Random Access, Sort, Report Writer, Segmentation and Library.

Nucleus	Functional Processing Modules						
	Table Handling	Sequential Access	Random Access	Sort	Report Writer	Segmentation	Library
Level 2	Level 3	Level 2	Level 2	Level 2	Level 2	Level 2	Level 2
	Level 2		Level 1	Level 1	Level 1	Level 1	Level 1
Level 1	Level 1	Level 1	Null	Null	Null	Null	Null

TABLE 1. Structure of the USA Standard on COBOL.

As can be seen in Table 1, the Nucleus has been divided into two levels. Each functional processing module contains two or more levels. In some functional processing modules, the lowest level is a null set of specifications. However, in all cases, the lower level is a proper subset of the higher levels of the same module. For example, the lower level of the Nucleus contains the elements of the language required for basic internal processing. The higher level contains the elements of the language required for the full capability of internal processing. The lower level is a proper subset of the higher level.

This organization provides the flexibility necessary to tailor specifications —and, hence, the compilers implementing these specifications—in such a way that they will satisfy the requirements of a large variety of data processing applications. At the same time this organization provides logical groups of language elements that can be referenced simply: therefore, quick determination can be made which standard elements comprise a given compiler with a greater degree of certainty than previously possible. A COBOL compiler that includes all the language features specified in a given level of each of the functional processing modules and the nucleus is considered to meet the requirements for an implementation of USA Standard COBOL. All the language features must, however, be implemented as defined in the Standard.

It can be seen from the structure of the COBOL Standard that many different sets of combinations of the nucleus and functional processing modules can be defined. The Standard defines two sets of combinations and refers to them as: the minimum USA Standard COBOL and the full USA Standard COBOL. The following definition is given in the Standard for these two sets of combinations:

"The minimum USA Standard COBOL is composed of the minimum level of each functional processing module and of the Nucleus. Because of the presence of null sets, the minimum standard consists of the low levels of the Nucleus, Table Handling, and Sequential Access. The full USA Standard COBOL is composed of the maximum level of each functional processing module and of the Nucleus."

content of the cobol standard

A brief description of functional capabilities included in the nucleus and each module of the Standard is as follows:

Nucleus. The Nucleus provides the basic language capabilities for the internal processing of data. This processing is accomplished through the use of statements that cause the logical path of the program to be altered, data to be transferred from one location of computer internal memory to another, and arithmetic functions to be performed. Facilities are provided for input and output of low-volume data. The Nucleus also defines the basic concepts of the language, the techniques for describing the structure of data, and the structure of the four divisions of a COBOL program.

Table Handling. The Table Handling module provides the language capabilities for defining tables of contiguous data items and for accessing these data items relative to their position in the table through the use of either subscripting or indexing. The facility is also provided for searching a table for a table element that satisfies a specified condition.

Sequential Access. The Sequential Access module provides the capability to access records of a file in an established sequence. The sequence is established as a result of writing the records to the file. The processing of sequential files is provided for through the use of statements that open, read, write and close the files. The facilities are also provided for specifying the device to which a file is assigned, the format of the records in the file, the sharing of memory area among files, and the point in processing at which a checkpoint is to be taken.

Random Access. The Random Access module provides the capability to access records of a mass storage file in a random manner according to a programmer-supplied key. In addition to providing for the processing of random access files through the use of statements that open, read, write, and close files, the facilities are also provided to update a record of the file and to initiate the seeking of a record of a file for subsequent reading or writing. The facilities are also provided for specifying the mass storage device to which a file is assigned, the actual key of the record to be retrieved or written, the format of the records in the file, the processing of labels on the file, the sharing of memory area among files, and the point in processing at which a checkpoint is to be taken.

Sort. The Sort module provides the capability for ordering the records of a file according to a set of user-specified keys. The keys are data items within each record being sorted. Optionally, a user may apply some special processing to each record of the file by input or output procedures. These procedures may consist of addition, deletion, creation, altering, editing or other modifications of individual records. These procedures may be applied before and/or after the records are ordered by the sort. Facilities are also provided for specifying the devices to be used by the sort, the sharing of memory area among the sort files and other files of the program, and the physical structure of the sort file.

Report Writer. The Report Writer module provides the facility for producing reports by specifying the physical appearance of a report rather than requiring specification of the detailed procedures necessary to produce that report. Two types of entries are provided for describing each report. One of the types of entries allows for specification of such physical characteristics of the report as the number of lines that are to appear on a page and the placement on the page of a group of items in the report. The other type of entry allows for the description of logical groupings of data items in the report. The types of report groups that can be specified include page headings and footings, report headings and footings, control headings and footings, and detail lines. A report group is presented as an individual unit and may consist of one or more data items to be presented on one or more lines in the report.

Segmentation. The Segmentation module provides the facility for specifying the segmentation requirements for an object program. Facility is provided to specify that the sections of the Procedure Division either cannot be overlaid by any other part of the program or that they can be overlaid. If a section is identified as a section that can be overlaid, facility is also provided to specify whether that section is to be provided in its "last-used-state" or its "initial-state."

Library. The Library module provides the facility for specifying text that is to be copied from the COBOL library. The library contains text that is available to a source program at compile time and the effect of the compilation of library text is the same as if the text were actually written as part of the source program. An entry in the COBOL library may contain source program text for the Environment, Data, or Procedure Divisions or any combination thereof.

modifications since cib 9

The proposed USA Standard COBOL was published for the purpose of soliciting comments and criticisms from the data processing community. This was done so that, to the maximum extent possible, the standard would reflect public consensus.

As a result, many comments and requests were received from organizations using or implementing COBOL and from various USASI committees. The majority of the comments pointed out areas in the proposed Standard that needed clarification or refinement. With the cooperation of the CODASYL COBOL Committee, clarifications and refinements have been provided and X3.4.4 has applied these clarifications and refinements to the Standard.

As published in CIB#9, the proposed USA Standard COBOL had eight instead of seven functional processing modules. The additional module was the Random Processing module. Several comments were received expressing concern about the adequacy of the random processing specifications. After careful review and consideration of these comments on the specifications, the Random Processing module was removed from the proposed Standard. The random processing specifications are, however, attached to the Standard as an appendix.

The comments on the random processing specifications have been forwarded to the CODASYL COBOL Committee for their consideration. The CODASYL COBOL Committee has organized a task group to resolve the ambiguities and inadequacies pointed out in the random processing specifications.

conclusion

Out of the years of work and negotiations concerning the content of the Standard, a reasonable COBOL specification has been adopted in the approved USA Standard COBOL. It is now up to the members of the data processing community to use the Standard and to comment on its effectiveness. ■

PRESENTING PAPERS FOR PLEASURE AND PROFIT

obscurantism triumphant

by DAVID M. JONES

Have you noticed how many people are presenting papers at technical conferences nowadays, and have you wished you could do the same? If so, you may find the following notes useful.

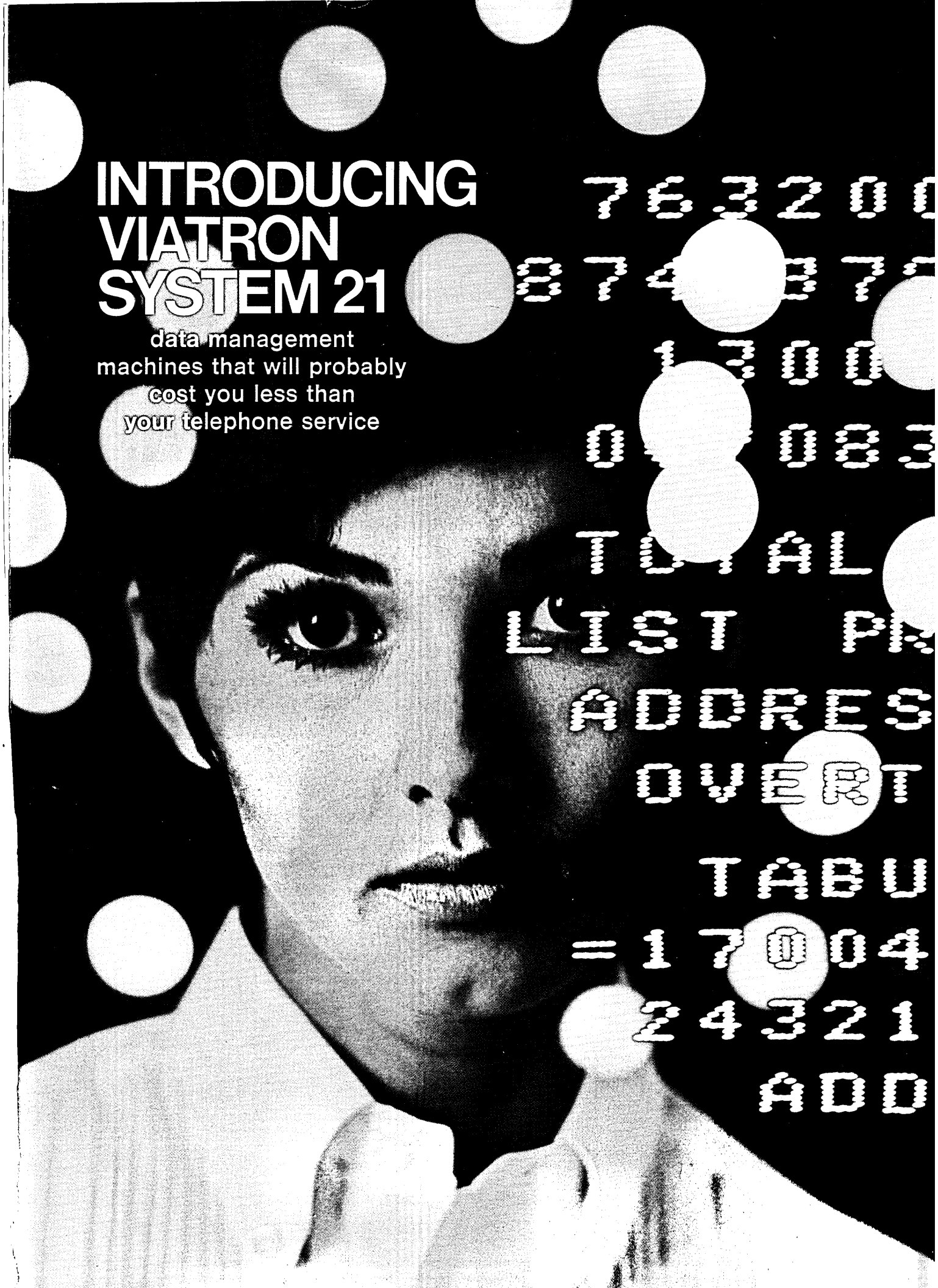
The first thing you have to do is *pick your conference.* Your choice here should depend mainly on your geographical preferences—the Balkan countries and non-warring parts of Asia are "in" at the moment—but if you can't find exactly what you want, be prepared to settle for somewhere closer to home, like Dublin or San Francisco. You can always give your *next* paper in Bangkok. Incidentally, you will find that your management, which might boggle at sending you 6,000 miles on a legitimate business trip, will always acquiesce when the magic phrase "giving a paper" is uttered. They cannot in all decency refuse to let you go, without making your company look somehow cheap, provincial, and against the march of science.

While it is desirable that the conference you pick should be in a field or discipline you are familiar with, it is by no means necessary for you to have anything original or interesting to contribute. If, on the contrary, you are productively working in the area and have come up with genuinely worthwhile results, you will probably not need to read this article. There should be no difficulties. The only advice I would offer is, do not rush into print recklessly. Most researchers in your position use their results sparingly, spreading them out over several papers, hoarding a little perhaps for some lean winter when the right symposium takes place in Miami. If your material is really too skimpy to fill more than one paper, you could try rewriting it again later on with slightly different wording and a new title. You will be surprised at how easy it is to get a re-hash accepted. One man I know has published 46 versions of the same article, and is currently working on a new draft for next year's SJCC. He is considered an authority in his field.

Let us suppose, however, that you are not so fortunate in the material you have available, and that you have nothing original or even interesting to present. Do not repine; other contributors will be in the same boat. In fact, of the papers presented at technical conferences, the majority are both unoriginal and uninteresting.

Then why, you may ask, should one take the trouble to write them? This is a naive question and if you asked it you deserve to be severely rebuked. Even if you feel no obligation to your family to get ahead—by enriching your resume, meeting others engaged in your field, and maybe landing a better job—you at least owe it to your company and to your profession to further the exchange of ideas. Anyway, how do you think the organizers could arrange full sessions if they have to make do with nothing but good material? Half the conferences would have to be called off. The published proceedings would be meager little documents—a poor testimony indeed to the vitality of the state of the art! The loss of prestige suffered by the Western scientific community could be enormous. If questions like the one above continue to bother you, you should seriously doubt your fitness to

Mr. Jones is a principal engineer at Raytheon's Missile Systems Division in Bedford, Mass. He holds an MA from Oxford University and a diplome d'etudes superieures from the Sorbonne, both in mathematics. He has presented several papers at technical conferences.


INTRODUCING
VIATRON
SYSTEM 21
data management
machines that will probably
cost you less than
your telephone service

System 21 puts the logic where the problem is—on every desk where data is gathered, processed, edited or needed—with a processor renting for $20 a month, a video display renting for $5, a simple attachment that converts a typewriter to a printer renting for $20 and a reusable tape cartridge that you can buy for only $4

Solve your paper work problem by putting digital logic where the problem is

Most businesses are trying to cope with rapidly pyramiding paper work problems with the tools of the past twenty or thirty years — the typewriter, the adding machine, the keypunch and the telephone — and with a new tool, the computer.

But computers have solved only a fraction of the problem. They're too sophisticated and too expensive to help people do ordinary jobs. Computers don't end paper shuffling.

System 21 does.

System 21 takes computer technology, simplifies it, miniaturizes it and distributes it so it can be used by the people who need it — the clerk who records data, the sales manager who wants to get information out into the field, the credit manager who wants to look up records, the electronic data processing manager who is trying to convert reams of paper into computer-usable data.

System 21 is a family of economical ready-to-run machines

It performs data entry, data control, data reporting, data display, data communication, and data storage and retrieval in the simplest and most economical way.

It is a total system designed to improve your total data management operation. Not by time sharing on an already over worked computer. Not by creating highly complex electronic bottlenecks But by giving **each** clerk and **each** administrator the tools he needs to record, edit, transmit and display data a his desk or in the field.

System 21 complements your presen computer operations. You can use i without making any modifications ir your existing computer system.

Microprogramming and large scale integration — the secret of VIATRON prices

A microprogrammed machine is simply a machine that has the logic built into it to do a specific job automatically.

Microprogrammed computers are fa

'e reliable and far less expensive to
d than ordinary computers that are
ıaze of very complex logic that has
e completed by programmers.

eliminating programming is only
reason for the low cost and in-
ent reliability of VIATRON System
Further economies are made pos-
e by large scale integration (LSI)
ızing mass produced metal oxide
ıiconductor (MOS) circuits that cost
y a tenth as much as conventional
ɛgrated circuits.

usable VIATAPE cartridges make ta compatible with both people d computers

e of the problems in data manage-
nt is that people talk one language,
nputers another.

\TAPE provides the new common
dium.

System 21 machines are designed
use this inexpensive recording me-
ım so data can be put into digital
m at the point of capture. A single
\TAPE cartridge that weighs less
ın 1½ oz. and measures less than ½
!½ x 4 inches stores the equivalent
1000 80-character lines or 20 type-
itten pages. Once information is on
\TAPE it is compatible with both
ople and computers.

stem 21 gives you all the low-cost
ɔls for generating VIATAPE, scan-
ıg VIATAPE, printing or displaying
ta from VIATAPE, converting data on
ATAPE to punched cards or IBM-
mpatible tape and converting infor-
ıtion on IBM-compatible tape or
rds to VIATAPE.

Your secretary will tell you a System 21 keyboard looks just like her typewriter keyboard

With System 21, data no longer has to be recorded by one person, converted into a computer-usable form by another and verified by a third. You can forget about keypunch and key-to-computer-tape operators.

The keyboard looks like a typewriter keyboard. The numbers and letters are in the right place. This means any girl can put data into digital form.

As she types each letter it appears on a video display together with formating guides so she knows just what she is doing. These formating guides can be set so she can control the data entry unit. Routine jobs become simply a matter of filling in so many blank spaces.

Once information is on VIATAPE it is easy to get it where it is needed

VIATAPE is almost impossible to damage — it's people-proof, weather-proof, hard-work-proof.

And it is simple to transmit data from one VIATAPE station to another over regular telephone lines. A System 21 data communications adapter costs as little as $25 a month and it also goes on-line to your computer for "real-time" applications.

Data Control — The need to know and the executive's function

One of the objectives of any data management system is providing executives with the facts they need in order to make decisions.

System 21 provides a real measure of data control. Information does not have to pass through a lot of hands or steps between the point where it is gathered or reported and the point it is acted on.

In fact, by decentralizing computer logic, management's control of its business is actually strengthened. As the flow of data or information becomes streamlined, management can get its hands on data faster and without the pounds of computer printouts it has to face now. Thus, executives can deal first-hand with immediate problems.

At the same time it is easier to restrict data to those who need it.

For $7.50 a month any television set can become a computer display

System 21 allows you to display data at your desk, at home, on the television set in your hotel room, or to send data over closed circuit television. All you need is information on a VIATAPE cartridge, a System 21 microprocessor and a standard television set or VIATRON display.

A simple $20 attachment converts a typewriter to a printer for data retrieval

Retrieving information from the digital domain is easy. In addition to VIATRON video display units, System 21 also includes an inexpensive attachment that converts a typewriter to a data printer. The attachment is not permanent. It can be removed or replaced in seconds.

The VIATRON rental agreement

Evaluation units can now be ordered for delivery in the summer of 1969

VIATRON does not require long-term lease agreements. All rental agreements contain a 30-day cancellation clause. Agreements for evaluation units are offered for a minimum of 90 days. Under a VIATRON rental agreement you can receive a number of spare machines at our expense. If one machine breaks down you just unpack another.

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SYSTEM 21

For more information about System 21 and the VIATRON Short-Term Rental Agreement write VIATRON Computer Systems Corporation, Dept. D-1, 105 Terrace Hall Avenue, Burlington, Massachusetts 01803.

practice your profession, and perhaps consider switching over to teaching high school.

To return to our subject, or, as the French say, *revenons a nos moutons* (the insertion of foreign phrases into your paper is a useful device which will be discussed later), suppose you have picked your conference, and that it is to be

devoted to an area of scientific practice about which you have some knowledge not worth passing on. You now have to choose a topic for your paper.

choosing your topic

Topics suitable to your purposes fall, broadly speaking, into three classes.

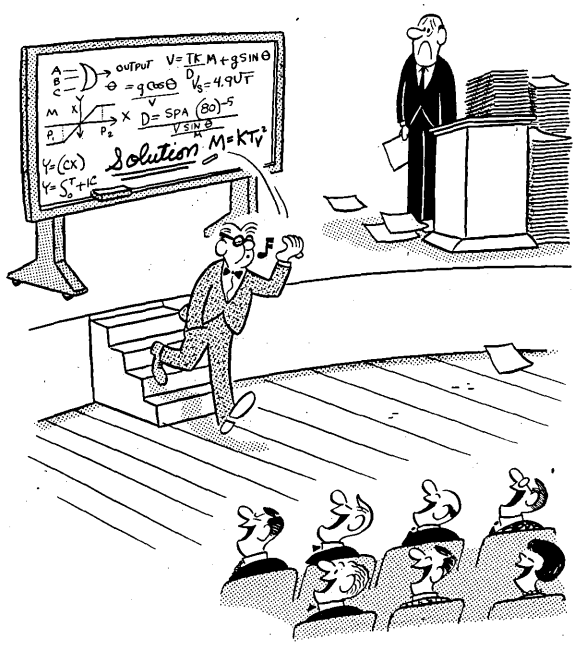
First, there is the *Solid Accomplishments* class. You may have spent the past year performing some routine project which has now been completed satisfactorily. You have done a good, if unspectacular, job. For example, you may have solved some simple engineering problem by means of elementary algebra coupled with a short FORTRAN program. Well, this may be nothing earth-shattering, but you are secure in the knowledge that you have actually done something useful, which is probably more than can be said about half the schmoes who will hear your paper. The only problem is that your work, although sound, is too trivial to be of general interest. If acceptance is based on an abstract, rather than on the paper itself, you can get around this by writing an incomprehensible abstract (useful pointers on how to do this will be given later). Another solution is to have written your computer program in some more rarefied language, like GPSS or MILITRAN. For some reason, people are always intrigued to hear about actual applications of these languages, and your paper, however trite, will be welcomed.

On a higher level of sophistication, there is what I will call the *Torch of Learning* topic. Your topic will belong to this class if you have spent the last two years researching some esoteric problem, at someone else's expense, and have failed to solve it. You should be able to get at least two papers out of this situation. In them you can elaborately describe, with an attention to minute detail worthy of an old-style craftsman, all the methods which did not work, and all the new approaches that failed. Your pitch should be that, although you have not actually solved the problem, you have established a good, firm base on which others can now build, and you should try to evoke the spirit of the poem *Vitae Lampada,* projecting if you can the heroic image of the exhausted Greek runner who, before falling unconscious to the ground, passes on his torch to the man behind.

Stress the positive accomplishments of your researches. Say things like: "A rigorous conceptual framework has not been established." If the problem entails solving for twelve variables and you can do it if eleven of these are held constant, say: "Certain important subclasses of this problem have proved tractable to analysis." If you have frankly despaired of ever getting anywhere, and have in desperation plugged numerical values into the variables more or less randomly, you should document this analysis and describe it as an "attractive heuristic approach" ("which nevertheless," you should add, "contains many rigorous elements").

A Torch of Learning paper is the easiest to write—it can often be lifted piecemeal from some Final Report—and there should be no problem getting it accepted. However, it should not be attempted by a beginner, and should usually be shunned even by the veteran paper-giver. For it exposes one to the terrible threat of being confronted at the conference by someone who has solved the problem. Indeed, it is possible that some smart alec in the audience will do the thing in his head while the unhappy researcher is still explaining how it took two years to construct his rigorous conceptual framework. I recall hearing of how Steinmetz, I think it was, once confounded someone in this situation by walking up to the rostrum and writing an analytical solution in four lines on the blackboard. This kind of thing can be very embarrassing, especially if the researcher is a university professor, as he generally is in these circumstances.

The third class of topics and, in my opinion, the best for your purposes, I call *Bland Generalizations.* To write this kind of paper, you do not have to do any technical work at all. All you have to do is string together a large number of tepid, generalized statements and label them "a critical ap-



praisal," "new horizons," or something like that. Unlike the Torch of Learning paper, this will not expose you to the threat of sharp contradiction at the conference, especially if you preface everything with qualifiers like "possibly," "conceivably," etc. Another advantage of the Bland Generalizations paper is that, once you have written one, it can be readily adapted to fit almost any other topic.

"In recent years much has been accomplished," you can say, whether referring to geophysics, numerical quadrature,

or scuba diving. "But much remains to be done."

Why any session chairman should accept a Bland Generalizations paper is a mystery to me, but the important thing is that most of them do and this is to your advantage.

the abstract

You have picked your conference and selected a topic, albeit perhaps a vague one. Usually, the chairman of the session at which you intend to speak will only require a satisfactory abstract as proof of the paper's worth. You can easily make one up for him by observing the following elementary rules.

First, realize that the most important thing about an abstract is its *style*, not content. By adopting the proper prose

style you can disguise the fact that you have nothing to say. Here are some powerful stylistic devices in common use today, which I urge you to employ:

Do not use one word when you can use two.

Avoid short, Anglo-Saxon phraseology.

Construct long, unnaturally convoluted sentences.

Throw in the occasional foreign phrase, preferably in the Latin tongue.

Suppose (to give a hypothetical example) that Isaac Newton were to rise from his grave and write a paper setting forth his First Law of Motion. This law may be baldly stated as: *A particle moves with constant velocity unless it is acted upon by a force.* This kind of lucid prose would be hopelessly inadequate for a modern abstract, and the manuscript would be rejected, even if the program chairman was unaware that the material was not state-of-the-art. Newton would have to rephrase the whole thing to start something like this: *A conceptual framework within which to apply, ex post facto, analytic and quantitative techniques to the study of the kinematic characteristics of a moveable geometric point at which matter is concentrated is proposed,* and continue in this way for 300 words or so. Newton would probably return to his grave rather than write swill like this, but he was, after all, a genius in a sense, and these notes are, as I have indicated, intended for those within the mediocre or incompetent ranks of practitioners.

I am happy to announce that I have discovered a veritable thesaurus of valuable abstracts, buried in old back numbers of the Bulletin of the Operations Research Society of America. Here may be found many a gem of tortuous prose, from which I will quote the following selections for tutorial purposes (taken from abstracts of papers presented at the Society's Twenty-Second National Meeting in 1962):

"The ligitimacy (sic) and relevance of the substantive concepts, the process of formulation, and the criticism will be commented on." (Herman Kahn).

"A viable action plan is a meld of sound ideas and real problems arranged in future time subject to the set of constraints appropriate to the entity for whom the plan is intended." (A. J. Wadman).

"The optimal emphasis is impossible of analytic determination, calling as it does for weighing risks and values that are not commensurate one with another." (J. Coyle).

"The underlying intent behind the construction of this planning and decision-making exercise . . . was to illustrate the philosophy and provide a simulated context in which the need for, and application of, system or mission analyses, cost-effectiveness studies and computational techniques to assist in the selection of preferred force structures could be shown to best advantage." (H. P. Hatrey and P. R. Lever).

The fact that the papers accompanying these abstracts happened to be of high quality is beside the point. They could easily have been garbage. If you managed to read the quotations above, you will have noticed the curious physiological effect this kind of prose has—the way the reader's head seems to reel, and his vision slowly blurs out of focus. Fatigue sets in. Mentally, one's guard is lowered—which is precisely the effect you hope your abstract will have on the session chairman!

The quotations from Kahn and Wadman, you will observe, could perform stout service in a Bland Generalizations abstract. Coyle's wording, on the other hand, suggests Torch of Learning (I liked "impossible of analytic determination"), and the protracted sentence by Hatrey and Lever has strong overtones of Solid Accomplishments.

It is always very easy to compose a Bland Generalizations abstract (another advantage of this type of paper). Furthermore, you can send them out on a routine basis, waiting for a favorable response from the right conference before actually writing the paper. This can save you a lot of effort. Flexibility can be achieved by making your abstract so general and vague that, when you eventually get up and face the audience, you can talk about almost anything.

A word of warning: don't make your prose *too* artificial. Rigid adherence to the rules may result in something that sounds like a parody, and the reader will think you are kidding. Consider, for example, the abstract to Marney and Smith's paper *(op cit)* whose title—*The Domain of Adaptive Systems: A Rudimentary Taxonomy*—sounds improbable enough in itself:

"The several divisions of contemporary behavioral inquiry variously designated as systems analysis, management science, operations research, and the like are currently embroiled sub rosa in critical and complex metascientific problems. This situation results from the fact that a fundamental directive of rational inquiry—the continuing drive toward comprehensiveness—has carried modern science beyond the limited scope of its earlier preoccupation with 'deterministic' physical systems. The weight of certainty amassed by earlier successes with well-behaved phenomena has been irretrievably dissipated by the present necessity for utilizing disputable procedures of statistical inference and probabilistic logic. In addition, traditional primitive notions collide with more recent foundations of inquiry. The resulting problems are therefore both conceptual and methodological in character. In this context, we attempt first to structure the field of phenomena which now appears relevant to contemporary behavioral inquiry. Some such holistic view is a prerequisite to cooperative effort among investigators ab-

sorbed in the multifarious interests characteristic of this area of research. Beginning with an elucidation of the central feature of behaviorism as a philosophical perspective, we show that it is a thoroughgoing acceptance of this perspective that has involved scientific inquiry, in general, with a drastically expanded field of phenomena—the domain of adaptive systems. A rudimentary taxonomy of adaptive systems is then developed as a means of structuring the conceptual context of behavioral inquiry. The resulting classification-scheme is suggestively very rich; should it prove generally acceptable and capable of exploitation, experimental results from a wide range of specialized researchers may eventually become recognizable as appropriate inputs to a synthesis at the level of formal decision theory. Conversely, subsequent advances in terms of formal theory can be fruitfully interpreted in terms of experience, thereby rendering general theory testable for correspondence with respect to each of the specialized disciplines presently associated with the domain of adaptive systems."

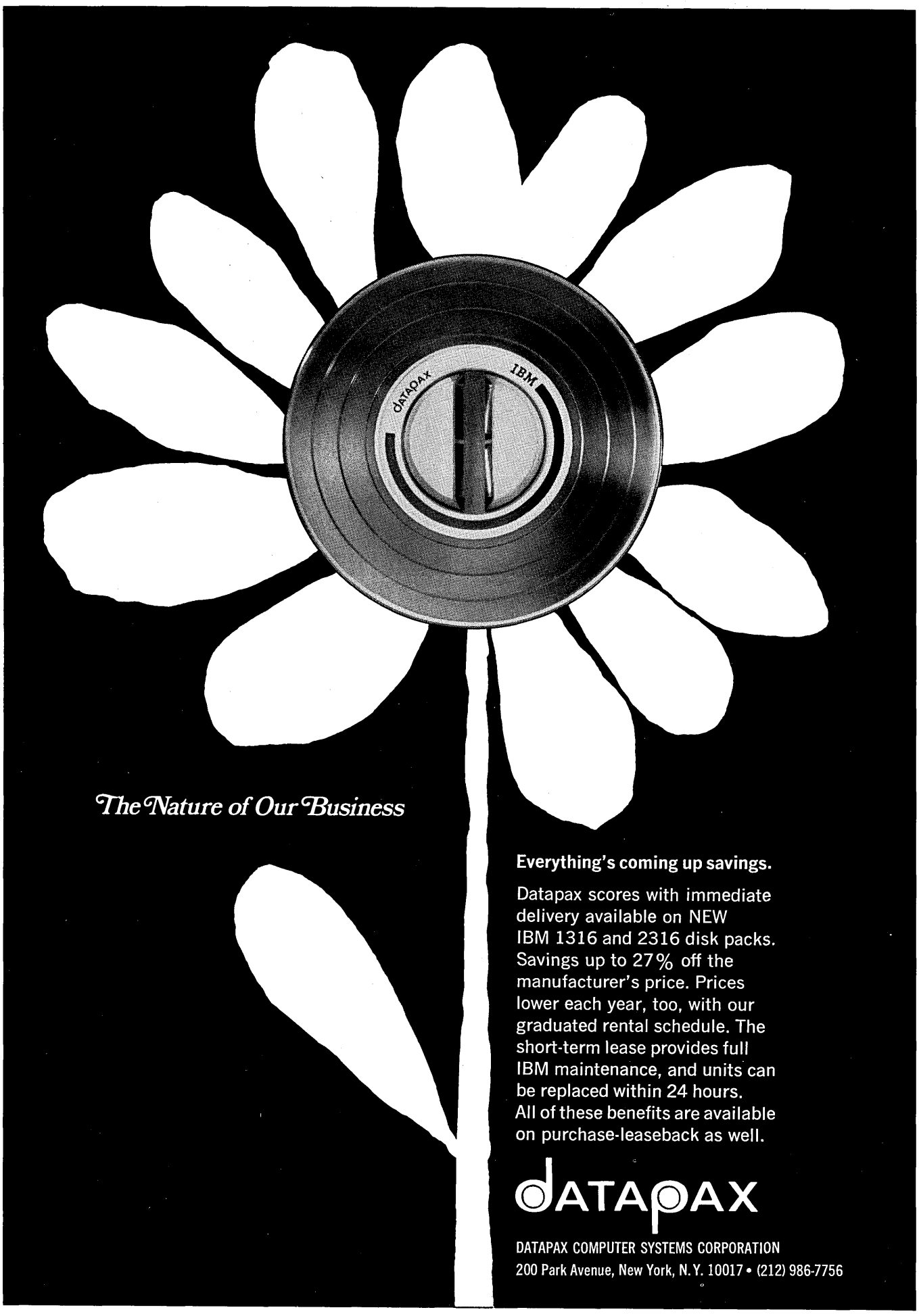
Verbal extravaganzas such as this are liable to plant in the reader's mind a suspicion that it is all a hoax. Fearful of possible ridicule, the program chairman may institute searching inquiries into the nature and quality of your paper. The whole purpose of your strategy, which was based on disguising and obscuring these factors, will be thwarted.

So much, then, for the abstract. Style, not content, is the important thing. Remember this, apply the stylistic devices I have described—in moderation—and you should have no trouble. Once your paper is accepted, your principal objective has been achieved. Your management cannot in all conscience refuse to send you to the conference now, and you can probably combine the trip with your vacation, if

you don't mind taking your wife along. Update your resume and make 50 copies. As an active participant, you will be at a decided psychological advantage when you talk to the personnel men who will always be found hovering furtively around the edges of these meetings.

summary

In summary, I should like to point out that, while much has been stated within the somewhat constricting framework of this article, much remains to be stated. Certain, but not all, important classes of presentations have been treated, and there remain horizons as yet unexplored. Conceivably, the author will attempt, *ex nihilo nihil fit,* to establish a more general perspective in the course of a subsequent article. ■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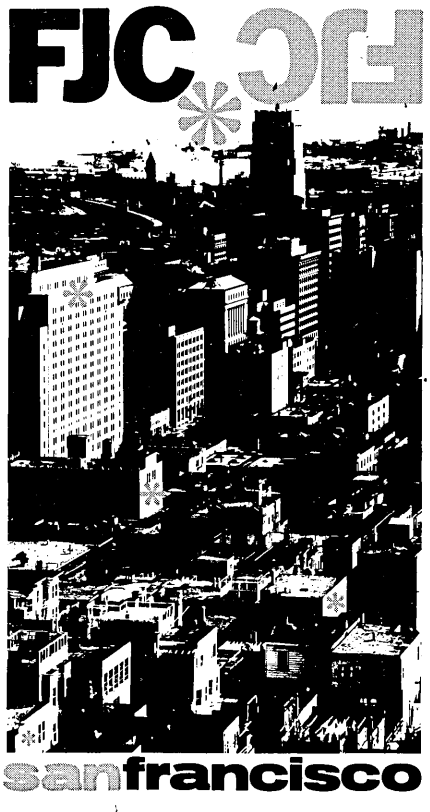
THE CONFERENCE PARTICULARS

A true three-ringer, the 1968 Fall Joint Computer Conference, will be staged December 9-11 in San Francisco's Civic Center (which includes the Civic Auditorium and Brooks Hall) and Nourse Auditorium; conference HQ is the San Francisco Hilton. The technical program will be held in the Civic Auditorium and Nourse; exhibits will be in Brooks Hall—and, with 130 exhibitors at last count and a waiting list with half-again as many, there may be machinery lined up on the sidewalks. (One company, fruitlessly trying to get either a booth or a hospitality suite in a nearby hotel, commented that it would be showing its new equipment in The City "concurrently" with the conference. Perhaps in the recent tradition, this persistence could bring about a full-scale "booth-in.")

The exhibits are free to all paid registrants; non-registrants will be charged an admission fee of $5.00. The exhibits will be open 10:00-6:00 on Monday, 10:00-9:00 on Tuesday, and 10:00-5:00 on Wednesday.

Pre-registration will begin on Sunday, December 8, at the Hilton. Regular registration will take place at the Civic Center during the three days of the meeting. As a change from past conferences, no special provisions have been made either for advanced or one-day registration. The fees ($20 for a member of a sponsoring society; $30 for a non-member; $3 for a full-time student) provide admission to the technical sessions and exhibits; members and non-members are entitled to one free copy of the *Proceedings*. Registration times are: Sunday, 2:00-9:00; Monday and Tuesday, 8:00-5:00; and Wednesday, 8:00-12:00 noon.



Howard Johnson, president of MIT, will give the keynote address at the opening session on Monday.

The conference reception will be on Monday evening at 6:00 in the Continental Ballroom of the Hilton. The conference luncheon, scheduled for Wednesday at noon, will also be in the Continental Ballroom. Dr. Garrett Hardin, professor of biology at the Univ. of California at Santa Barbara, and an authority on evolution, will address the luncheon on the possible effects of the computer age on the development of man and his society. Also at the luncheon, Maurice V. Wilkes will be presented with the Harry Goode Memorial Award. Mr. Wilkes is being honored for his achievements in the engineering and software aspects of the computer industry.

It's been two years since the Fall Joint Computer Conference gathered the clan in San Francisco, and it's been a revolutionary two years for Paris West. The dowager of the Pacific has been discovered to have flowers in her hair and grass in her backyard; urban renewal is eclipsing her urbanity; and an affable new mayor is escorting her enthusiastically into the '70's. All in all, the scene should be an interesting backdrop for the '68 FJCC—a conference that follows the industry's own busy two years of growth and change. Perhaps in weary reaction to the in-

creasing intensity of volatile subjects (e.g., patents/copyrights, FCC inquiries, standards, separate pricing), technical chairman Robert H. Glaser of COMPATA, Inc., has noted that the '68 program will be a return to an emphasis on more formal presentation of related-subject papers, and therefore, fewer panels and open sessions on controversial issues.

While it's probably safe to predict that December will find San Francisco chilly and foggy with possibility of showers, it is also a surety that this will not stop the 6,000-plus computerites from Christmas shopping around Union Square and going to some sessions. This year's technical program will attempt to lure attendees with 47 sessions (157 papers) and seven panel sessions. Glaser has announced that this will fill 1,500 pages of a two-volume edition of the *Proceedings*. The paper sessions are described in detail in another part of this section.

The first panel session will be presented on Monday morning at 10:30 in Polk; the topic is "MIS Value Analysis/Justification." Chairman Dennis Mulvihill of Touche, Ross, Bailey & Smart, has noted that the session will view the state-of-the-art with respect to economic quantification and justification of MIS. Panelists will be P. Duane Walker, IBM; Michael Ballot and Kenneth Knight of Stanford; James Arachtingi of Auerbach, Pollak & Richardson; Al Zipf, Bank of America; and George Turner, Univ. of California.

Monday afternoon (1:45 in the Arena) a panel discussion will be held on "The Impact of the FCC Interdependence Inquiry on the Computer Industry;" chairman is consultant Louis Feldner. One of the panelists for this session, Bernard Strassburg, chief of the Common Carrier Bureau of the FCC, has commented that much of the turbulence surrounding the common carrier industry is due to the explosive growth of information processing, and the aggressive marketing activity of the computer industry. In addition to Mr. Strassburg, members of the panel will be Congressman John Dingell, chairman of the Subcommittee on Activities of Regulatory and Enforcement Agencies; professor Manley Irwin, consultant to the FCC; Michael Duggan, consultant to the President's Task Force on Communications Policy; and Paul Rodgers, general council for the National Assn. of Regulatory Utility Commissioners.

An interesting emphasis of this year's conference is the three-part session on robotry (or, in its more formal and all-inclusive term, artificial intelligence). The sessions will take the form of panel discussions, a remote demonstration, and a tour to the artificial intelligence laboratories at Stanford Research Institute.

On Monday, at 3:45 in the Arena, D. C. Engelbart of Stanford Research will present a talk on "A Research Center for Augmenting Human Intellect;" attendees will be given the background on a computer-based, interactive, multiconsole display system being developed by SRI under the sponsorship of ARPA, NASA and RADC. The session will use an on-line CCTV hook-up to the SRI computing system in Menlo Park, Calif. Following the presentation, remote terminals to the system in operation may be viewed during the remainder of the conference in a special room that will be set aside for that purpose.

A second session on robots "Problems in the Implementation of Intelligent Robots," will be held on Tuesday at 8:45 in Nourse. Chairman of the session is Bertram Raphael of Stanford Research Institute. This session will involve a technical discussion on capabilities in mechanical engineering, pattern recognition, heuristic programming, neural networks and computer systems. Information on the tour of "live robot" installations will be available at the end of this session. Panelists will be L. Chaitin of SRI; J. A. Feldman of Stanford Univ.; T. Sheridan, S. Papert and L. Sutro of MIT; and R. J. Lee of the Air Force Avionic Laboratory.

Dr. William H. Davidow (left), General Chairman and Robert H. Glaser, Technical Program Chairman

A final session on robotry will be held at Nourse Auditorium on Tuesday at 1:30. Entitled "Human Augmentation Through Computers and Teleoperators," the chairman is Arthur Critchlow of Mobility Systems. Serving on the panel will be Donald Comer of Mobility Systems; Gary Hollander of Hollander Assoc.; Edwin G. Johnson of the USAEC; H. E. Mergler of Case Western Reserve Univ.; Elmer Shapiro of SRI; J. K. Hawkins of Robot Research; and Tom Sheridan of MIT. Following the presentation of their material, these panelists will be joined by the chairmen and the panelists of the other sessions on robotry for a group discussion on "Robots for the Future."

"Process Control Programming Languages," will be the topic for discussion by a group of panelists on Tuesday morning, 8:45, Room 416, 4th floor. Chairman is Eric A. Weiss, Sun Oil Co., and panelists will be Mr. Weiss; John H. Hiestand of Profimatics; T. J. Williams of Purdue; and F. R. Field, Jr., of E. I. du Pont deNemours.

A last panel session, "Computer Design Automation: What Now and What Next?" is scheduled for Wednesday morning, 8:45, room 416, 4th floor. Chairman is Jerome Kurtzberg of IBM. The panelists will be D. R. Gorman of RCA; R. L. Russo and W. E. Donath of IBM; and M. A. Breuer of the Univ. of Southern California.

Of particular interest at this year's conference will be a meeting, on Tuesday evening, December 10, at 8:00 p.m. in the Civic Auditorium. This special discussion, entitled "Information, Computers and the Political Process: A Public Examination," has been coordinated by Russell Berg of Hewlett-Packard, and will be open to the public. A group of distinguished panelists will discuss the possibility of the new information and communications technology creating an informed populace that may be newly responsive to the needs and activities of our society. Members of the panel are: Dr. Robert Hofstadter, Nobel Laureate professor of physics at Stanford; Dr. Emmanuel G. Methene, director of the Harvard program on technology and society; Dennis Flannagan, editor of *Scientific American;* Dr. John R. Pierce, director of communications system research for Bell Labs; and Dr. Garrett Hardin, professor of biology at the Univ. of California at Santa Barbara.

Two special communications services will be offered by the conference committee (headed by general chairman, Dr. William Davidow of Hewlett-Packard). A computer-driven message center using 10 crt monitors will be operated during regular conference hours. When a message is left at the center, the name of the recipient will be entered into the system and continually displayed at all the monitors. Phone number of the center is (415) 863-1394.

A second service is the information center, which will also be open during regular conference hours, and which will provide three services: information on the locations and times of the different meetings of the sponsoring societies; a roster of conference atten-

dees; and what the program calls "roving information girls to answer inquiries pertaining to social activities."

Since the foreknowledge of that type of service may interest more wives in attending, an extensive program has been planned for the ladies, including trips to Sausalito and the Peninsula, a tour of Ghirardelli Square, a talk by Dr. John Osborne on "The Doctor and the Computer," and a special production of "The Fantasticks" by a professional repertory group. Registration for the tours will be on Sunday 2:00-9:00 in the Hilton adjacent to the regular conference registration, and Monday 9:00-11:00 a.m. in the Rosewood Suite at the Hilton. Throughout the conference, a hospitality for the families of the attendees will be maintained in the Rosewood Suite. Local hostesses will also be available to assist visitors in planning unscheduled tours and shopping trips.

The Computer Science Theater at the '68 show will consist of 25 films, divided into three concurrent programs: a general section; a section on computer-generated pictures; and a third section on hardware. A list of films, times and locations of showings will be distributed at the conference.

A shuttle bus will serve the conference between the Hilton and the Civic Auditorium, with service to the Jack Tar Hotel. As in the past, this service begins at 8:00 a.m., and runs at five-minute intervals during session hours and ten-minute intervals during exhibit hours. The service is free.

A special education program will this year, as in the past, welcome students from several Bay Area counties. The students will be told about careers associated with data processing, given a tour of the exhibit area, and see a demonstration of some time-sharing systems. The FJCC will also host a group of secondary school administrators and board members; they will be guests at a discussion on the importance of computer training in the secondary school.

The FJCC is sponsored by the American Federation of Information Processing Societies (AFIPS). Members of AFIPS are: ACM, IEEE Computer Group, Simulation Councils, Inc., and the American Society for Information Science. Affiliate members are the American Institute of Certified Public Accountants, Assn. for Machine Translation and Computational Linguistics, Society for Information Display, and the Special Libraries Assn.

And we're already looking toward Boston in May. . . . ■

hello, frisco!

A GUIDE TO THE CITY

Call it Frisco and immediately you are labeled an infidel, crass and boorish. Call it Baghdad-by-the-Bay and prepare to get kissed by Herb Caen. THE CITY, as emblazoned on the shirts of the Warriors' basketball team, is called many things by various people. Travelling salesmen call it SFO; Engineers call it San Fran; and COBOL programmers say SAN-FRANCISCO, CALIFORNIA, 94900. But whatever you label it, however you describe it—get set to enjoy its many splendored charms.

Of all the new world communities, the Golden Gate City is the most unique west of the Hudson. There is a special atmosphere here, a progressive city with a strange dependence on tradition and formality. It commands a magnificent position, jutting out over one of the most beautiful bays in the world. It has an overabundance of weather: a rainy season to make one consider building an ark; enough wind to delight the hairdressers and Montgomery Street girl watchers; fog sufficient to harbor a symphony of horns; and temperature that can and usually does vary 30° in as many miles.

Depending upon one's particular bent, there are a number of "musts" for the San Francisco visitor.

For entertainment, San Francisco's North Beach area (Broadway and Columbus) is renowned for both topless and good music. Unfortunately, the topless industry which was acclaimed by male tourists throughout the world died on March 1, 1968 at the age of three years nine months. Its cause of death was attributed to overexposure. Today, North Beach has branched out to new variations of the topless. These include the Condor's Nude Girl on a Piano; Pierre's Thoroughly Naked Millie; Gigi's The Nude in the Bedroom (personally checkrated); El Cid's Nude Orphan Fanny; Goman's Interracial Love Dance; and even a topless shoeshine (a bargain at $3.00).

Interspersed among the many relatives of the dead topless are a few clubs that resisted the trend toward nakedness and still provide more than their fair share of good music. These include El Matador and Basin Street West.

To see some of the old programming drop-outs, a visit to the Haight-Ashbury neighborhood would be in order. Here is the home of San Francisco's "love" children where banana peel smoking caused a quiver in United Fruit stock and where flower power got its start. Here also is the home of the underground presses, the haute couture salons of the hippies, and the head shops where one can purchase a variety of paraphernalia and artifacts at outrageous prices.

For geography and topography any direction within the city is rewarding. To the north end there is the reddish-orange span of the world's second longest suspension bridge. Like any good system it is constantly in a state of maintenance, and the manager of the Bridge Authority is always talking about extensions.

Close by are Ghirardelli Square, the Cannery and Fisherman's Wharf. Ghirardelli Square is a magnificent collection of shops, galleries, restaurants, theatres and plazas concocted in a 19th century chocolate factory. Two blocks to the east, bordering on Fisherman's Wharf, is the Cannery, a comparable complex housed in an old Del Monte fruit processing plant. And of course, there is Fisherman's Wharf, San Francisco's answer to St. Tropez

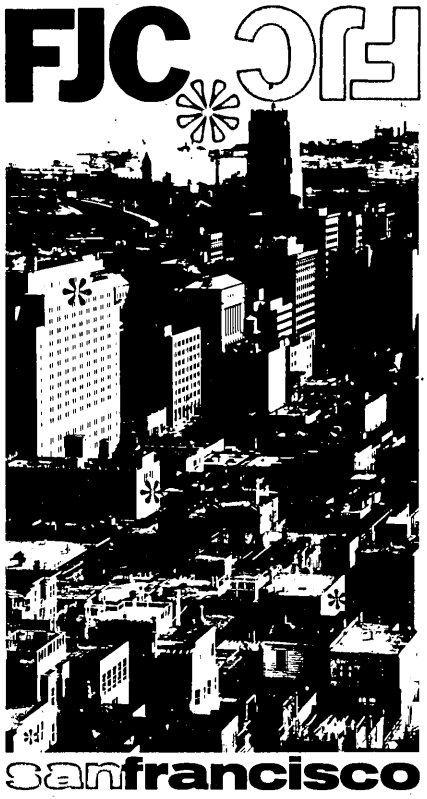
without Brigitte Bardot. It's a nice place to look, but I wouldn't want to eat there.

To the south and just about in the center of the city is Twin Peaks, one of the approximately 40 hills of San Francisco. Some of the more fashionable hills are Nob, Russian, and Telegraph, but the most magnificent view extending from the Golden Gate Bridge across the majority of the city and the bay and even past the Oakland Bay bridge can be seen from the view area atop Twin Peaks.

In San Francisco one can ride on a national landmark. In February '64 the United States Department of the Interior named the cable cars a national historical landmark. The lifeline of the cable car, much of it dating from 1889, is approximately 10½ miles of wrapped steel cable 1½" in diameter. The cable plugs along at a steady 9½ miles an hour and on some of the 21% grades one is happy to know that the cable cars have four separate braking devices. Adjacent to Fisherman's Wharf is the old brick car barn and power house where one can watch the winders thread the cable through figure eight's and back via slack absorbing tension racks. This activity continues publicly until midnight.

San Francisco's Chinatown lifts the Bamboo Curtain to expose a colorful conglomeration of pagoda roof buildings, ornamented balconies, oriental styled banks and service stations, outdoor produce markets and delicatessens and the hustle and bustle normally associated with the pre-war Chinese mainland. More than 65,000 inhabitants make this the largest Chinese settlement outside of Asia. Because most of the community has roots in Southern China, the language spoken is Cantonese dialect (Grant Avenue is known by many as DuPont Gai) and most of the food served is Cantonese style. The four major geographical cuisines are: Northern-Peking; Southern-Cantonese; Western-Szechwan and Eastern-Shanghai. There are three Northern restaurants worthy of sampling. These are North China, Tai Ho Luo, and Manchurian. One specialty is an oriental delicacy known as chiao tzu, but if you call them by their common name of pot-stickers you'll be just as happy. Although the Cantonese restaurants are by and large identical, one worthy of a visit is Sam Wo. Loosely translated the name means "Three in Peace." The entrance is through the kitchen and there are dining rooms on the second and third floors. The second floor is served by the most interesting character in Chinatown—Edsel Ford Fong.

Of the 20 pages of classified ads for restaurants in the telephone directory, the following selection represents the best or at least most interesting of the variety of cuisines offered in the city. For a while I believed that the FJCC was held in San Francisco in the fall because it fell in the middle of the crab season. To sample the best of the Pacific dungeness crab, try one of the old traditional San Francisco restaurants such as Tadich Grill, Sam's, or Jack's. For French style, or what we call continental, the fame of Ernie's on Montgomery Street is prodigious. Chef Paul Guiaud, formerly of Maxim's, The Tour D'Argent and the Hotel de la Post, has presided over the classic cuisine of Ernie's for the last seven years as his one assignment in the United



States. Few cellars in any American restaurant can boast six vintages of Chateau Haut Brion, six of Chateau Margaux, five of Chevel-Blanc, seven of Lafite-Rothschild, five of Chateau Latour . . . all of prime vintage years.

More typically French and completely informal are the family style Des Alpes and Elu's Basque. Fancier French is served by the Charles family —Robert at his unadvertised non-telephone-served Charles restaurant (Battery at Pacific) and ex-wife Cherie at the Fleur de Lys. At Charles, bartender Vasili serves up both libation and show when his specialty drink "la Guillotine" is requested. The measuring glass is a ceramic snail's shell. An interesting marriage of the two greatest cuisines is Koe's Auberge which is a French restaurant run by Chinese.

North Beach is the "Little Italy" of San Francisco. Some typical examples of its "ristorantes" are Fior D'Italia (fancy), Montclair (homey), and the Old Spaghetti Factory Cafe (mad). After dinner meander down to Aquatic Park for a game of bocce ball on the out-door courts there.

For Russian food try Boris & Mary's and for Greek food there's the Minerva Cafe (which wisely should be called Athena Cafe).

San Francisco also has a Japantown (Nihonmachi) around Post and Buchannan Streets. This year a $15 million Japanese Cultural & Trade Center was formally opened and includes a Japanese theatre-restaurant, hotel, five-tiered pagoda, and outdoor festival area. The most interesting Japanese food is a country style-Japanese restaurant called Mingei Ya. Their specialty, O Mitsu Taki, comes complete with Mongolian steampot and final course of hot soup.

For after dinner interest, one should have a Cappuccine Venetia at the heated out-door Enrico's Coffee House or an Irish Coffee at the impossibly crowded Buena Vista adjacent to the Hyde Street cable car turntable.

San Franciscans are continental in their love of the arts. They support an opera company with a glittering tradition, a symphony orchestra in its 56th season, a ballet which has won world acclaim, an International Film Festival in its 12th year, a resident theatre repertory company of exceptional caliber and three public art museums. Those that should not be missed are the Palace of the Legion of Honor and the Brundage collection at the DeYoung Museum. The latter contains nearly 6,000 Asian art treasures spanning over sixty centuries of oriental history.

San Francisco also boasts 24 foreign language newspapers including two Russian dailies, a Swiss weekly printed in French, German and Italian, a Hungarian bi-monthly and an assortment of Chinese. Plus a half a dozen underground papers with a language all their own.

It is probably impossible to "explain" San Francisco; it's certainly hard enough to describe it. The true character of San Francisco is a product of its "foreignness"—the Italians of North Beach, the Chinese and Japanese, the Irish of the Mission, the Russians of Clement and the Hippies of the Hashbury. The combination of all of these heritages and cultures is responsible for this happy accident, this potpourri of reasonable people thriving together in one of the most pleasant places on the face of the continent.

—HOWARD BROMBERG

THE PRODUCT PREVIEW

AMP, INC.
Harrisburg, Pennsylvania
The 2981A card reader senses all 960 positions of a standard 80-column card. The manually-operated unit measured 9½" x 8⅝" x 2¾", and is designed for behind-panel mounting with either vertical or horizontal card slot. For information:

CIRCLE 176 ON READER CARD

AMPEX CORPORATION
Redwood City, California
An IBM-compatible tape memory system, model TM-Z, operates in both 7- and 9-track modes and offers tape speeds up to 24 ips; packing density is up to 800 bpi. The unit is designed with a single capstan drive. It is priced at $3,500—according to the company, 20-40% below the price of comparative systems. Deliveries will begin in Dec. '68. For information.

CIRCLE 177 ON READER CARD

ANDERSON JACOBSON, INC.
Mountain View, California
The ADT 233 Mobile Acoustic Data Terminal is designed for time-sharing users. The unit includes an acoustic coupler linked to a mod 33 Teletype; when the telephone handset is placed in the acoustic receptacle of the terminal, the user can conduct a two-way

conversation with the computer. The ADT 233 is compatible with an ADC 300 terminals and 103A2 or 101C Data-Phones. The terminal is available with or without the paper tape punch and reader. For information:

CIRCLE 178 ON READER CARD

BASIC COMPUTING ARTS, INC.
Mountain View, California
The AMFG 101 is an analog multivariate function generation system that is comprised of two separate subsystems: a function data processor and a function data generator. The function data processor (FDP) is a compiler which the company will guarantee to run on any digital computer (already owned by the customer) that provides standard FORTRAN IV. The FDP reads a special language for describing functions, arguments and data points. The processed data is punched onto paper tape or cards for use by the function data generator (FDG) hardware. The FDG unit is a 110 V, portable device that is connected to any analog computer via trunk cable connectors located at the rear of the unit. Control buttons are located on a small front panel and on the card or paper tape reader located on top of the unit. The FDG employs hard-wired algorithms to generate functions of one, two and three variables. Linear interpolation over the surface of an n-dimensional hyperplane is used to compute function values that lie between given points. The package is large enough to accommodate a fully expanded system (FDG can be expanded to handle 32 arguments, 64 functions and 16,000 data points). The hardware is being built by Interdata under contract to BCA, and the AMFG 101 will be exhibited in the Interdata booth at the FJCC. BCA expects to begin deliveries of the unit in January. For information:

CIRCLE 179 ON READER CARD

COMMUNITYPE CORPORATION
New York, New York
The 100SR data communication terminal is a source automation device designed to provide multibranch or-

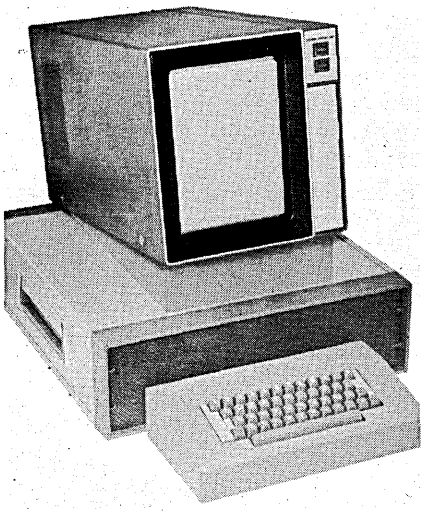
ganizations with a management information system that links subsidiaries, field offices, and other remote locations with the corporate computer. The

100SR picks up signals from the Selectric typewriter which is used as an input device, and records the input information onto a magnetic tape cassette, located in a drawer beneath the unit. The device has format capabilities, and can go into and out of record mode automatically. At the end of the day, information stored on the tape can be transmitted via Data-Phone to a computer at a speed of 1200 bps. Another company device, the T500SR, translates the transmitted information into a computer-compatible code, and this code is input to the computer. For information:

CIRCLE 180 ON READER CARD

COMPUTEK, INC.
Cambridge, Massachusetts

This newly-formed company will be exhibiting its Series 400 family of



stand-alone display terminals which feature a curve generator for graphics that enables curves to be drawn directly rather than approximated by straight-line segments. The 400 mod 20, first in the series, includes a storage crt, an alphanumeric keyboard, curve and vector generators, character generator and interfacing for standard data sets. For information:

CIRCLE 181 ON READER CARD

COMPUTER COMMUNICATIONS, INC.
Inglewood, California

The CC-33 Teletype Compatible Display Station is code and transmission compatible with mod 33 or 35 Teletype units. The station has a crt/keyboard and control unit; the control unit, the CC-301 mod 111 display controller, displays alphanumeric or graphic data on a standard tv receiver, accepts information from a keyboard or other input device, controls all I/O devices at the station, and communicates with any computer. The serial interface of the CC-301 is full duplex to handle 110 baud Teletype transmissions. For information:

CIRCLE 182 ON READER CARD

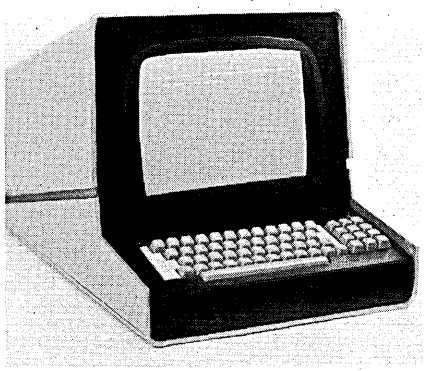
COMPUTER PERIPHERALS CORPORATION
San Diego, California

The DSU-8100 is a modular fast access disc storage system featuring 25 and 50 million bit head-per-track and moving-head disc storage modules which can be randomly combined to provide memories from 25 million to multi-billion bit capacities. One disc drive serves up to four disc storage modules. Average access time is 16.7 msec; data transfer rate is 3 MHz bit serial. The DSU-8100 can accommodate up to three computers in one operational system. For information:

CIRCLE 183 ON READER CARD

DATA DISC, INC.
Palo Alto, California

The Television Display System is basically a clustered display system that uses a disc as part of the control unit achieving, in effect, a time-shared graphics system. Up to 128 images, each consisting of combinations of line drawings and alphanumerics characters, are stored in the disc memory unit and can be simultaneously displayed at up to 128 terminals. An integral character generator, under control of a gp computer, will provide up to 4,080 characters per image from a 64-character ASCII set; or up to 2,560 characters per image from a 96-character ASCII set. The graphics information is formed on a field of 250,000 picture elements. Individual terminals are priced at under $3K. The company sees potential for the TV-compatible system in such areas as CAI. For information:



CIRCLE 184 ON READER CARD

GENERAL COMPUTERS, INC.
Los Angeles, California

Model 200 is the first in a new series of Punched Card Programmed Diode Function Generators (DFG); the DFG is programmed by the insertion of a standard punched card. The unit provides for the programming of a start point, a central slope, 10 pairs of breakpoint-slope values, a central slope increase, a function increase and a start point increase; all functions can be programmed from one card. The start point may be set to any value in the range of ± 100 volts. For information:

CIRCLE 185 ON READER CARD

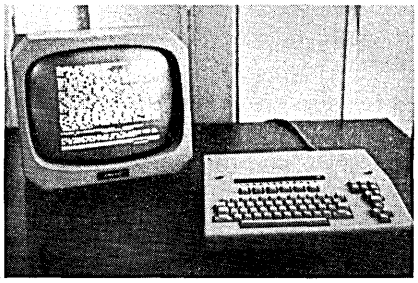
GERBER SCIENTIFIC INSTRUMENT CO.
Hartford, Connecticut

The automatic digitizer is designed as optional equipment to complement the Gerber Series 2000 stored program graphical display systems. These systems, when equipped with the automatic digitizer, will be able to complete a graphical to digital conversion task at "greater speeds." The digitizer consists of three major assemblies: a line follower, an operator's console, and a digitizing program. The line follower uses a vidicon sensing system. The operator's console consists of a tv monitor, a control panel and a foot-actuated speed control. The digitizing program allows the Series 2000 control computer to collect, sort and initiate recording of data; it will also initiate data readout when preset limits are reached. For information:

CIRCLE 186 ON READER CARD

HENDRIX ELECTRONICS
Milford, New Hampshire

A 17" crt remote data terminal has a 2,000 character capacity (100 characters per line) and a 64-character font (expandable to 96 characters). A data set interface of up to 2400 bps or a direct computer interface with up to



500 KC bit transfer rates is provided. The terminal, which operates in full- or half-duplex mode, is capable of incremental graphics and has Selectric hard copy as an option. For information:

CIRCLE 187 ON READER CARD

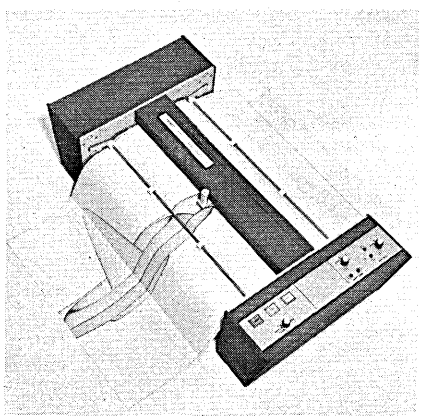
HEURISTIC SYSTEMS CORPORATION
Santa Monica, California

The Computer Performance Monitor (CPM) is a data-gathering hardware device designed to measure system utilization. CPM results can be used to evaluate system performance, increase operating efficiency and identify system components requiring alteration. The CPM has 16 decimal accumulators, 20 isolation probes and a removable logic panel. It records results on an IBM-compatible 7- or 9-track tape drive at 800 bpi. According to the company, the monitor can be attached to any signal line in any computing system without imposing line-loading on the system or degrading system performance. For information:

CIRCLE 188 ON READER CARD

HOUSTON INSTRUMENT
Bellaire, Texas

The DP-3 COMPLOT Plotter is a recorder designed for computer graphics, and is generated by the operation of three independent axes. The pen carriage (Y) axis moves bi-directionally over a 22" paper surface; the pen may be raised or lowered (Z axis). The paper (X axis) moves bi-directionally under the pen beam for records up to 144' long. The DP-3 uses Z-fold paper;



bi-directional stepping motors produce incremental steps at rates up to 300 steps a second. For information:

CIRCLE 189 ON READER CARD

INFORMATION CONTROL CORPORATION
El Segundo, California

The ComRac 1000 core memory system has a 900 nsec cycle time and a capacity of 8K (36-bit) core, expandable to 32K. Power supply is detachable and mounts on the rear of the memory. Standard options, such as built-in tester, data save, zone control, special interface and read/modify/write, are available. For information:

CIRCLE 190 ON READER CARD

LOCKHEED ELECTRONICS CO.
Los Angeles, California

The CR-95 is a 1-usec core memory available in capacities of 4,096 and 8,192 words with word lengths variable in 4-bit increments from 8 to 36 bits. Access time is "less than" 500 nsec. Designed as a memory or buffer for small systems, the CR-95 meets MIL-E-16400 specs. For information:

CIRCLE 191 ON READER CARD

TYMSHARE, INC.
Los Altos, California

The Data Transceiver offers the capability to operate a Teletype as a remote portable terminal for access to time-sharing computers. The terminals may be used to communicate with a computer connected to a 103A 11 dataset from any location where a telephone is available. The transceiver will connect to mod 33, 35 and 37 Teletypes, graphic plotters and other equipment

with EIA interface. The unit also has a magnetic receiver which eliminates interference from local room noise. It will operate in either full- or half-duplex mode; transmission rates are 300 baud. For information:

CIRCLE 192 ON READER CARD

THE PAPER SESSIONS

Monday, 10:30
Arena
TIME-SHARING

Chairman:
Kathleen Beisty
Bradford Computer and Systems, Inc.
New York, New York

In the past five years there has been a steady increase in the use of time sharing systems. While most computer applications are still run in a batch environment, the percentage run under time sharing has climbed rapidly, and more and more computer hardware is being dedicated to time sharing. Already dozens of companies have sprung up to furnish time sharing services, and now count revenues in the millions.

To reach this modest stage in the development of time sharing, the computing industry has faced and—with varying degrees of success—overcome a maze of technical problems. But many problems remain to be solved before we can even guess at the ultimate impact of time sharing.

Three papers to be presented at this session will deal with some of these problems. One paper investigates utilization of the University of Pittsburgh time sharing system, called PITT. Another paper examines some design features of IBM TSS/360. And the third looks at a debugging support system for testing a time sharing system. All three are of interest to anyone involved in planning, developing, or installing a time sharing system.

The PITT system, developed for the IBM 360/50, has been in operation since March 1966, with 31 remote terminal users and a batch user. The paper on this system explores cpu usage for various kinds of processing—such as conversational language, assembler, compiler, applications, supervisor calls, and general system overhead. The paper also considers system performance in relation to time slice size and user requirements. The conclusions drawn from these and other performance measurements lead to suggestions about the use of a 2361 large capacity storage unit, the importance of an efficient file system and

system integrity, and the use of a console system versus its batch equivalent.

The initial release of TSS/360, in October 1967, has been modified and its performance improved as a result of extensive measurements and analysis. The paper on this system reaches several conclusions that stem from operating experience. It verifies paging as a sound concept, emphasizes the need and relative simplicity of an open-ended command system, and points out the desirability of an integrated approach to resource allocation. These design concepts are central in the latest TSS/360 releases.

The remaining paper describes a time sharing debugging system, and has special interest for the individuals who must budget and schedule the development of a time sharing system. The paper emphasizes several functions needed in a time sharing debugging support system. These include access to system programs through user terminals, interruption of the time sharing system to isolate and correct bugs, monitoring of user or system progress, automatic activation of the debugging system by a pre-defined condition, and creation of a debugging system that is totally independent of the time sharing system. A debugging system that meets this description is now being developed for the TSS/360.

The authors of these papers will explain, in detail, the facts that led to their conclusions. Consequently, this session will not be tutorial. Instead, it will offer a highly technical discussion on the design, debugging, and use of time sharing systems. The experience reflected here should prove extremely helpful to other developers of time sharing systems.

The PITT Time-Sharing System for the IBM System 360, by George F. Badger, Jr., E. Andrew Johnson, and Richard W. Philips.

Debugging in a Time-Sharing Environment, by William A. Bernstein and James T. Owens.

A Time-Shared Operating System, by Alexander S. Lett and William L. Konigsford.

Monday, 10:30

Larkin I

RELIABILITY, MAINTENANCE AND ERROR RECOVERY IN THIRD GENERATION SYSTEMS

Chairman:

Dr. Sanford Elkin

Control Data Corporation

Palo Alto, California

Data processing systems are liable to both hardware and system software failure. In first and second generation systems the impact of such failures was typically limited by the scope of the system itself to the one or limited few programs operating at the time. Resumption from the beginning of the program or pre-planned check point typically constituted complete recovery.

Third-generation systems have increased in complexity. They have assumed responsibility for the management and retention of user files, and they support and automatically schedule the concurrent operation of increasing numbers of batch and interactive tasks. Information maintained both on direct access devices and in memory is critical to continuing system operation. Much of this information is dynamically updated in place and as a consequence even partial loss may discontinue and delay system operation.

The growing scope of vital system-maintained information has increased the vulnerability to failure of these systems. Provision must be made for on-line maintenance of peripheral equipment, and for protection against environmental system failures. Rapid and smooth restoration of service subsequent to hardware and software failure has become a necessity. Considerations for system protection and recovery are, therefore, critical aspects of third-generation system design.

This session presents four papers which treat different aspects of this problem area. In the first paper: Software techniques for system restart and recovery are discussed within the environment of a multi-access, multi-programming, single processor system. The affects of power failure, main memory failure, and direct access device failure are related to system and user information retained in memory and on direct access devices. Critical elements of system control information are enumerated and software techniques to protect and reconstruct such elements are indicated. User file content and structure are examined in light of failures, and recovery techniques are discussed. The efficiency of alternate solutions in eliminating or localizing the impact of failure and the overhead implications they place upon the system are weighed to isolate preferable approaches.

The second paper addresses error recovery procedures and recovery management support from a programming point of view. A number of functions such as Instruction Retry, Selective Termination, Refreshing Core, and some possible I/O techniques are discussed. The Recovery Management Support for the System/360 Model 65 is then looked at to determine how some of these functions have been implemented and how they contribute to the solution of the Error Recovery Problem.

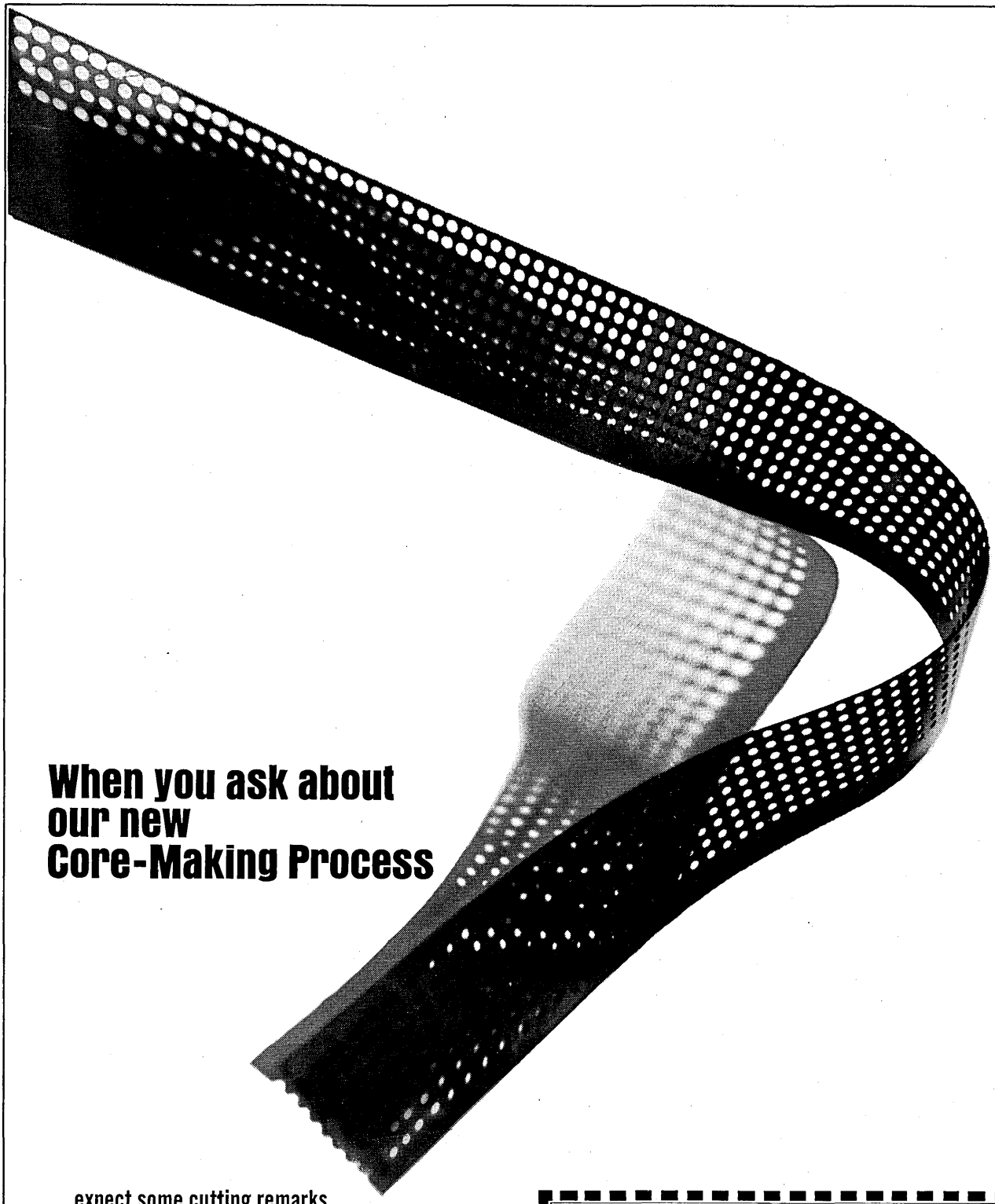
The third paper addresses the question of how to maintain peripheral equipment without interfering with the normal operation of a computer system. It describes OPTS-600, the *On-Line Peripheral Test System* for GECOS III (*General Comprehensive Operating*) Supervisor for the General Electric 625/635 Computer System). OPTS-600 is an integral part of the total operating supervisory system. The test executive operates within the framework of GECOS III, but provides for all test dispatching, peripheral allocation, language processing, issuing of test I/O, memory space management and error output. The test executive will control from one to eight individual peripheral tests in a multi-program environment, concurrent with normal customer operation.

Console request verbs describe the exact type of test to be executed on the desired peripheral. A complete library of comprehensive Test Pages is available for selection by the maintenance engineer. The Test Page represents a text explicitly designed for a particular peripheral.

Test Pages are written in a test and diagnostic English-type language. This language is also available to the maintenance engineer via conversational console entries. In this manner the maintenance engineer can write and execute tests of his own design concurrent with customer operation.

The fourth paper deals with the reliability of the power supply and environmental conditioning systems for a modern large-scale computer installation. The provision of fail-safe electric power and reliable environmental conditioning for the computing facilities of the Westinghouse Tele-Computer Center was a matter of serious concern from the outset of the planning for the center in 1961. The measures eventually taken to achieve these goals considerably exceed those initially thought to be adequate; so it is obvious that a few lessons were learned along the way. The purpose of this paper is to describe the evolution of these facilities; to recount some of the problems encountered and their solutions; and generally to share with others the benefits of some experience in this relatively neglected area of planning for computer systems which must provide a high degree of operating reliability.

Considerations for Software Protection



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and Recovery From Hardware Failures in a Multiaccess, Multiprogramming, Single Processor System, by G. Oppenheimer and K. P. Clancy.
Error Recovery Through Programming, by A. Higgins.
OPTS-600, by G. W. Nelson
Fail-Safe Power and Environmental Facilities for a Large Computer Installation, by R. C. Cheek.

Monday, 10:30
Larkin II
NUMERICAL CONTROL

Chairman:
Robert Little
IIT Research Institute
Chicago, Illinois

Numerical control, one of the fastest growing application areas of computer technology, has given tremendous impetus to the automation of complex manufacturing operations. One paper in this session deals with the general problems of investigating the performance of an automated production system through modeling and simulation. APT is a major component of numerical control systems. As the computer language used with NC machinery, it has achieved widespread use throughout the world. Standardization efforts by USASI X3.4.7 on this extremely complex and dynamic language have led to a computer language representation methodology which will have an impact on future language standards work. The third paper deals with enhancing numerical control capability through on-line use of APT. Details of an approach are offered. Individuals with an interest in simulation, language specification and large on-line applications, as well as those who are directly involved in numerical control, should find this session stimulating.

Methodology for Computer Simulation, by Gastone Chingari.
Subsets and Modular Features of Standard APT, by Clarence G. Feldmann.
A Remote Batch Processing System for APT, by M. E. White.

Monday, 10:30
Nourse
THE COMPUTER FIELD: WHAT WAS PROMISED, WHAT WE HAVE, WHAT WE NEED
(Software Session)
Chairman:
Louis Fein
Consultant
Palo Alto, California

The computer field, like other fields, has had both successes and disappointments. Yet, largely because the computer field has been growing so rapidly, it is difficult even for computer people, let alone the general public, to keep informed on what had been promised in the past, what we now have, promised or not, what is now being promised and what is needed in hardware, software, systems and applications.

In an attempt to organize sessions that would serve to inform computer people as well as the general public on where we have been, where we are, and where we are going, the 1968 FJCC program committee endorsed my inviting specialists in hardware, software, systems and applications to participate. In December 1967—12 months before the date of the '68 conference—I wrote to over 80 experts in industry, research institutes, government, education, journalism and private consulting, soliciting their participation.

The following is excerpted from that letter of solicitation:

"The hardware men would tell about the promises that were made, what we have, and don't have, and why, and what is now being promised on such things as cryogenics, kilomegacycle components, nanosecond memories and microelectronics. The software men should make a similar assessment on things like computer independent languages, applications oriented languages, multiprogramming, standardization, compatibility, program translation and operating systems. The systems men would cover systems like STRETCH, time-sharing, hybrid systems, robots and interactive systems. Finally, the applications men would handle successful applications in business, science, education and the military, and disappointing ones such as pattern recognition, natural language translation, information retrieval, chess playing, and brain modelling.

". . . We are hoping, of course, that this session will be well enough received so that succeeding Joint Computer Conferences will decide to have similar sessions on: The Computer Field—Past, Present, and Future, where different topics in the four categories would be covered and where promises and accomplishments made since preceding conferences would be assessed.

"Of course, there are risks in such a sensitive undertaking. Pessimists, with an aim to embarrass, will want to pin to the wall those who made irresponsible and outrageous promises; optimists, with an aim to excuse, will be inclined to whitewash them and concentrate on successes. It is not the purpose of this session to praise or to condemn. The purpose is to inform—to inform the computer community and the community at large about what the score is. So that, whereas speakers should not shun praise or criticism, they should do so only if it serves to inform—to let us know where we stand."

Over 40 respondents indicated a willingness to participate. Others replied that the sessions were a good idea but they themselves were busy; some suggested other speaker experts. One or two who are themselves "controversial" didn't want to re-enter the "arena" at this time. (Some, it turned out, thought that they were invited to speak on a panel rather than to deliver a paper that would be referred to determine acceptance.)

To the 40-odd respondents and to suggested alternates, I mailed our invitations on February 23, 1968. The following is excerpted from that letter:

"Thank you for your generosity in offering to deliver a paper on the topic 'What was promised, what we have, what is being promised' in a facet of the computer field that you are expert in.

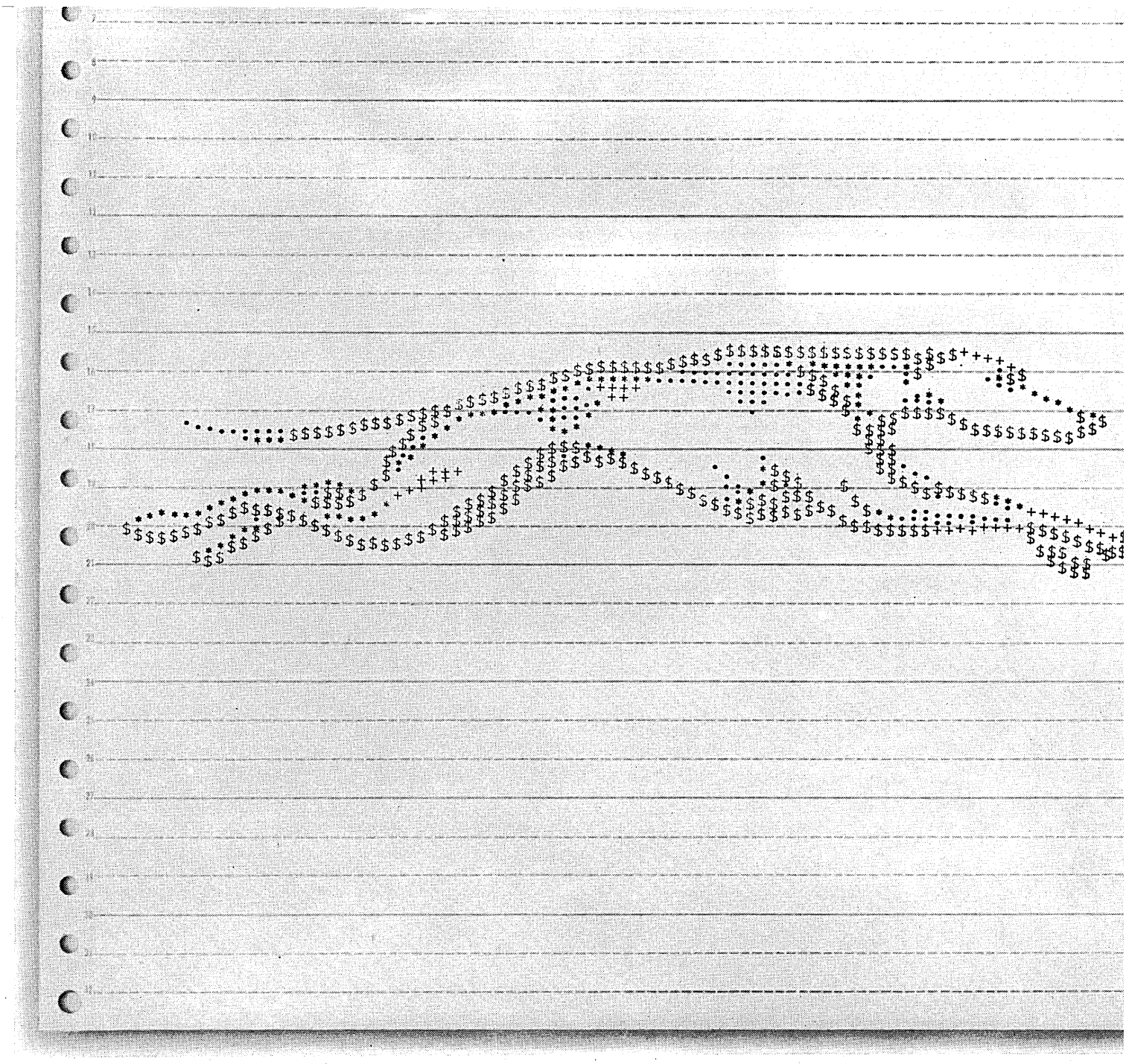
"Your role is to educate both your colleagues and the public at large. So avoid detailed descriptions unless they serve to illustrate. Consider yourself both as philosopher and technician.

"Your paper, like every other submitted paper for the conference, will be refereed for relevance and accuracy; a high standard of scholarship is expected of you. Thus, your paper will not be automatically accepted because I invited it.

"You realize, of course, the risks of this peculiarly sensitive undertaking. If we are not careful, it could deteriorate into a 'mud slinging' session. I am resolved, however, that this session will be informational, not polemical.

"Don't cover up anything. For example, if it is so that an outlandish promise was made because funding would not otherwise have been available, say so. Document your facts and support your appraisals and projections. Make clear why you say what you say. Consider the audience to be your students, not your judges or the judges of those whose work you are reviewing."

When the paper deadline arrived,



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about a dozen papers were received. They were duly referred and six were accepted to be delivered in one of the two sessions (one devoted to hardware; another, software).

One can only conjecture on why so few acceptable papers materialized. Is it noteworthy that three speakers are from government-associated research centers; two from universities; one from industry? The development of these sessions is perhaps a microcosm of the development of the computer field itself. Indeed, for these sessions, I am tempted to write a paper entitled, "The Papers I Was Promised; The Papers I Have; The Papers I Need" . . .

Software Compatibility:
What Was Promised, What We Have and What We Need, by John A. Gosden.
Interactive Systems:
Promises, Present and Future, by Jules I. Schwartz.
Multiprogramming: Promises, Performance and Prospects, by Thomas B. Steel, Jr.

Monday, 10:30
4th Floor
Room 415
APPLIED MATHEMATICS

Chairman:
Dr. Glen Lewis
University of Southern California
Los Angeles, California

This session deals with papers which concern themselves with mathematical problems which are solved by computers. In such cases one must not only find a mathematically rigorous algorithm which solves the problems but one which also leads to efficient machine implementation. Two papers deal with Fourier transforms, one with solving nonlinear systems of equations and one with implementing statistical packages.

An Algorithm for Finding a Solution of Simultaneous Nonlinear Equations, by R. H. Hardaway.
An Economical Method for Calculating the Discrete Fourier Transform, by R. Yavne.
Nonlinear Interactive Stepwise Regression Analysis, by Leta Edwin, R. Crandall and A. Edwin.
Recursive Fast Fourier Transforms, by Dr. G. Epstein.

Monday, 1:45
4th Floor
Room 415
DIGITAL SIMULATION OF CONTINUOUS DYNAMIC SYSTEMS — WHERE IS IT? WHERE IS IT GOING?

Chairman:
Jon Strauss
Carnegie-Mellon University
Pittsburgh, Pennsylvania

This session takes a brief, but comprehensive, overview of the use of digital computers in the simulation of dynamic systems. As indicated by the title, the objectives are twofold:
1. To review the current status of the use of digital computers in simulation, stressing the relationship to the use of analog and hybrid computers.
2. To predict, both on the basis of current trends and on economic and technological factors, the future course of continuous system simulation on digital computers.

After the presentation of the authors' papers the session will take the form of a panel discussion in which the participants have been encouraged to take controversial positions on the topics to be presented.

Digital Simulation of Continuous Dynamic Systems: An Overview, by Jon C. Strauss.
Mathematics of Continuous System Simulations, by David H. Brandin.
Salem — A Programming System for the Simulation of Systems Described by Partial Differential Equations, by S. M. Morris and W. E. Schiesser.
TAF — A Steady State, Frequency Response, and Time Response Simulation Program, by Thomas E. Springer and Otis A. Farmer.

Monday, 1:45
Larkin II
FRONTIER DIRECTIONS IN INTERACTIVE GRAPHICS

Chairman:
Richard Conn
University of California
Lawrence Radiation Laboratory
Livermore, California

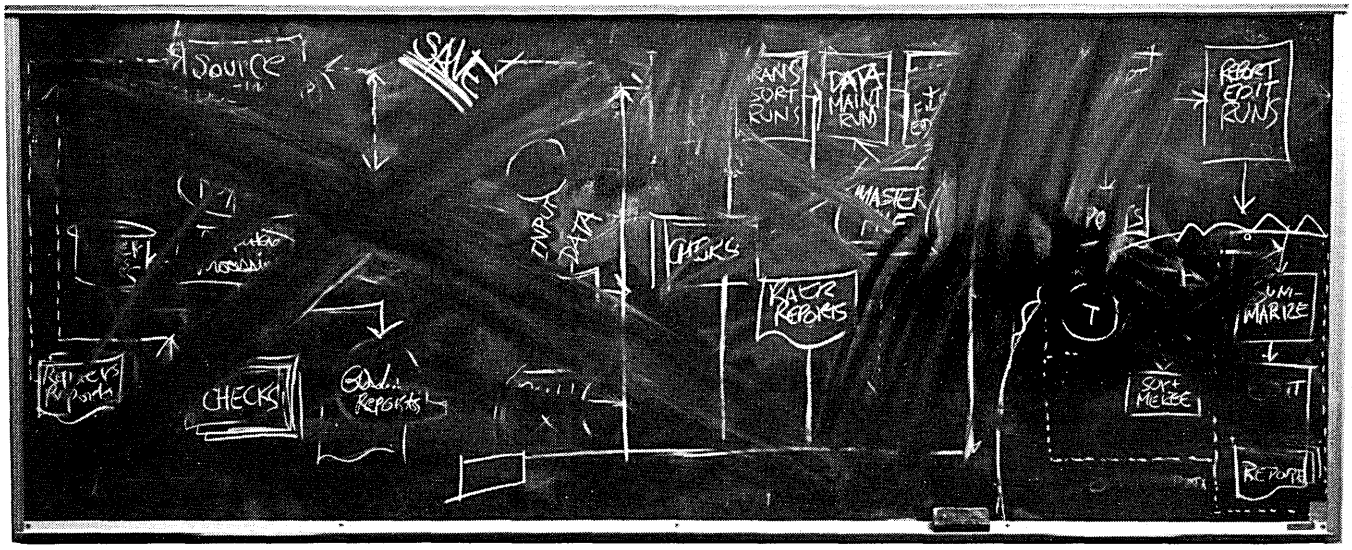
Computer buffs manifest a not always acknowledged need to communicate with their machines as they do with their loved ones. Many experiments have been undertaken to improve the external receptors and affectors of the machine as well as its linguistic capabilities. Among the more promising of the former (the interface) efforts is the early work in interactive graphics; an effort that has been stimulated by the recent proliferation of time-sharing environments. Where it would have been difficult for an investigator to tie up his firm's (or school's) computing facility while gazing at a crt, it is no big deal to shake loose a single terminal. The manufacturers are meeting this situation with better, faster, cheaper equipment.

But the development of good, fast, cheap pictorial soft copy with tablet ease input is still a long way from holding stimulating conversation with your favorite computer. Even if voice recognition systems were available for immediate use it would be no real thrill to dial a computer and whisper DO 400 I equals 1 comma 50. What can we expect between now and the time the human/machine interface is truly understood? In the area of interactive graphics we have a partial answer.

Papers in the session, Frontier Directions in Interactive Graphics, tackle the problem in half a dozen different ways. Graphics is classically defined as the art of making drawings algorithmically and calculating properties from those drawings. Examples are architectural and engineering drawings with stresses as a calculated property. Computer graphics is typically understood in a broader context and any drawn input or computer generated picture is considered an example. The graphic process becomes interactive when the response, i.e., the displayed output, is generated fast enough to hold the user's unfrustrated interest. One of the papers investigates just this—the user's frustration threshold: How do delays affect the continuity of a user's thought while he is solving problems?

Another of the papers centers about a user in the solution of a particular problem, the firing squad synchronization problem. It requires the design of a circuit simulating a commander and his line of n soldiers. Each soldier can "talk" only to the neighbor on his flanks. After the commander says fire, all n soldiers must fire at once. This problem, interesting enough in itself, takes on new meaning when solved graphically. Is the problem one of a class which may be similarly solved?

Problem solvers often desire to enhance their intuitive understanding by means of some geometric construction. Working with problems in two or even three dimensions (with certain qualifications) creates no new difficulties. How may we be aided visually when working with multidimensional structures? A third paper expounds a technique in which such spaces are displayed in two dimensions with each data point in approximately the same



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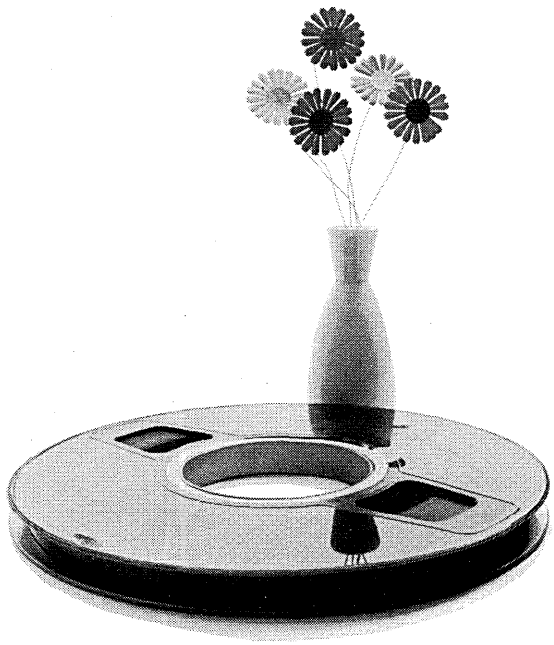

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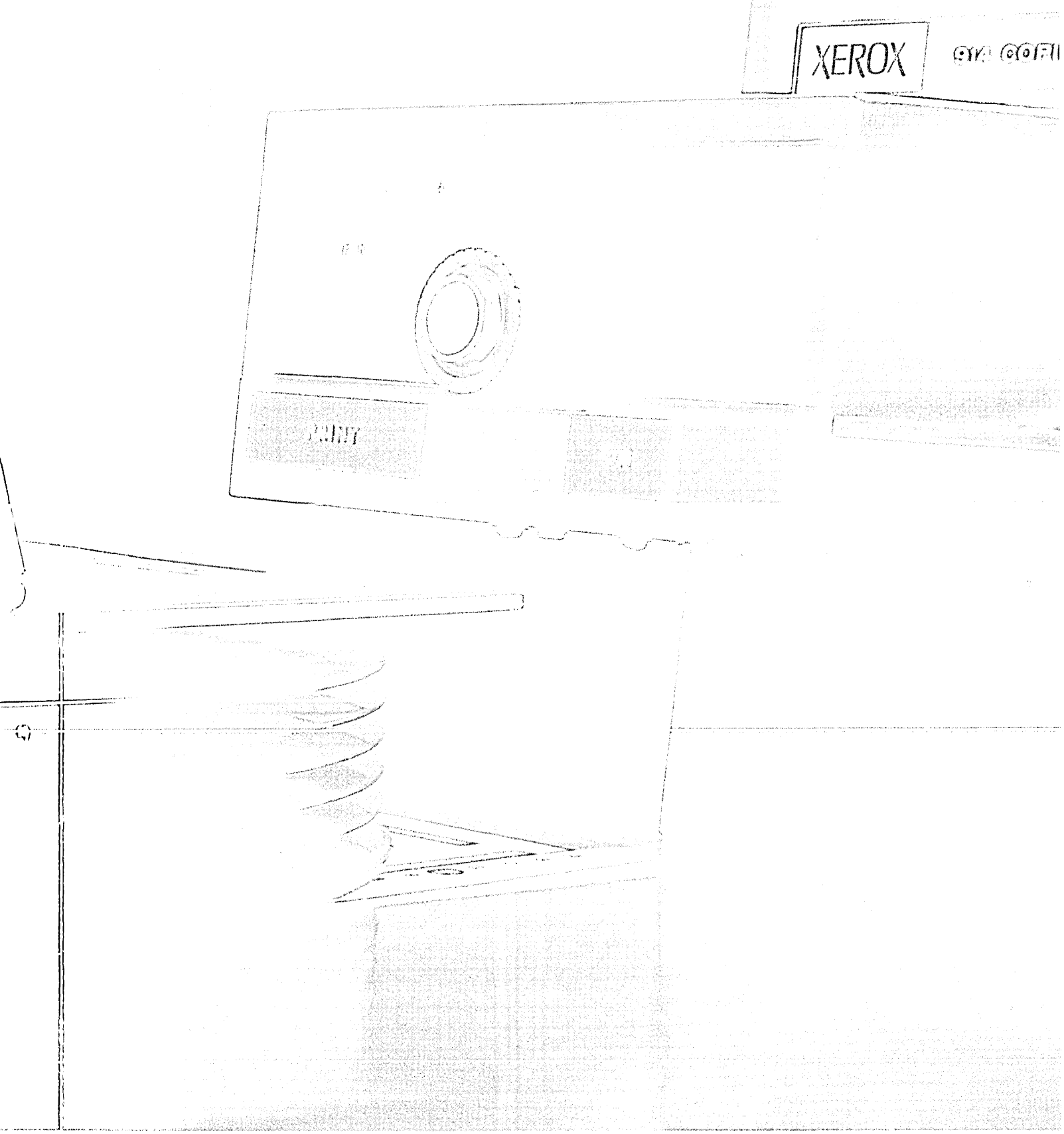

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Most disc packs promise a packing density every bit as good as the hardware. (Our Mark VI is still waiting for the hardware to catch up.)

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- Incremental write/incremental read
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- Recording format: 7-track IBM compatible
- Recording speed: 0-300 characters/second
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relationship to its nearest neighbors as it was in the original space.

Two of the papers swing to the other end of the spectrum using display terminals with light pens and tablets as the ears and voices of comprehensive on-line information systems. The first of these centers about a nationwide communications system linking many atomic powered electric generating plants. The second surrounds an augmented computer driven library catalog. Both systems will utilize interactive graphics to provide their users with information at heretofore unavailable speeds.

The last paper takes a hard look at a specific graphic technique particularly relevant to integrated systems of the type just discussed. It describes a method for non-typists to communicate by pointing at displayed words and phrases.

If we fail in this session to offer that quantum jump toward lovable machines, we will certainly have made an honest effort to indicate the trends and directions of current man/machine communication.

The Organization and Formatting of Hierarchical Displays, by G. T. Uber, P. E. Williams, B. L. Hisey and R. G. Siekert.

Projection of Multidimensional Data for Use in Man-Computer Graphics, by T. W. Calvert.

The On-Line Firing Squad Simulator, by R. M. Balzer and R. W. Shirey.

Interactive Telecommunications, by D. W. Cardwell.

Computer-Driven Display Facilities for an Experimental Computer-Based Library, by Dr. Donald R. Haring.

Response Time Man-Computer Conversational Transactions, by Dr. Robert Miller.

Monday, 1:45

Polk

MIS DESIGN

Chairman:

Gordon L. Murray

Haskins and Sells

New York, New York

The art of MIS design has not progressed to a point where standardized techniques have emerged. The various efforts going on have experimental characteristics and the most effective approaches and techniques largely remain to be proven. The subject matter of this session covers three approaches to MIS systems design aspects that should be of interest to those faced with finding the most effective solution to fundamental design problems.

Design and Implementation of a General Purpose Management Information Systems Data Bank, by Honien Liu.

Omnibus: A Large Data Base Management System, by Roy P. Allen.

A Design Approach to User Customized Information Systems, by Robert G. Rangel.

Monday, 1:45

Larkin I

TERMINAL LANGUAGES

Chairman:

Arnold Greenman

Programming Sciences Corp.

New York, New York

Second-generation computing systems were batch-oriented. One job at a time entered the computer and was completed before the next job was begun. The cpu functioned on two levels: the instruction execution level and the I/O interrupt level. The user had to have a solid programming background to use the second-generation software, but with competent machine operators he almost never had to come in contact with the machine at all. The man-machine interaction was indirect.

Third-generation hardware and software have changed this. The cpu still functions on two basic levels, but a much more complicated software system, an operating system, has made the man-machine interaction much more direct. Today the user no longer has to have programming ability. The programs and systems now being implemented under sophisticated operating systems seek to provide instantaneous information through terminals. The user today, and in the future, may be a manager seeking corporate information, an engineer solving problems or an accountant auditing a client.

The terminal is the interface of man to machine. The man using the terminal is in a very real sense programming the machine, but provisions must be made for this man in case he is not a programmer. The need therefore exists for terminal languages to guide the non-programmer.

This session will examine the concept of terminal languages, what they are and what they should be. The papers presented at this session will deal with two conversational and one non-conversational language.

The Tymshare Conversational Language (TCL) provides an incremental problem solving capability in the tradition of algebraic languages like FORTRAN. The paper develops criteria for algebraic languages in a conversational or interactive environment.

META-PI is an on-line interactive compiler-compiler. It was produced as an approach to solving the problem of language implementation. In an interactive environment, the user can define operations to scan statements in his language for correct syntax and then generate code.

The Bell Line Drawing Language (B-LINE) was developed to produce publication quality pictures on a cathode ray tube. The objective was to design B-LINE to be used by persons with all degrees of programming background.

The languages presented at this session are essentially three entirely different *applications*. None is a universal conversational language, but all contain certain requirements for such a language. The papers will acquaint us with some aspects of terminal languages. The open forum after the presentations will provide some criteria for a universal terminal language.

Computer Graphic Language, by Amalie J. Frank.

Tymshare Conversational Language, by Richard K. Moore and W. Main.

Meta Pi—An Interactive On-Line Compiler-Compiler, by John T. O'Neill, Jr.

Monday, 1:45

Nourse

COMPUTER MODELS OF VISION AND SPEECH

Chairman:

Prof. D. Raj Reddy

Stanford University

Computer Science Department

Stanford, California

There have been many attempts to provide visual and voice input to computers. This session presents some recent results in these areas. It should be of interest to people concerned with man-machine interaction, artificial intelligence and robots. This session, the first of these sessions on robotry, and the related panel discussion along with the organized tours are expected to give a better understanding of the problems and potentialities of providing a computer with these human-like abilities. Information on the tour of "live robot" installation will be available at the conclusion of this session.

Linguistic Methods in Picture Process-

ing: A Survey, by W. F. Miller and A. C. Shaw.

Decomposition of a Visual Scene Into Bodies, by A. Guzman.

A Limited Speech Recognition System, by Dr. Daniel G. Bobrow and Dennis H. Klatt.

Computer Models for Speech and Music Appreciation, by P. Denes and M. V. Mathews.

A Computer with Hands, Eyes and Ears, by J. McCarthy, D. Reddy, L. Earnest and P. J. Vicens.

Monday, 1:45
4th Floor
Room 416

MEDICAL INFORMATION SYSTEMS

Chairman:
Dr. Ted Kehl
University of Washington
Seattle, Washington

This session treats the problem of building computerized medical information systems which contain everything from real-time physiological data to standard medical history forms. The design, operation and legal considerations of such medical data banks are treated in detail. The computer hardware/software specialist is introduced to the terminology and special requirements of this fast developing medical application.

The Automated Medical History, by Weksel, Paul N. Sholtz and John Mayne.

The Key to a Nationwide Capability for Computer Anaylsis of Medical Signals, by Cesar H. Caceres, Gabriel Kishner, David E. Winer and Anna Lea Weihrer.

A Legal Structure for a National Medical Data Center, by Roy N. Freed.

Monday, 3:45
Polk

PLANNING MODELS FOR MANAGEMENT

Chairman:
A. Seelenfreund
Stanford University
Graduate School of Business
Stanford, California

The purpose of this session is to unfold a vista of sophisticated techniques that the computer has placed in the hands of management. The papers describe the construction and implementation of planning models for the analysis of important business decisions. The applications are interesting in themselves; but, possibly more important, is the preview of the future use of the computer as an integral part of the management planning and decision-making process. The session should be of interest to individuals seeking the solution to important management problems.

An Approach to Simulation Model Development for Improved Planning, by James McKenney

Operations Research in a Conversational Environment, by Michael Conners.

Mediac—
On-Line Media Planning System, by Leonard Lodish and John Little.

Development and Use of Computer Models for the Southern Pacific Company, by Alan Seelenfreund, E. P. Anderson and R. K. McAfee.

Monday, 3:45
Larkin I

PLAIN TALK: MACHINES THAT SPEAK YOUR LANGUAGE

Chairman:
Gary Martins
Rand Corporation
Santa Monica, California

One of the most important—and difficult—problems in the design of data-management systems is that of man-machine communication. Research workers at several institutions, although motivated by differing interests and goals, have adopted the point of view that machines can and should be made to use the natural languages of man.

This point of view is still the focus of some controversy, and the systems which embody it are still largely experimental. Yet the arguments are achievements of those who are pursuing this line of development and are impressive enough to warrant general attention. Three exceptionally promising approaches to the natural-language man-machine interface will be described by researchers from Harvard University and the System Development Corporation.

A Computational Model of Verbal Understanding, R. Simmons, J. Burger and R. Schwarcz.

Procedural Semantics for a Question-Answering Machine, by W. A. Woods.

A Natural Language Compiler for On-Line Data Management, by Charles H. Kellogg.

Monday, 3:45
Larkin II

PRICING COMPUTER SERVICES WHAT? WHY? WHEN? HOW?

Chairman:
Norman R. Nielsen
Stanford University
Stanford, California

Historically the demand for computer services has greatly exceeded the supply. Since economic considerations have dictated that any given computer center operate but a limited amount of equipment, the use of some form of allocation procedure has been required to ration the available capacity. Thus, for example, computing time budgets or long turnaround times have been used to restrict demand. In other instances administrative rules have been superimposed, such as only "short jobs" will be processed during the prime shift.

However, there are really two aspects to computation—the amount of computation which is performed and the time at which that computation is performed. In other words there are cycles and service, both of which are in limited supply and must be allocated. Allocation procedures of the type mentioned above have certainly served to allocate resources along these two dimensions, but they have done so in an arbitrary way and have not attempted to maximize the value of the available computing services to the user population.

The problem has been further compounded with the introduction of third generation computers which have been designed for multiprogrammed and/or time-shared operation. Thus, it is no longer sufficient to talk in terms of computer "time" or "service" as if this were a single commodity, for the resources within a single computer system can now be utilized in part by several different users or jobs at the same time. Further, because of the modular design of these new systems, the supply of particular resources can be increased or decreased in response to the needs of the user population. It is no longer necessary to mold the users' requirements to "the system." However, in order to operate effectively management needs information about the quantities that should be offered of the various services, but the

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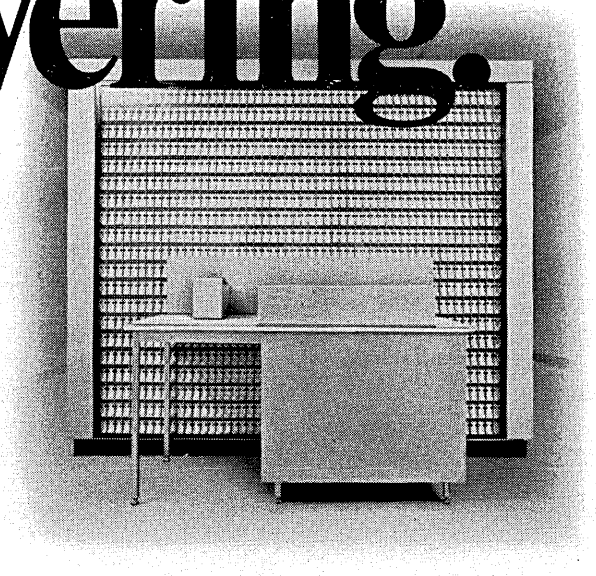

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aforementioned procedures do not provide this information.

Recently a great deal of attention has been directed towards the use of pricing as a mechanism for allocating computer resources. Pricing here is taken to mean the setting or use of charges for the purpose of controlling or influencing resource usage as distinguished from the levying of charges for the purpose of recovering operating costs. In many ways pricing tackles the problems mentioned above. Yet, it should not be considered a panacea for computer center management problems. It is the purpose of this session to explore in greater detail *what* pricing means with respect to the allocation of computer services. This includes a consideration of the advantages and disadvantages of pricing relative to other means of allocation. In other words, *why* price? There will also be a discussion of *how* pricing can be implemented.

The first paper will discuss the use of prices as an allocation mechanism and will compare the effectiveness of this technique with that of alternative procedures. Of course, the use of any price system requires some form of "money," and the second paper will examine the effect that a user's source of funds has upon the operation of a price system. The third paper will develop a framework for priority pricing and will demonstrate its applicability for time-sharing services. The final paper will consider prices as they relate to the many individual resources in a large complex system and will illustrate their application in a large computation center.

Prices and the Allocation of Computer Time, by Neil Singer, Herschel Kanter and Arnold Moore.

The Use of Hard and Soft Money Budgets and Prices, by Seymour Smidt.

Priority Pricing with Applications to Time-Shared Computers, by Maurice Marchand.

Flexible Pricing: An Approach to the Allocation of Computer Resources, by Norman Nielsen.

Monday, 3:45
4th Floor
Room 415

DATA STRUCTURES FOR COMPUTER GRAPHICS

Chairman:
Andries Van Dam
Brown University
Providence, Rhode Island

The papers in this session cover two aspects of data structures for computer graphics not yet frequently discussed: alternatives to pointer structures and "division of labor" tradeoffs between a central computer and a satellite computer driving a display.

Data Structures and Techniques for Remote Computer Graphics, by Frank S. Greatorex, Jr.

Graphical Systems Communications: An Associative Memory Approach, by Edgar H. Sibley, Robert W. Taylor and David G. Gordon.

Description of a Set-Theoretic Data Structure, by David L. Childs.

Monday, 3:45
4th Floor
Room 416

HYBRID SYSTEMS FOR PARTIAL DIFFERENTIAL EQUATIONS

Chairman:
J. D. Kennedy
J. D. Kennedy Company
Palo Alto, California

Phenomena characterized mathematically by differential equations which have derivatives with respect to more than one independent variable are described by a class of mathematics called Partial Differential Equations (PDE's). Many physical systems studied with computers lie within this realm, so a considerable proportion of computer time and budget are expended in solving these types of scientific problems. Engineers have typically turned to the special-purpose or general-purpose analog computer as the means to solve PDE's, while mathematicians and other non-engineering students usually have resorted to general-purpose digital computers. Both classes of computers have their respective advantages, yet both suffer considerable disadvantages.

The special-purpose analog computer has the advantage of optimizing certain characteristics to solve a particular type and complexity of PDE; however, the development cost may be high, the accuracy questionable, and the flexibility for adaptation to other classes of PDE's may be quite restrictive.

The general-purpose analog computer (electronic differential analyzer) has a distinct speed advantage because of its parallel hardware, and the flexibility it incorporates for solving a broad class of problems; however, the large number of components required for reasonable mesh-sizes and the four-decimal-digit per component accuracy have placed severe restrictions on its application to solving PDE's.

A general-purpose digital computer advantages lie in ease of programming, large data storage facility, and high accuracy afforded by floating point arithmetic and error-correcting integration techniques. Being serial in operation and requiring a large number of computation per solution because of the requirement for small step sizes (to prevent mathematical instability), the digital computer thus has serious economic disadvantages.

The role of hybrid computers in solving PDE's is expanding rapidly as improved operating software permits the efficient operation of newly developed hardware composed of solid-state, reliable circuitry which takes full advantage of the characteristics of both the general-purpose analog and digital computers. Hybrid computers offer economic advantages over all-analog or all-digital computation.

This session will present the following methods of applying hybrid computers to the solution of PDE's:

1. Continuous time—discrete space.
2. Continuous space—discrete time.
3. Assumed mode.
4. Assumed sum separation of variables.
5. Semi-discrete form of coupled ordinary differential equations.

Most of the authors have Ph.D's or are Ph.D. candidates, many are university professors with research projects involving computers, and all the authors are involved in the electrical, chemical, or control engineering fields. It is believed that this session will add greatly to the scientific computer fields because the economic benefits have considerable potential.

Applications of Functional Optimization Techniques for the Serial Hybrid Computer Solution of Partial Differential Equations, by Hiroshi H. Hara and Walter J. Karplus.

Hybrid Assumed Mode Solution of Non-Linear Partial Differential Equations, by Jon C. Strauss and Donald J. Newman.

Hybrid Computer Integration of Partial Differential Equations by Use of an Assumed Sum Separation of Variables, by J. Robert Ashley and Thomas E. Bullock.

A Hybrid Computational Method for Partial Differential Equations, by G. A. Coulman and J. F. Svetlik.

Preliminary Investigation of a Hybrid

SESSIONS . . .

Method for Solving Partial Differential Equations, by R. M. Howe and S. K. Hsu.

Tuesday, 8:30
Arena
PROGRAMMING SYSTEMS I

Chairman:
Martin E. Hopkins
Computer Usage Company
New York, New York

Three papers are presented in this session which advance the now well-established art of compiler generation. While the papers have some common areas, such as the use of PL/I, they differ markedly in other respects due to the diversity of the goals. XPL is a working compiler generator system which can be used to rapidly produce efficient compilers which are broadly useful. The authors hope to ". . . dispel the myth that the generation of compilers is necessarily a long and arduous task. . ." The syntax directed processor writing system described by Ferantzy and Gabura is intended for experimental work which transcends the production of compilers. The QUIP system is perhaps not, strictly speaking, a compiler at all but it does point the way to a method of writing generator programs which would be available to those working in many fields.

QUIP—A System for Automatic Program Generation, by F. C. Bequaert.

The XPL Compiler Generator System, by W. McKeeman, J. Horming, E. Nelson and D. Wortman.

A Syntax Directed Processor Writing System, by Eors Ferentzy and James Gabura.

Tuesday, 8:30
Polk
THE MINI-COMPUTER

Chairman:
Paul R. Low
IBM Corporation
Hopewell Junction

It seems only reasonable in this era of mini-skirts, mini-cars and mini-vacations that we should have mini-computers, and if we have mini-computers, why not a mini-session to discuss them? Accordingly, two papers discussing various aspects of very small computers have been selected for this session. The session format will consist of the formal presentation of the two papers followed by a question-and-answer session in which audience participation is encouraged.

The Mini-Computer: A Programming Challenge, by R. Hooper.

The Mini-Computer: A New Approach to Computer Design, by G. Ottaway, R. Shirk and D. Hitt.

Tuesday, 8:45
Larkin I
EXECUTIVE SYSTEMS FOR HYBRID SIMULATION

Chairman:
John E. Sherman
Lockheed Missiles & Space Co.
Sunnyvale, California

The concept of hybrid computers has been known for many years. However, it is only in the last three years that a significant number have been produced and put into operation. The hybrid computer field is still in its infancy. Large scale hybrid computers, which offer the versatility and speed of a modern analog computer coupled to large and powerful digital computers,

are the most powerful scientific computing devices available today.

The papers presented at this session have been carefully selected to present to the listener a description of five large, modern, *operational* hybrid computing systems. Each of the systems involves different combinations of hardware.

Three of the major analog computer manufacturers are represented: Applied Dynamics, Inc.; Comcor, Inc. (a subsidiary of Astrodata); and Electronic Associates, Inc. Four of the manufacturers of large scientific digital computers are represented: Control Data Corp.; International Business Machines; Scientific Data Systems; and Univac. The point to be stressed here is that all of the systems described in this session are in operation and producing useful results.

The Lockheed Hybrid System (A Giant Step), by C. K. Bedient and L. L. Dike.

A Priority Interrupt Oriented Hybrid Executive, by G. N. Soma, J. D. Crunkleton and R. E. Lord.

Growing Pains in the Evolution of Hybrid Executives, by Martin D. Thompson.

The Boeing/Vertol Hybrid Executive System, by Donald A. Willard.

Family I: Software for NASA Ames Simulation Systems, by James S. Raby, Edward A. Jacoby and Donald E. Robinson.

Tuesday, 8:45

Larkin II

SYSTEMS TECHNIQUES FOR INTERACTIVE GRAPHICS

Chairman:

Irving R. Schwartz

Adage, Inc.

Boston, Massachusetts

Interactive graphics systems are being developed to meet a growing need for on-line graphical communication between the user and his computing equipment. Older forms of outputing computer results, usually in numerical form, often fail to describe their real meaning. And for many processing tasks graphical input is the best way—and sometimes the only way—to state the problem successfully. Control by the operator to manipulate and modify display images can be important in certain kinds of heuristic studies, like computer-aided design, signal processing, and math modeling.

The papers presented in this session describe several design approaches for interactive graphics systems.

(Continued on page 116)

Stand-Alone Remote Graphic System, by Michael D. Rapkin and Othman M. Abu-Gheida.

An Interactive Graphics Terminal for Generation and Display of 2D and 3D Structured Images, by Thomas G. Hagan, Richard J. Nixon and Luis J. Schaefer.

A Head-Mounted Three-Dimensional Display, by Ivan E. Sutherland.

A Clipping Divider, by Ivan E. Sutherland and Robert F. Sproull.

A Low Cost Computer Graphic Terminal, by Malcolm Macaulay.

The Rand Video Based Graphic Communications System, by T. O. Ellis.

Tuesday, 8:45

4th Floor

Room 415

COMPUTERS IN BIOMEDICAL RESEARCH

Chairman:

R. N. Linebarger

NASA/Ames Research Center

Orlando, Florida

Moffett Field, California

Some of the most significant but least publicized applications of computer technology lie in biomedical research. This session explores major uses of computers in biology and medicine, including system modeling, image processing, monitoring of the critically ill and real-time data acquisition. Both the medical problem area and the computer techniques employed are treated in order to expose the computer scientist to meaningful biomedical research problem areas which have potential for computer utilization.

Computer Simulation of a Nonlinear Blood Flow Model, by Herbert A. Crosby and Murlin K. Klukis.

A Computer System for Real-Time Monitoring and Management of the Critically Ill, by D. Stewart, D. Erbech and H. Shubin.

Computer System for Research and Clinical Application to Medicine, by Reed M. Gardner and T. Allan Pryor.

The Use of Computers to Improve Biomedical Image Quality, by Robert H. Selzer.

Tuesday, 9:45

Polk

LARGE SCALE INTEGRATION

Chairman:

James B. Angell

Stanford University

Dept. of Electrical Engineering

Stanford, California

This session has been organized to indicate that it is possible *now* to design and build digital systems with large scale integrated circuits, and is thus in direct contrast with many recent presentations and published articles that have dwelt on predicting the future of large scale integrated circuits and their impact.

While various authors and orators have recently indicated that LSI will have a well defined place in providing main-frame memory in computer systems, the papers of this session will show that it is feasible to plan more elaborate, challenging LSI structures.

The opening paper of this session will describe the design of a functionally complete computer built using metal-oxide-semiconductor (MOS) large-scale integrated (LSI) arrays. This presentation will include a discussion both of the technical trade-offs in the design and of the unique administrative decisions which were required

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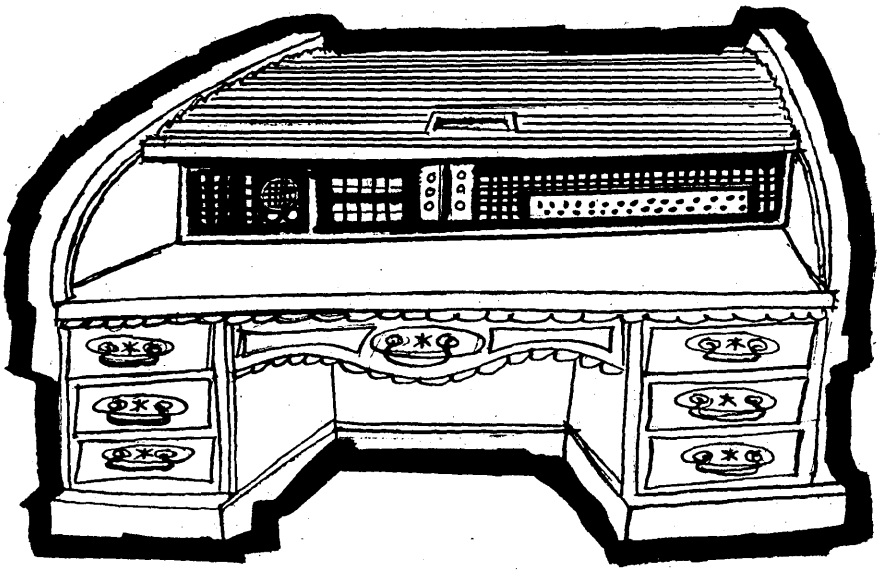

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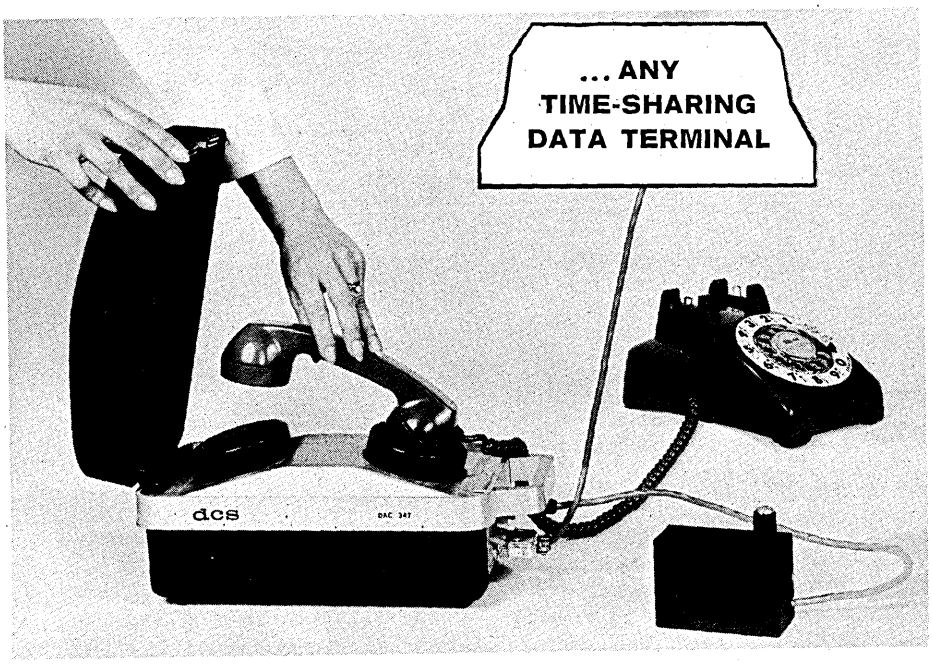

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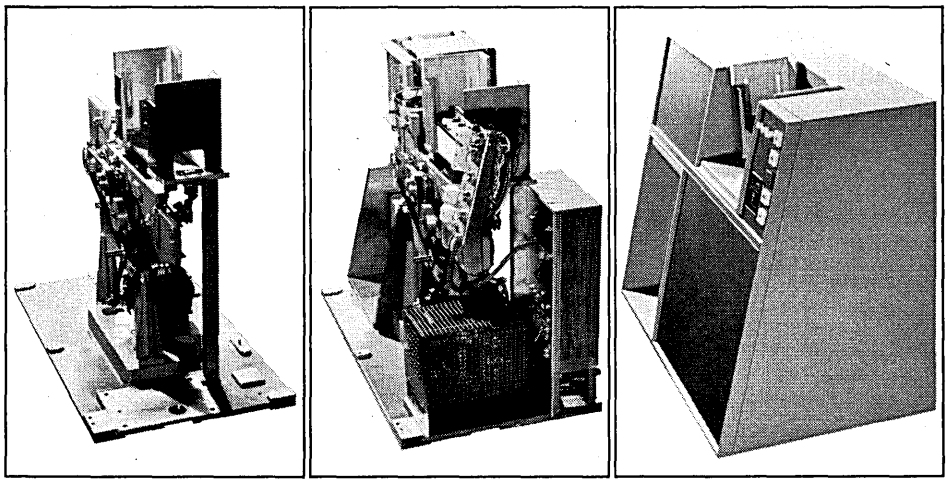

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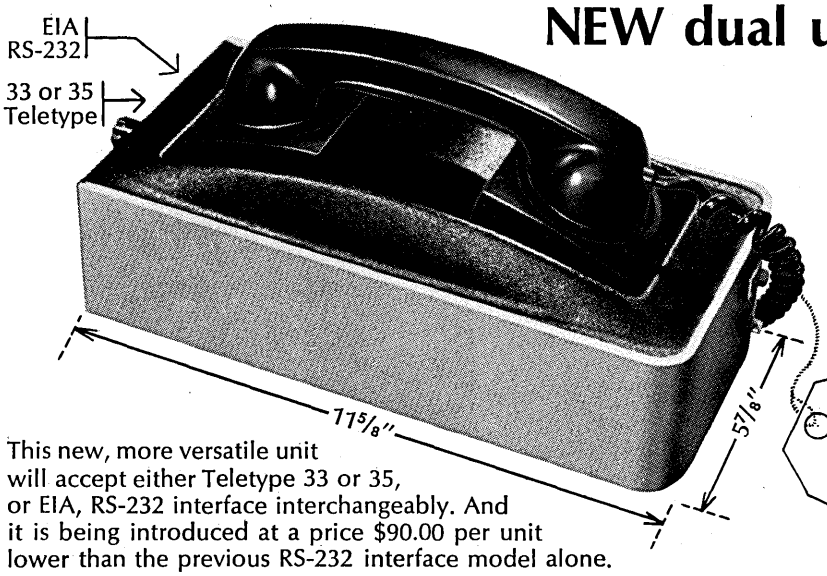

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enroute. For example, the authors will show the extensive use of design aids and the interactions between device designers, logic/system designers, and design aids and how these interactions are evolving in the LSI era.

The second paper discusses, from a sometimes skeptical point of view, the differences between some of the remarkable promises which have been attributed to LSI in computer service and the more probable advantages which they will be able to provide. An evaluation will be given of such device limitations as thermal dissipation, restricted flexibility in interconnections due to multilayer wiring limitations, and the limited architectural advantages associated with scratch pads, microprogramming, replicated subsystems, and hardware-software tradeoffs, so often advertised as substantial advantages in the LSI era.

The third paper develops a very useful concept of using a micro-programmable register array to provide a significant advantage in terms of 1) maximizing the gate-to-pin ratio and 2) minimizing the number of array types. These two criteria are also presented as a meaningful basis for evaluating how successful a designer is at the fine art of logic partitioning.

The final paper is an example of how inherent advantages of LSI can be exploited, through a proper design philosophy, to provide a modular structure which can be readily replicated to achieve any desired size for a high-speed multiplier. The design shows how multiplication logic can be successfully divided into modular blocks, using a technique which requires only a single circuit type and no control logic.

The session is aimed at computer architects, computer designers, digital circuit designers and semiconductor LSI designers. These people should receive from the session the impressions that 1) complete systems can be built with LSI now, 2) many previous predicted problems are indeed significant but soluble and 3) the need for ingenuity is just as important as ever and now has spread into such areas as logic partitioning and the use of computer aided design.

Engineering for Systems Using Large Scale Integration (LSI), by C. F. O'Donnell and R. Booher.

A Computer System Designer's View of Large Scale Integration, by Melvin E. Conway and Lester Spandorfer.

Efficient Partitioning for the Batch-Fabricated Fourth-Generation Com-

puter, by N. Cserhalmi, O. Lowenschuss and B. Scheff.

A High-Speed Modular Multiplier and Digital Filter for LSI Development, by Donald F. Calhoun.

Tuesday, 10:15

Arena

OPERATING SYSTEMS (PART I)

Chairman:

Jacques Bouvard

Honywell, Inc.

Wellesley Hills, Massachusetts

Seven quality papers grouped into a two-part session will focus upon the problem of system performance optimization, both from the theoretical and practical viewpoint. Perhaps the most interesting facet of this program is the insight that it provides into the basic, yet elusive problem underlying the design of many contemporary operating systems—the actual impact of the software control structure over the total system behavior.

As the operating system gradually evolved from a collection of simple-minded utilities into a comprehensive system management tool, its effect on the system performance characteristics has grown out of proportion. Correspondingly, the designer must broaden his perspective and shift his emphasis from the local sub-optimization of individual functions to the optimization of the entire system, both hardware and software. As one of the authors so aptly puts it, it is truly amazing how seemingly minor changes in a system can have a profound effect on the overall performance.

One of the most effective means to increase system performance lies in the aggressive exploitation of hardware/software trade-offs. Along this line, T. Hatch and J. Geyer discuss the interaction between hardware and software facilities in the design of the large-scale Honeywell 8200. The general philosophy in this case consists of implementing via software the more complex, yet infrequently used control facilities while relying on the hardware to handle the more detailed but heavily used service functions. Typical of this approach is the way in which multi-programming is implemented. The software handles program scheduling and resource allocation while the hardware dynamically controls sharing of memory access, input-output channels and central processor usage among contending programs. Using the same principle, extensive protection facilities are provided via complementary hardware and software capabilities balanced in such a way as to optimize total system effectiveness.

Performance optimization implies the ability not only to analyze the qualitative interaction between system components but also to derive quantitative performance measurements of the system behavior. In the light of their experience with the development of large scale operating systems, D. Campbell and W. Heffner examine the relative merits of several measurement techniques. Two points are emphasized: first, measurement and analysis facilities must be conceived at the earliest stage of system design and applied throughout the entire development cycle in order to provide a meaningful basis for optimizing trade-offs decisions; second, these facilities must provide a detailed insight into the internal system behavior on a dynamic as well as statistical basis. Expanding upon some of the concepts introduced earlier by Cantrell and Ellison, the authors describe in detail the event trace technique and its application in the design of the large-scale GECOS III operating system.

In a penetrating analysis, Denning examines the "thrashing" phenomenon, the extreme performance degradation which may occur in a multi-access time-shared environment because of excessive paging. Thrashing is shown to be directly caused by the large amount of time required to access information stored in secondary storage. Furthermore, the author establishes that using the conventional memory management strategies (such as first page in, first out or last recently used page, first out), thrashing causes an abrupt collapse in performance rather than a gradual degradation as one would intuitively expect as memory becomes increasingly more crowded. The author suggests a two-fold solution: the use of the working-set memory management algorithm which tends to smooth the impact of thrashing over system performance, and the introduction of faster secondary storage such as bulk core to reduce the value of access time.

Simulation is one of the methods often used in analyzing actual or projected performance of a multiprogrammed or fixed page size computer system. In all such studies, critical assumptions must be made regarding the dynamic behavior of programs under execution and the demands that these programs place on the various system resources. Freibergs presents the results from an extensive study conducted on a variety of program types. Each program was executed interpretively, instruction by instruction, and its requirements in terms of central processor and memory usage collected between successive calls to the supervisor. Results of this analysis show that between supervisor calls, most programs have only short instructions sequences; moreover, they usually require more than one page of memory for instructions and data. The results provided in the paper can offer a realistic input to simulation models.

Inherent in the concept of multiprogramming and in the sharing of multiple system resources among concurrent programs on an exclusive basis is the possible occurrence of the situation once described by Dijkstra as the "deadly embrace." Briefly stated, the problem occurs when two or more tasks are waiting for a resource held by another one of them; in other words, when a program is allowed to be placed on a queue waiting for a resource without first releasing the other resources that it already controls. To cope with this system interlock situation, Murphy proposes an elegant queue management and resource allocation technique which detects interlocks prior to their occurrence and without the rigid restrictions usually entailed by the conventional methods. The algorithm provides for isolating the minimal set of resources which must be released by a program when the possibility of interlock is detected; it also lends itself to the identification of the minimal set of resources for which a request for control must be denied.

The practical applicability of the design concepts introduced earlier in the session is further illustrated in two case studies. In both situations, strenuous but well defined performance requirements are successfully met within modest equipment configurations by optimal "tuning up" of the system to the characteristics of its environment. The dual processor checkout system described by Smith provides extensive support in monitoring test article data and in processing commands to the test article under stringent reliability and responsiveness requirements. The author develops an intriguing analogy between the logical structure of the system and that of the human brain. In the system built around a dual Sigma 7 configuration, all test data and commands are processed by both computers and compared for validation purposes. Inconsistencies activate the Executive Subsystem which isolates malfunctions and determines the proper course of action to continue testing. Should half of the system fail, the other half is fully capable of carrying on the test operations. The author stresses the significance of hardware/software optimization on two levels: in establishing the design criteria and resolving trade-offs, and through frequent

testing of rigidly defined processes. In another system also built around a Sigma 7 configuration, Day and Krejci discuss the characteristics of an operating system providing real-time support to a large number of users. The service consists mainly of processing data obtained in the course of experiments and returning either commands directly to the apparatus or data to the scientist to assist him in the conduct of the experiment. Simulation results indicate that the system is able to handle the demands of all the proposed concurrent users with a minimum system overhead.

All in all, the session promises to be interesting and constructive. The depth of the material presented provides a measure of the considerable progress made over the last few years in the area of operating systems. Of course, there is always room for further refinements; we may hear about some of them at the 1969 Joint Computer Conferences.

Hardware/Software Interaction on the Honeywell 8200, by T. Hatch and J. Geyer.

Measurement and Analysis of Large Operating Systems During System Development, by D. J. Campbell and W. J. Heffner.

Thrashing: Its Causes and Prevention, by Peter J. Denning.

Tuesday, 1:30

Arena

PROGRAMMING SYSTEMS II

Chairman:

Harold R. Gillette

Control Data Corporation

Palo Alto, California

The introduction of three papers which present aspects of new programming languages may seem presumptuous to some. Yet the "ideal" language for all programming applications does not exist. The papers presented are diverse in scope, thought provoking in content and perhaps controversial in result. They contribute to the ever-growing source of ideas and techniques in programming languages.

WRITEACOURSE is an "Algol-like" language whose commands have been chosen to provide the educator with a language which he finds natural in his application. As a result, it should be easy for educators and psychologists to learn to use this language. The WRITEACOURSE system is itself a PL/I interpreter, so WRITEACOURSE may be installed in many general-purpose computing centers.

The second paper will introduce a compiler-compiler which has been built for use with languages designed to control automatic test equipment. It allows for the syntax and semantics of these languages to be defined or changed using a meta-language program. The object language which is to be produced can also be easily defined or changed using this same meta-language. Equipment which is available in an automatic test equipment configuration can be defined or changed as new equipment is developed or old is modified.

The third paper provides a philosophical basis and motivation for ELF —an Extensible Language Facility. The subject will be introduced by discussing the need for a variety of programming languages and exploring several alternative ways of providing for such a variety. Following this, the overall design criteria will be presented and discussed which have provided the sources of constraint in the development of the language facility. The facility will then be considered from three points of view: as a language, from the point of view of compiling programs in the language, and from the point of view of the interface between the language and the system.

WRITEACOURSE: An Educational Programming Language, by Earl Hunt and Mary Zosel.

A Table Driven Compiler for Use with Automatic Test Equipment, by Roland L. Mattison and Robert T. Mitchell.

On the Basis for ELF: An Extensible Language Facility, by T. E. Cheatham, A. Fischer and P. Jorrand.

Tuesday, 1:30

Polk

MEMORY TECHNIQUES— HERE TODAY

Chairman:

Otto Gutwin

IBM Corporation

Essex Junction, Vermont

The papers of this session describe new uses and techniques for computer memories which can be readily adapted to present day computers. The first two papers show how memories can be made more versatile with only minor modifications. The last two papers give the memory designer a look at a feasible new memory cell and an economical technique for the addressing circuitry.

Associative Processing for General Purpose Computers Through the Use of Modified Memories, by H. Stone.

Addressing Patterns and Memory Handling Algorithms, by Sherry Sisson and M. Flynn.

Design of a 100-Nanosecond Read Cycle NDRO Plated Wire Memory, by Takashi Ishidate.

High Speed, High Current Word Matrix Using Charge Storage Diodes for Rail Selection, by S. Waaben and P. Carmody.

Tuesday, 1:30

Larkin I

AUTOMATED MAINTENANCE AND CHECKOUT OF HYBRID SIMULATION FACILITIES

Chairman:

Maughan S. Mason

IBM Corporation

Palo Alto, California

Hybrid computers are a valuable facility for solution of many types of scientific and engineering problems.

Since the charge for use of such facilities is not inconsiderable, it behooves the user to minimize lost time (thus maximizing his opportunity to achieve worthwhile results) and to ensure that he obtains valid data the *first* time. One means for accomplishing these goals is through implementation of some form of computer system checkout. Such checkout can be done on various levels of sophistication, from the simple check of proper static operation of the separate computing modules, to thorough dynamic checks of the complete system (including the specific problem being solved).

While such checks can be performed in a manual mode, a computer can be used to automate the process, which will speed completion of the series of checks, eliminate (or at least minimize) human error, and in general make life easier for the maintenance crew. The goal of such a system is cost reduction and improvement of methods and results.

The above steps are quite common for analog computers. For sophisticated hybrid computers, however, we are now in the middle-to-late development stage. The formal papers presented in this session will describe in detail the automated preventive maintenance and calibration programs used in modern, large scale hybrid computer facilities. Emphasis will be placed upon the criteria used to establish particular portions of these programs—

that is, why it was implemented in this way, rather than that way.

The panel has been chosen for their ability to bring out these reasons, and add to the audience's understanding of what can be done, and the trade-offs involved.

Attendees (hybrid computer users, computation facility managers, and computer software developers) should be able to use the results of this session to develop their own program (or to improve the system presently being used).

One of the major goals of the session is to encourage audience participation, and a free and easy exchange of technical ideas.

Don't miss it.

Automatic Checkout of a Large Hybrid Computing System, by Jesse C. Richards.

Hybrid Diagnostic Techniques, by Thomas K. Seehuus, William A. Harmon, William Maasberg, Gordon R. Bolton, Albert S. Jackson, Richard V. Jackson and A. J. Mauceri.

Tuesday, 1:30

Larkin II

DYNAMIC RESOURCE ALLOCATION

Chairman:

Wayne Lichtenberger

University of California

Berkeley, California

A large computer system involves a large investment in hardware. The organization of this hardware is chosen to optimize its utilization but a much better utilization can be obtained if the hardware resources available can be allocated to various tasks in a flexible and dynamic fashion. This is the basic reason for multi-programming and an important consideration in time-sharing. This session includes papers on the subject of memory and cpu allocation and overall time-sharing hardware design. This session should be of interest to persons engaged in research in or design of computer systems.

Demand Paging in Perspective, by C. J. Kuehner and B. Randell.

Program Behavior in a Paging Environment, by B. S. Brawn and F. G. Gustavson.

Janus: A Flexible Approach to Real-Time Time-Sharing, by J. Kopf and P. Plauger.

A Parallel Process Definition and Control System, by Dan Cohen.

Tuesday, 1:30

4th Floor

Room 415

LABORATORY AUTOMATION

Chairman:

I. N. Hooton

Atomic Energy Research Establishment

Harwell, Didcot,

Berkshire, England

The continuing increase in the use of digital computers to aid laboratory experimentation makes this special interest session an essential part of the Fall Joint Computer Conference. The session gives participants the opportunity to discuss all aspects of computer usage within a real time environment and to interact freely with speakers. In addition to topics of general interest, the papers to be read include applications in space research, medicine, nuclear research, molecular biology and chemical analysis. They also range from the monitoring of an individual hospital patient to the automation of a complete laboratory.

A Computer System for Automation of the Analytical Laboratory, by P. J. Friedl, C. H. Shederholm and T. R. Lusebrink.

Real-Time Time-Sharing, the Desirability and Economics, by B. E. F. Macefield.

A Modular On-Line Computer System for Data Acquisition and Experimental Control, by R. W. Kerr, H. P. Lie, G. L. Miller and D. A. H. Robinson.

A Standardized Data Highway for On-Line Computer Applications, by I. N. Hooton and R. C. M. Barnes.

Use of a Computer in a Molecular Biology Laboratory, by T. H. Gossling and J. F. W. Mallett.

A Small Computer as an On-Line Multiparameter Analyzer for a Neutron Spectrometer, by M. G. Silk and S. B. Wright.

Applications of Digital Computers to the Long Term Measurements of Blood Pressure and the Management of Patients in Intensive Care Situations, by John L. Corbett.

Tuesday, 1:30

4th Floor

Room 416

HAND-PRINTED CHARACTER RECOGNITION

Chairman:

John H. Munson

Stanford Research Institute

Menlo Park, California

The recent commercial announcements of machines for hand-printed character recognition indicate that this long-heralded technique is finally coming of age. This session should be of interest to those who have worked in character and pattern recognition and also to those who would assess the present state of the art. We hope to conclude with a discussion period, which will also allow those producers of machines not represented by papers to be heard.

Some Conclusions on the Use of Adaptive Linear Decision Functions, by E. R. Ide, C. E. Kiessling and C. J. Tunis.

Experiments in the Recognition of Hand-Printed Text: Part I — Character Recognition, by John H. Munson.

Experiments in the Recognition of Hand-Printed Text: Part II — Context Analysis, by Richard O. Duda and Peter E. Hart.

The Design of an OCR System for Reading Handwritten Numerals, by Patrick J. Hurley, Wm. S. Rohland and Patrick J. Traglia.

Tuesday, 3:45

Polk

NEW MEMORY TECHNIQUES

Chairman:

Arthur V. Pohm

Iowa State University

Dept. of Electrical Engineering

Ames, Iowa

The papers of this session were chosen to provide the computer designer with a view of some of the new possibilities for achieving main frame memory in future computer designs. The first two papers treat techniques that are newcomers in the large memory areas; whereas the last two papers describe substantial advances in the organization and technology of magnetic memory media.

Holographic Read-Only Memories Accessed by Light-Emitting Diodes, by D. H. R. Vilkomerson, R. S. Mezrich and D. I. Bostwick.

Semi-Conductor Memory Circuits and Technology, by Wendell B. Sander.

2½D Core Search Memory, by Michael W. Rolund and Philip A. Harding.

Design of a Small Multi-Turn Magnetic Thin Film Memory, by W. Simpson.

Tuesday, 3:45

Arena

(Continued on page 124)

SESSIONS . . .

OPERATING SYSTEMS (PART II)

Chairman:

Jacques Bouvard

Honeywell, Inc.

Wellesley Hills, Massachusetts

A continuation of the Tuesday morning session.

The Dynamic Behavior of Programs, by I. F. Freibergs.

Resource Allocation with Interlock Detection in a Multi-Task System, by James E. Murphy.

A Dual Processing Checkout System, by Kenneth C. Smith.

An Operating System for a Central Real-Time Data Processing Computer, by Paul Day and Henry Krejci.

Tuesday, 3:45

Larkin I

HYBRID SIMULATION TECHNIQUES

Chairman:

G. W. McClary

Martin-Marietta Corporation

Orlando, Florida

This session should interest all conference attendees who are associated with an analog-hybrid facility. The three papers are on diverse subjects, but all impinge on the improvement of simulation hardware and techniques to solve problems more efficiently and widen the areas of application. The authors and facilities represented by these papers are well-known to readers of *Simulation*.

The first paper, by Rahe and Karplus, will be presented by Mr. Rahe. The sampling frequency necessary to represent a continuous signal by a sequence of pulses within a predefined error criteria is dependent on the signal activity and its spectral characteristics. If samples are taken at a fixed interval, allowance must be made for the highest rate of change the signal will attain. Since in most cases this is achieved only briefly, a large number of unnecessary samples are taken. But, if the interval is continuously varied by appropriate rules, more efficient use may be made of computer time, digital storage, and communication channels. The scheme of Rahe and Karplus bases the sampling rate on approximations made in the continuous domain at subintervals.

The second paper, by Conant, describes a third generation (following ASTRAC, ASTRAC II and APE II) high-speed digitally controlled iterative differential analyzer developed at the University of Arizona hybrid computer laboratory. It utilizes Motorola and Fairchild integrated circuit components. The amplifiers have a 30 MHz unit gain bandwidth and the computer can operate at iteration rates as high as 2000 runs/sec.

An interesting sidelight for those with an interest in education which will probably be more fully examined in the discussion period than in the main paper is the group or project thesis concept. LOCUST was actually developed as a Ph.D. dissertation.

The third paper, by Gilbert and Moran, describes a technique for utilizing patchable synchronous logic elements. The authors believe their approach is simpler and more direct than one described earlier by Witsenhausen, and they further state that in some cases the analog synchronous logic elements perform tasks more efficiently than the digital portion of a hybrid computer. After the operation of these elements is described an example is given showing how they may be utilized to efficiently solve a two parameter optimization problem.

Following the papers as much time as possible will be allowed for discussion among the panelists and for questions from the audience.

An Adaptive Sampling System for Hybrid Computation, by George E. Rahe and Walter Karplus.

A New Solid State Electronic Iterative Differential Analyzer Making Maximum Use of Integrated Circuits, by Brian K. Conant.

A General Programming Technique for Patchable Synchronous Logic Elements, by R. A. Moran and E. G. Gilbert.

Tuesday, 3:45

Larkin II

APPLICATIONS OF COMPUTERS TO PROBLEMS OF THE ATMOSPHERE AND GEOPHYSICS

Chairman:

M. Rotenberg

University of California

La Jolla, California

Ready access to large computers permits physicists to attempt ambitious studies of complex natural phenomena. Two papers are presented. The first gives a perspective view of how digital computers aid our understanding of the earth's atmosphere; computer manufactured movies will be shown. The second describes a rapid computer method for solving coupled equations encountered when studying the earth's normal modes.

Computer Experiments in the Global Circulation of the Earth's Atmosphere, Akira Kasahara.

Computational Problems Encountered in the Study of the Earth's Normal Modes, by Freeman Gilbert and George Backus.

Tuesday, 3:45

4th Floor

Room 415

PROGRESS IN DISPLAYS

Chairman:

Jan M. Engel

IBM Systems Development Div.

San Jose, California

This session is presented by the Society for Information Display (SID) to commemorate its joining the federation of distinguished societies that comprise AFIPS. The papers are not published in the *Proceedings*. They can be found in the special journal published by SID.

Displays are rapidly becoming one of the more important aspects of modern information systems—but as this session attempts to show, there is more to displays than meets the eye. The papers, all invited, that were chosen for this session present a technical assessment of the current status of displays as related to information processing systems and attempt to pinpoint directions that will be favored for future developments. This session should prove of interest to all attendees concerned about peripheral equipment and man-machine communications.

Effective Information Displays, by H. R. Luxemberg.

Display Technology — Light Valving Techniques, by G. J. Chafaris.

Display Technology — Photorecording Techniques, by David Wilcox.

Display Technology — Laser Displays, by Leo Beiser.

Symbols, Sense and Sin, by Glenn C. Kinney.

Display Programming — 1968, by E. M. Thomas.

Challenges Presented to the Computer Field by Display Technology, by L. C. Hobbs.

Wednesday, 8:30

Arena

COMPUTER GENERATED PICTURES — PERILS, PLEASURES, PROFITS

Chairman:

George Michael

University of California

Lawrence Radiation Laboratory

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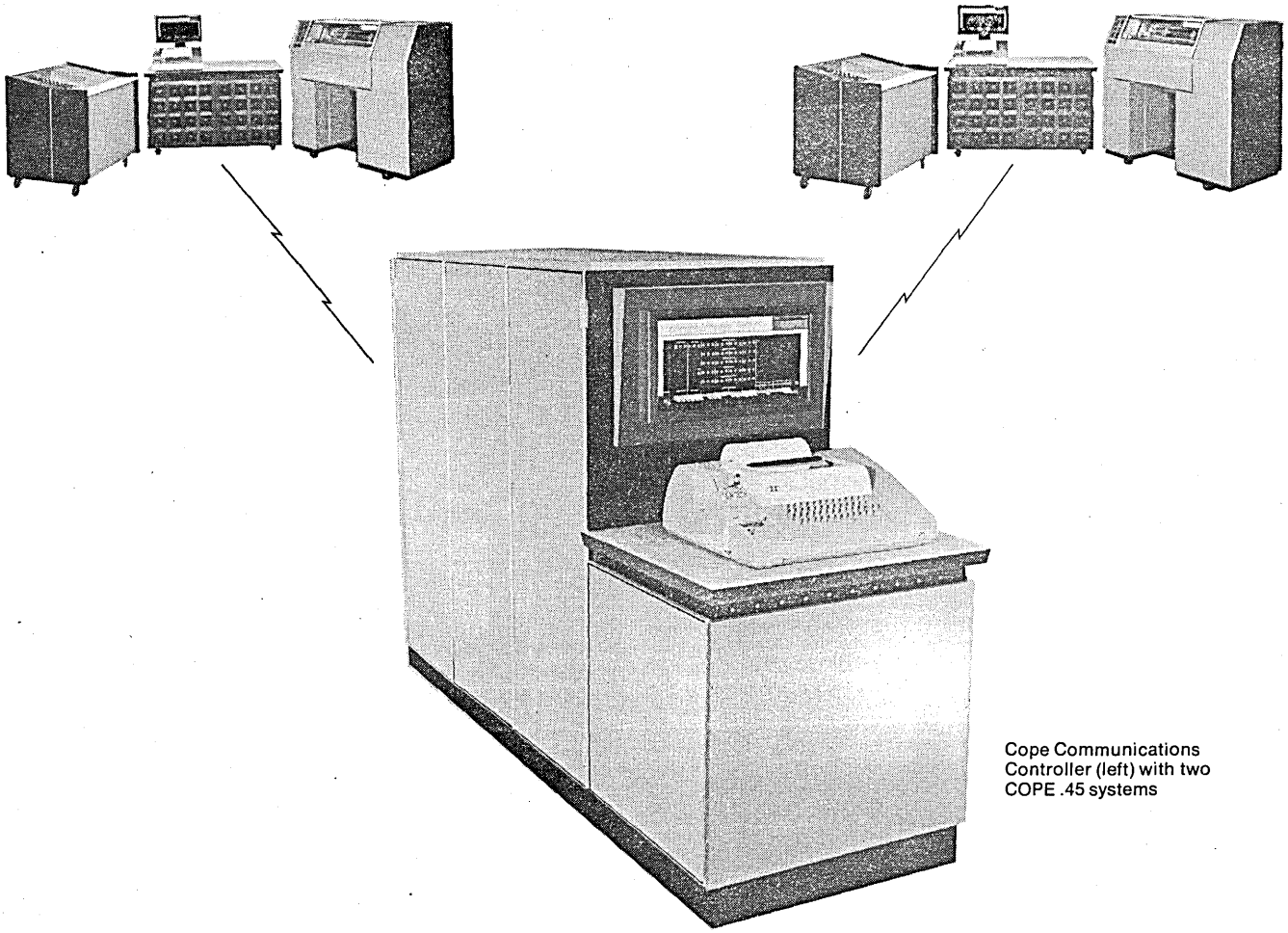

Cope Communications Controller (left) with two COPE .45 systems

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FOR 3M CO. CIRCLE 58 ON READER CARD→

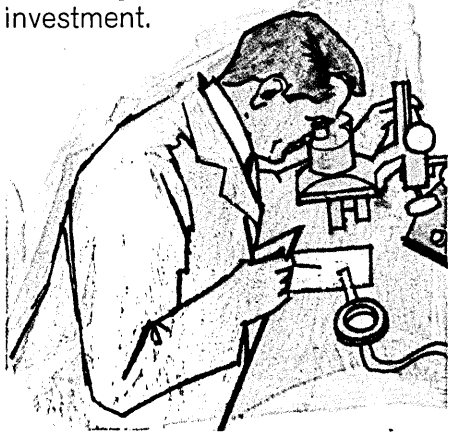
Take a good look at this label. It's on our new "Scotch" Brand 777GP Computer Tape.

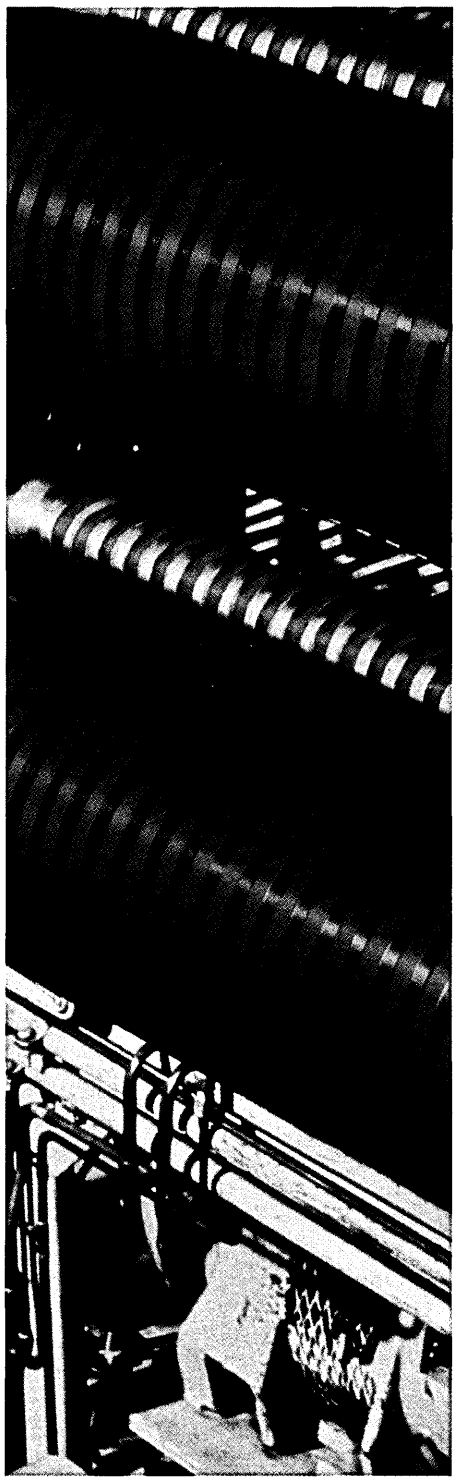
This is 3M's Guaranteed Performance* Tape that makes costly roll-by-roll certification obsolete.

What is "Scotch" Brand 777GP? A new Guaranteed Performance computer tape designed specifically for use on third generation computers—an extension of the high reliability "Scotch" Brand 777 Computer Tape except that it does not require roll-by-roll certification.

*What performance can I expect from 777GP? With 777GP there are no read errors. In this critical area you will receive the same long term reliability as with certified "Scotch" Brand 777 Computer Tape. (For detailed specifications and performance characteristics ask your 3M representative for specification sheet M-CL155.)

How can 3M assure such performance? Because 3M's exclusive binder formulation has eliminated oxide re-deposits that cause read errors, and today's third generation dual-gap head computers now compensate for minor tape flaws with no loss of data. In addition, 3M's advancements in manufacturing technology have reduced minor tape defects to the point where roll-by-roll certification is no longer a valid investment.





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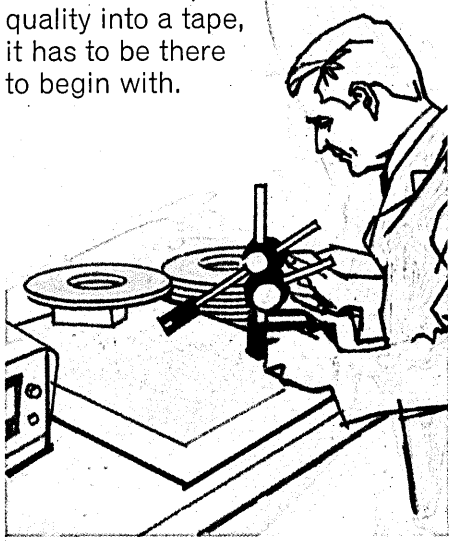

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CIRCLE 59 ON READER CARD

Livermore, California

Some of our day-to-day communication problems arise from the inherent complexity of the things we are trying to discuss. Others come about because of a relative unfamiliarity with the topic or its jargon. It is simply true that a graphic demonstration, anything from the shaking of a fist to a full-scale motion picture presentation, raises communication efficiency. It is also true that the graphic demonstration by itself is usually inadequate. At least the fixation of ideas on film argues that they should indeed be well thought out. All topics look easy to reduce to a film presentation but most are not. While computer generated pictures have been used for some time now, we have by no means exhausted their usefulness. This session will make full use of computer generated films to illustrate the various points mentioned above.

Computer Animation and the Fourth Dimension, by A. Michael Noll.
Computer Displays in the Teaching of Physics, by Judah L. Schwartz and Edwin E. Taylor.
Art, Computers and Mathematics, by Charles Csuri and James Shaffer.
Computer Generated Pictures, Pleasures, by John Whitney.
What Good Is a Baby? by Nels Winkless and P. Honore.
A Computer Animation Movie Language, by D. Weiner and S. E. Anderson.

Wednesday, 8:45

Nourse

THE COMPUTER FIELD: WHAT WAS PROMISED, WHAT WE HAVE, WHAT WE NEED

(Hardware Session)

Chairman:

Louis Fein

Consultant

Palo Alto, California

(See page 102)

Hardware Design Reflecting Software Requirements, by Saul Rosen.
What Was Promised, What We Have and What Is Being Promised in Character Recognition, by A. W. Holt.
High Speed Logic and Memory: Past, Present and Future, by Arthur W. Lo.

Wednesday, 8:45

Polk

NEW TRENDS IN PROGRAMMING LANGUAGES

Chairman:

Ascher Opler

IBM Corporation

Yorktown Heights, New York

At this session attention will shift from standard language development and language processor development to equally significant topics now engaging the attention of computer language specialists. Topics featured include definitional facilities for allowing user expansion of programming languages, compiler-compilers, user languages and conversational program development techniques.

Dove's paper presents some of the latest work on the development of compiler-compilers. Metsker reports an excellent example of the development of user languages. Newey's presentation deals with techniques for processor construction that allows users to extend the programming language with minimum additions to the compiler. The paper by Bratman, Martin and Perstein presents a picture of a modern on-line graphics-aided program development system.

Cabal — Environmental Design of a Compiler-Compiler, by R. K. Dove.
Cage Test Language — An Interpretive Language Designed for Aerospace, by Gene S. Metsker.
An Efficient System for User Extendable Languages, by Malcolm C. Newey.
Program Composition and Editing with an On-Line Display, by Harvey Bratman, H. G. Martin and E. C. Perstein.

Wednesday, 8:45

Larkin I

BULK MEMORY DEVICES

Chairman:

William A. Gross

Ampex Corporation

Redwood City, California

Bulk memory devices contain volumes of information stored on overlaid surfaces; discs are stacked into cylinders, strips are piled into book-like containers, and tapes are rolled up like scrolls into cylinders. Used to store 10^8-10^{12} bits, such stores use mechanical positioning and magnetic, electron beam, or laser beam transducers to cause the state change in the recording medium in the write mode, and to detect the state in the read mode. Mechanical access permits on-line bit costs down to the order of 10^{-4} cents, but at a penalty of access times which may run to seconds.

The session aims to give an overview of the state-of-the-art of the performance of bulk memory devices and to provide some extrapolations, as well as to describe some novel memories with capacities of 10^{11}-10^{12} bits which are in different stages of development and production.

Although increased performance is a continuing goal, development efforts increasingly aim at reducing costs, both initial purchase or lease cost (for on-line and off-line storage requirements) and operating costs (by increasing reliability, simplifying maintenance requirements, and reducing repair costs).

The first paper reviews bulk memory performance, discusses the technological state-of-the-art, and predicts future performance achievements. The remaining three papers describe specific development efforts which lend credence to the predictions and aim to give an awareness of some specific developments. One describes a development effort to achieve 10^7 bits per square inch storage density using a laser beam transducing system. A breadboard model is described which has generated 10^{-8} error rate in readout. Another describes a prototype of a 10^{12} bit storage system which uses video recording type magnetic tarnsducers and achieves 10^{-10} error rate in readout. The final paper describes a mechanical self-correcting system which also records performance data. It is installed and operating in both a 10^{11} bit and a 10^{12} bit storage system.

The practicality of 10^{12} bit storage systems seems to be demonstrated. It is hoped that the session will permit those who must design computer systems with large memories to anticipate availability, and to plan more specifically for such memories. Exotic transducers such as electron and laser beam devices are possible. It appears that the developing technologies will permit total memory prices to be held to reasonable levels as bulk memory sizes increase.

New Horizons for Magnetic Bulk Storage Devices, by F. D. Risko.
Laser Recording Unit for High Density Permanent Digital Data Storage, by K. McFarland and M. Hashiguchi.
A Random Access Terabit Magnetic Memory, by S. Damron, J. Miller, E. Salbu, M. Wildmann and J. Lucas.
Diagnostics and Recovery Programs for the IBM 1360 Photo-Digital Stor-

Erma is gone, but her memory lives on.

Erma's memory is alive and processing traveler's checks in San Jose, California. We built the core memories for Bank of America's ERMA computers back in 1959. They contained 80-mil cores providing a cycle time of 32 microseconds and an access time of 12 microseconds. Capacity was 4000 words (28 bits/word). One of those memories is still in use. It's slow by today's standards but perfectly suited for its job.

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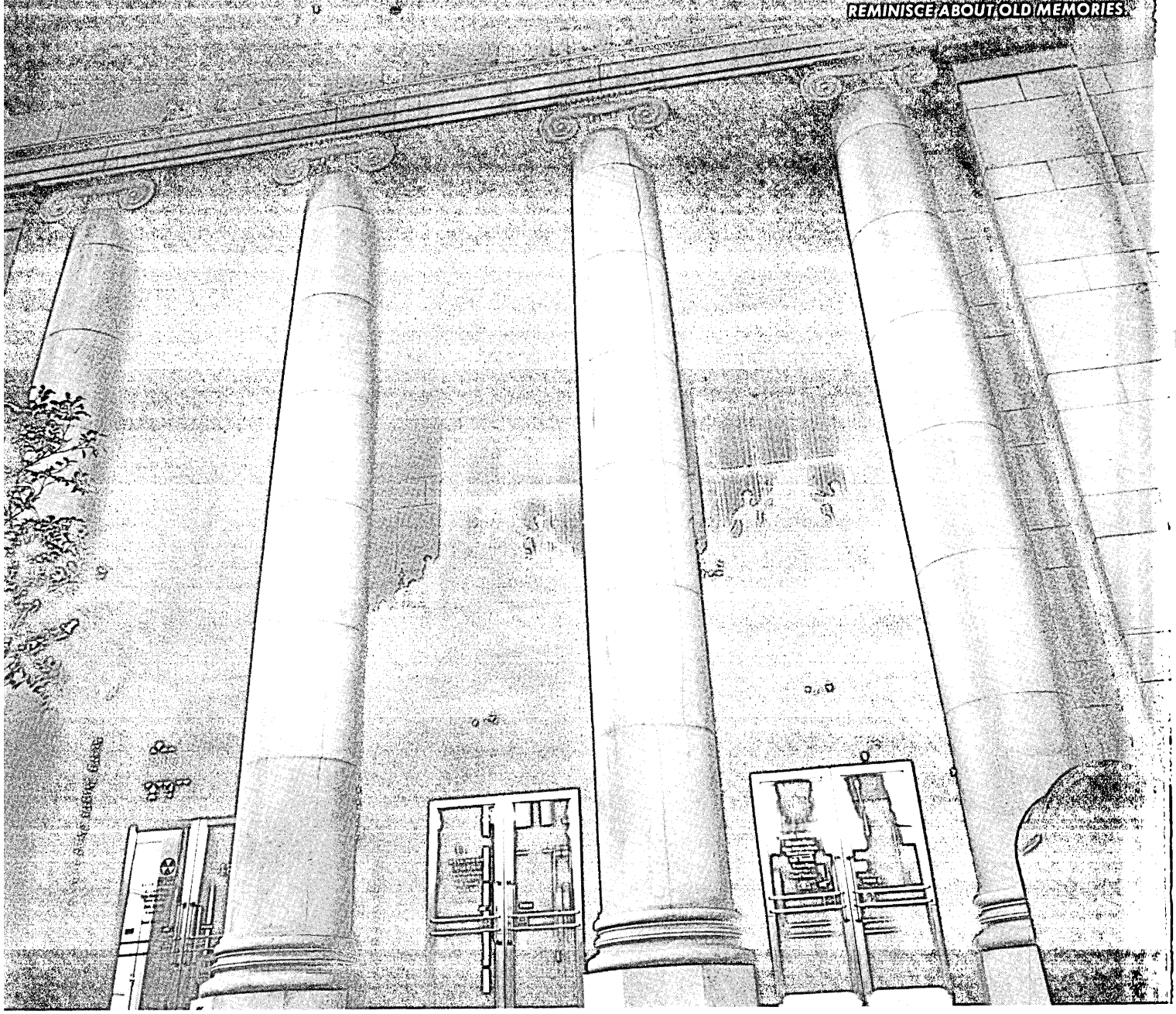

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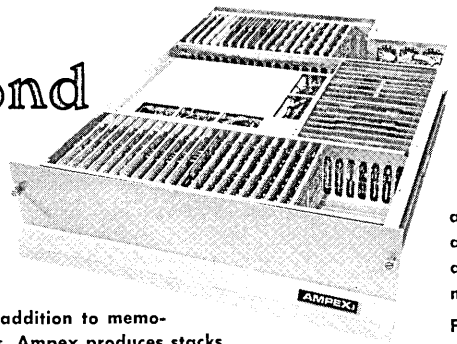

The new Ampex 25DM-500 has a full cycle time of 500 nanoseconds and an access time of 300 nanoseconds. The basic memory module is 8K x 36 bits. It uses 18-mil cores in a 3-wire 2.5D configuration. Maximum capacity is 32K x 72 bits. This fast new memory is the latest in our wide line of core memories. They include small, inexpensive 1.5 microsecond memories (RF-1), the 1.0 microsecond RF-4, the fast access (350-nanosecond) 900 nanosecond RG memory, the 3-wire 3D 750 nanosecond 3DM750, and the new 500 nanosecond 25DM-500.

In addition to memories, Ampex produces stacks, arrays and cores. We supply a full line of ferrite cores from 18 to 80-mils O.D., including a line of standard cores for wide temperature requirements. The memory designer will find help in our design assistance and our catalog of commercial and military arrays. Stacks are available in 2.5D and 3D (3 or 4 wire) configurations; 18-, 22-, 30- and 50-mil core sizes; regular or ruggedized to meet MIL-E-16400 or MIL-E-5400.

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age System, by D. P. Gustlin and D. D. Prentice.

Wednesday, 8:45
Larkin II

SIMULATION IN THE DESIGN AND EVALUATION OF DIGITAL COMPUTER SYSTEMS

Chairman:
Robert J. Creasy
IBM Corporation
Palo Alto, California

Simulation is a tool required by many diverse disciplines for the design, development, optimization and operation of complex systems. Some fields, such as nuclear or aeronautical engineering, cannot economically exist without it. The computer industry, because of the relative simplicity of its systems, is not yet dependent on simulation. However, the number of variables in such systems and their relationships are beginning to outstrip our ability to handle them as we have done in the past. The future engineering of computer systems, both hardware and software, cannot be considered without extensive use of simulation.

Simulation of computer systems does not have an untarnished reputation. The over-simplified models and unrealistic results which have characterized some simulations are of course not the generic fault of simulation, but rather a reflection of our inexperience. As our use of simulation increases, the results we obtain will more closely approximate reality and system specification and development will benefit in many ways. The three papers which compose this session show a trend in this direction.

The first paper discusses the application of a family of simulation models in the design of the Federal Aviation Agency's National Airspace System. These models have been of significant value in appraising alternative designs and locating critical resource bottlenecks. Design techniques for achieving maximum performance in a multiprocessing environment are presented. Also included are problems involving simultaneous processor competition for common data.

Resource management in a time-sharing system is examined in the second paper for seven case studies. A study of such parameters as the value of the time slice, cpu utilization, number of users and response time for each case provide some insight into the complex relationships of these variables.

The third paper examines a model of the MVT option of OS/360 (Multiprogramming with a Variable Number of Tasks) running on an IBM System/360 Model 65 cpu. Throughput as a function of system and workload parameters is presented with attention to the pattern of delays suffered by individual jobs. The changing of this overall pattern as a function of available main storage is interpreted.

Simulation Design of a Multiprocessing System, by Reino A. Merikallio and Fred C. Holland.

A Simulation Study of Resource Management in a Time-Sharing System, by Sandra L. Rehmann and Sherbie G. Gangwere, Jr.

Performance of a Simulated Multiprogramming System, by Meir M. Lehman and Jack L. Rosenfeld.

Wednesday, 8:45
4th Floor

REAL-TIME INFORMATION SYSTEMS AND THE PUBLIC INTEREST

Chairman:
Harold Sackman
System Development Corp.
Santa Monica, California

There is a large and growing cultural lag between computer developments and social applications. This cultural lag is particularly acute for real-time information systems which are the modern embodiment of the application of information to control ongoing events. The public has poured in vast sums of money and commensurate manpower to develop the concept and extend the practice of real-time information systems, especially in military command and control and in manned spaceflight systems. But the public has received relatively little in return by way of positive social fallout. Who is accountable for this state of affairs and what are the implications of the public interest for the computer milieu?

Even the most casual examination reveals an ethical and moral void in the principles and practice of developing real-time information systems in the public interest. There is a long-standing, largely unwritten philosophical stance in the computer world that severs technological affairs from human values, that considers the morality and ethics of computers to be a fruitless and meaningless quest for nondefinable entities. We are embarrassed to speak of alternative moral objectives in the design of computer networks when we specify system requirements. At a more fundamental level, serious philosophizing on the impact of computers on society, vigorous discussion and debate over alternative social approaches, is rarely heard in the computer forum. It is the layman, not the computer professional, who has taken the lead and has captured the public eye in this field.

In the meantime, the vast growth of computerized information services, evolving steadily toward on-line and real-time services, raises great economic, political, educational and social questions. As computer-accessible information stores grow by leaps and bounds, we do not know where to draw the line between public and private information. As large economic factions battle over advantageous positions in the coming mass market for information services, we hear much about monopoly, mergers, and free enterprise, but little about the enhancement of human intelligence and the potential for elevating the excellence of democracy. In the battle between the economic giants, the individual user is the forgotten man.

While physical, biological, and social scientists are contributing their advanced technical knowledge toward international peace and arms reduction, global population control, and the reconstruction of urban society, computer scientists follow rather than lead the information revolution of their own making. International information networks are still primitive in design, scope and concept in the perspective of global problems and the need for global understanding through the free exchange of human knowledge. There is an international public as well as a national public, and we have hardly recognized, let alone responded to the information needs of such publics.

Real-time information systems are among the most powerful instrumentalities developed by man to meet social problems as they arise in time to solve them. This session is devoted to a critical examination of key humanistic prospects of this new force for social change in meeting public needs—in socio-political affairs, in international science and technology, in mass use of computer utilities, in educational practice, and in working toward a public philosophy.

Real-Time Systems and Public Information, by C. West Churchman.

National and International Information Networks in Science and Technology, by Harold Borko.

Real-Time Computer Communications and the Public Interest, by Michael M. Gold and Lee L. Selwyn.

Toward Education in Real-Time, by Perry E. Rosove.

A Public Philosophy for Real-Time Information Systems, by Harold Sackman. ■

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Multi-Application Computer. That's MAC. And for $11,950, MAC's 16-bit words say a lot.

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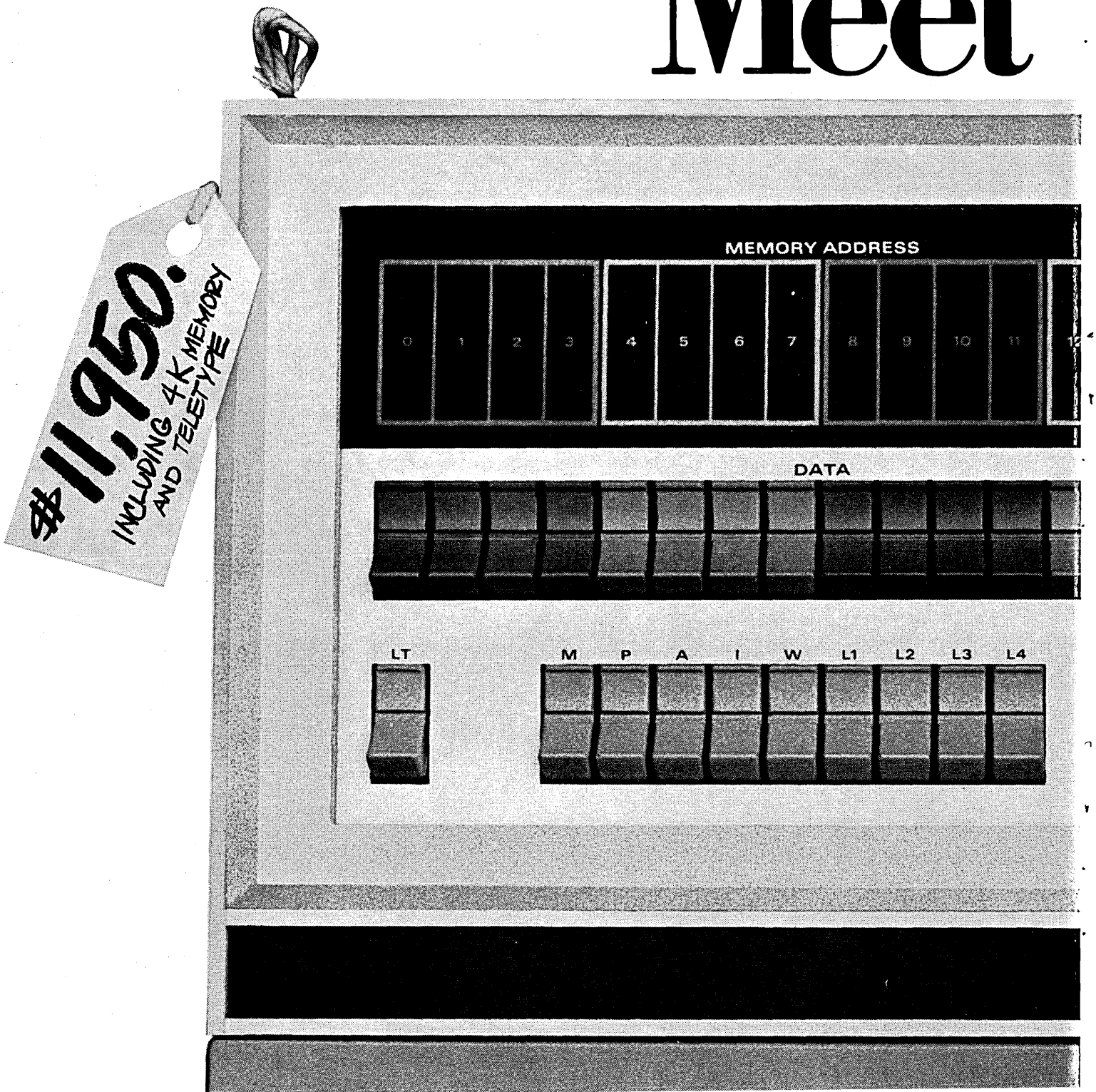

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Of course this is only an introduction to MAC. For full details write MAC, Lockheed Electronics Company, Data Products Division, 6201 East Randolph Street, Los Angeles, California 90022.

See MAC at the FJCC.

LOCKHEED ELECTRONICS COMPANY
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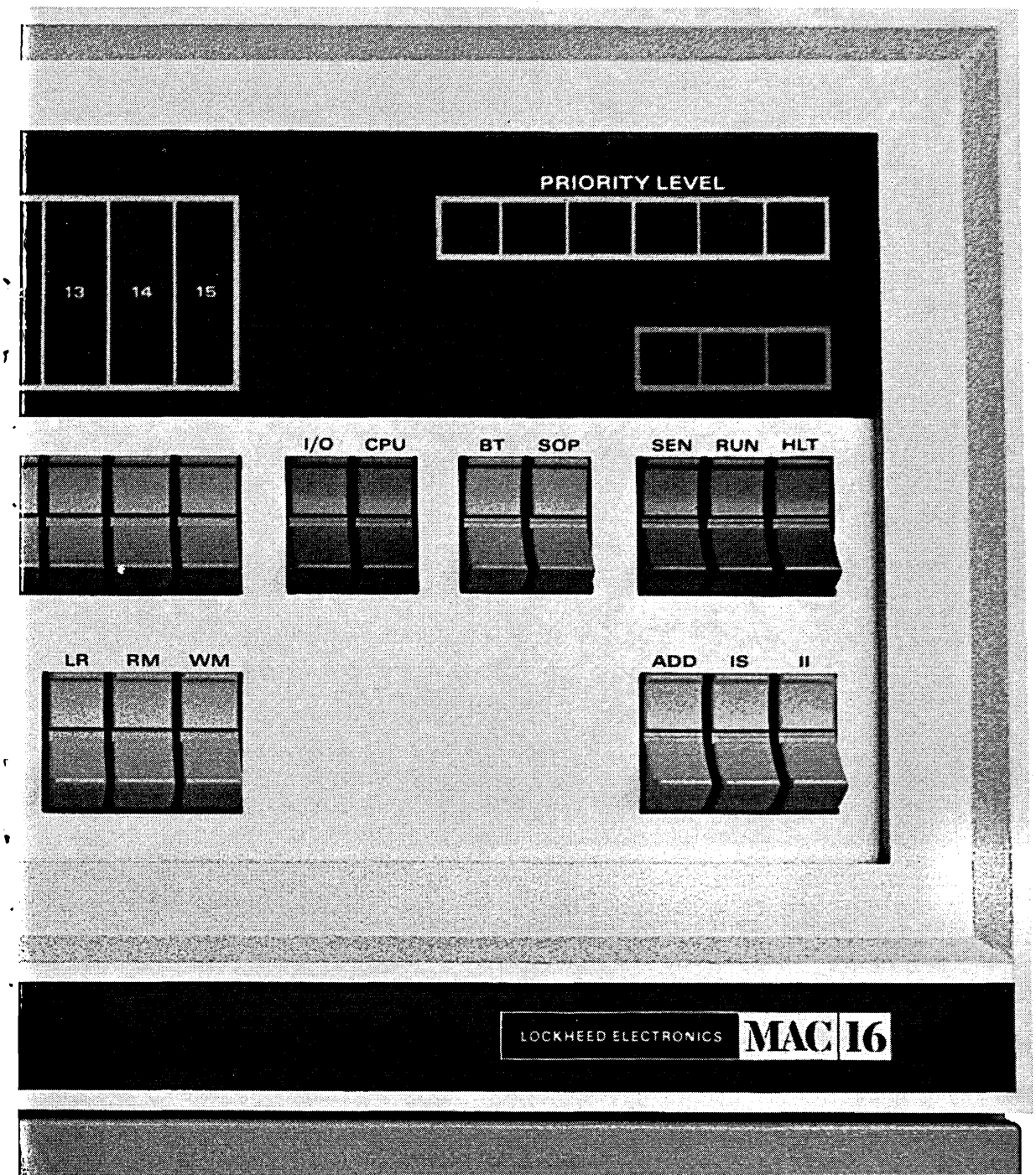
MAC



Let MAC do it.

AEROSPACE SOFTWARE SEMINAR

One of the ways in which professional societies have chosen recently to fulfill their obligation to their members is by providing an education service. The ACM offers professional development seminars. Most of these are sponsored by the national ACM but some, either because of a regional interest or perhaps because of the pilot nature of the seminar, are sponsored locally.

A professional development seminar on Aerospace Software was held in Hawthorne, Calif., in September, co-sponsored by the Los Angeles chapter of the ACM and the Special Interest Group on Application of Computers in Space. The seminar was presented by Logicon, Inc.

Approximately 150 attendees ($45 per ACM member) nearly filled the seminar room. It was really an all-day affair with the seminar scheduled to run from 9:00 a.m. to 4:30 p.m., programming in the Space Programming Language (SPL) from 4:45 to 5:30, a recovery hour (cocktails anyone?) from 5:30 to 6:30 and an evening symposium ($6 including dinner) from 6:30 to 10:00.

Certain facets of the seminar were very well done. Early registrants were provided with a staggering set of reprints (19!) on aerospace software. Many of these papers were from the 1966 Spaceborne Software Workshop and the 1966 Aerospace Computer Symposium. All seminar participants received, at the seminar, copies of all but one or two of the presentation slides. The physical facilities of the seminar were very good with participants seated at tables so that adequate writing space was available.

The seminar was divided into six parts covering: (1) the operating environment; (2) the software development cycle; (3) simulation and its role; (4) computer simulators; (5) programming the onboard computer; and (6) validating the program. As can be seen from this listing, the seminar covered the entire aerospace software field.

Frank Troeger, manager of the Logicon Titan III program office, presented the portions on the operating environment and the software development cycle. He covered the topics very completely—perhaps, in some respects, in too much detail. The differences between aerospace software and other "real-time" software were described. These highlighted the facts that frequently in aerospace applications the software is the only flexible element, but it is prepared under severe hardware constraints, must be ultra-reliable, and for outputs in *real* "real-time." It was pointed out that the hardware-software tradeoffs made for aerospace applications frequently lead to hardware constraints that cause a "dis-ease" of programming. Common problems of the software development cycle were listed as: changing and/or inadequate specifications, short lead time and poor user-programmer communication, minimal manpower and support tools, and obsolescent hardware.

During the last portion of his presentation, Troeger presented his views on configuration management as applied to software development. He found sympathetic ears in the audience but the writer does not share his conclusions that it raises costs and lengthens schedules. This seems to neglect a very basic fact of life. That is, that the AFSC 375 configuration management approach came into being because hardware contractors were not producing on schedule the desired hardware to meet the necessary specifications. Since a similar situation has been found to exist in the development of operational programs and/or support software, it is only natural that the government user turns to a more structured management approach to obtain the desired product on time and within budget.

Marvin Turner, Logicon's head of scientific applications, presented the material on simulation and its role. He covered the use of simulation in system definition, mission planning, math modeling, computer program design, computer programming, and operational usage. The conclusion seemed to be that simulation is good and desirable and how much is done is determined by the available funds. The only controversy sparked here was brought about by the stated conclusion of the superiority of digital simulation. Analog defenders rushed in, but bloodshed was avoided by everyone's agreeing that each type of simulation has its place.

After lunch, Ray Rubey, head of advanced systems and languages at Logicon, presented material on computer simulators and programming the onboard computer. The presentation covered types of computer simulators, the general structure of interpretive simulators, solutions for the practical problems of memory and word layout, and a recommendation that aerospace computers have an instruction set that is compatible with an existing family of ground computers. With respect to programming the onboard computer, the problems generated by the fixed-point arithmetic of aerospace computers was emphasized. In addition, the various types of major cycles that can be used for the executive routine were described. The need for complete documentation when the software is completed was contrasted with the "I'll document my program when I have time" approach of the non-aerospace world.

Vi Henderson, Logicon's manager of computation and software, covered the validation problem. Mathematical, logical, interaction, timing, and memory correctness are items determined during program validation. The digital tools the validator has at his disposal are program flow analyzers, compare programs, quality evaluators, and equation comparators. The desirability of validation being performed by an independent organization was stressed. Since validation of a computer program is something of an art, it is not surprising that Vi's presentation lacked the definiteness that a practitioner might desire.

In most of the presentations the speakers gave good descriptions of the problems encountered in aerospace software development. Solutions, however, were for the most part described in vague terms. In fact, one was left with the distinct impression that a certain amount of purposeful selling was being done by the speakers to convince the audience that they really understood the problems and you should go to them for solutions.

This leads one to two questions: Why give a professional development seminar and/or why attend one? From the ACM's standpoint, they are filling a need for their members and, if the seminar is successful, they make a few bucks. From the presenting organization's viewpoint, it can only be thought of as technical marketing. The attendee hopes to: increase his knowledge of a field in which he either wants to be or is active; see old friends; and make new ones.

Opinions as to the worth of the seminar were very clearly divided. Practitioners thought it had very little value to them; persons outside the field found it a good introduction. Judging by the attendee reaction, there would be a higher percentage of satisfied participants if the seminars were clearly labeled as *tutorial.*

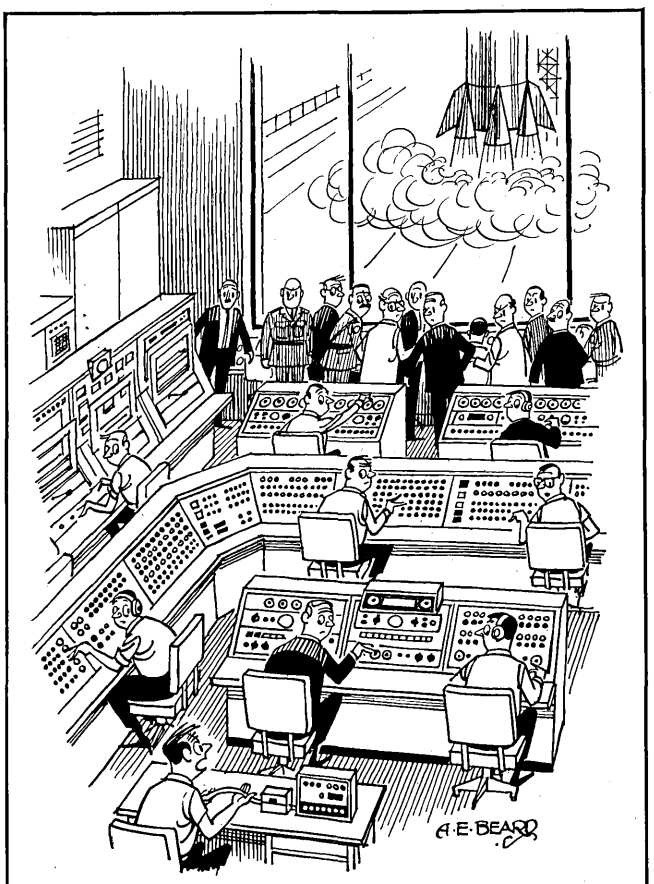
SPL/J6 (Space Programming Language/JOVIAL 6), subject of the post-session discussion, is a language developed by SDC under Air Force sponsorship. The current version is pointed toward preparation of typical flight computer programs. SDC has defined the language and is currently working on the compiler implementation problem. SPL is a procedure-oriented language using free-form statements. It includes provision for: interrupt statements; control of program subportions; data management; code optimization with respect to time or memory space; programmer reference to computer registers; and embedding of assembly code in the SPL program.

The SPL programming demonstration was almost a complete bust because SDC's hook-up with the main plant in Santa Monica didn't work well and the session started late and had a fixed cut-off time due to another meeting being scheduled in this particular room. Levi Carey did his best under the circumstances. Fortunately, SDC provided adequate copies of a short, descriptive write-up so the attendees had something to carry away.

The evening symposium, actually a meeting of the local SIGSPACE organization, provided a panel prepared to discuss leading questions concerned with the development of spaceborne computer programs. The panel was chaired by Len Urban of Nortronics and consisted of Edward Bersoff of NASA-ERC; Levi Carey, SDC; Lt. Roger Engelbach, SAMSO; Richard Snyder, Autonetics; Walt Sturm, Aerospace; and Dean Hartwick, Logicon. The symposium was run on the premise that there should be a maximum opportunity for audience participation. A question was presented. One, or at most two, panel members were permitted to make short comments (3-4 minutes) and then the audience was permitted to comment or to question the panel members. This gave everyone, including those with very little to contribute, a chance to have their say. The questions had to do with the utility of procedure-oriented languages for aerospace software, hardware limitations as they affect software, etc. One of the amazing things that comes out of a session like this are the trivial objections presented in a pompous, non-trivial way to the use of a procedure-oriented language for preparing spaceborne computer programs. Everything from increased transcription errors to inefficiently compiled code was discussed, virtually all with a "we *hate* change" attitude.

It is this writer's considered opinion that the sooner the purchasers of aerospace software adopt a "let's get with it" attitude, the sooner aerospace software will achieve the timely flexibility of which it is capable. This symposium certainly left little doubt that, left to their own devices, the aerospace software producers will make little progress.

—RALPH CONN



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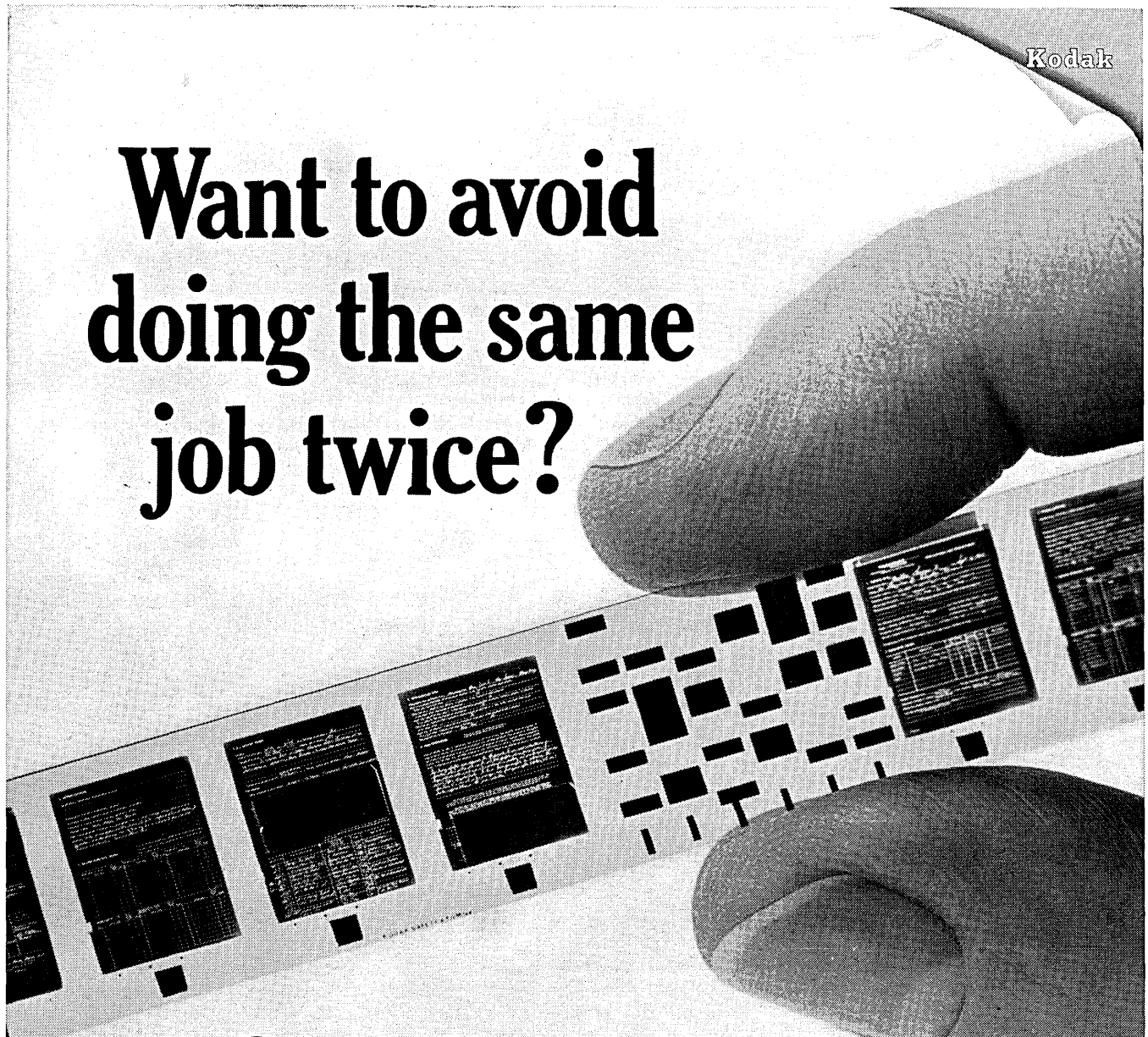

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PRELIMINARY WWMCCS SPECS RELEASED; CHANGES MAY BE MADE TO ATTRACT BIDS

Preliminary specs for the Worldwide Military Command and Control System (WWMCCS), otherwise known as the "Big Mother," have been released by the Pentagon, but the more significant news may be in a covering letter.

"Some consideration is . . . being given to removing force control and scientific applications from the mandatory requirements in the RFP . . . to broaden competitive aspects of the selection," said the letter. It added that "the requirement for upward compatibility between machines of varying sizes is another item receiving consideration. Alternate methods of meeting compatibilities of varying sized machines are being investigated by DOD and suggestions from industry on this point are welcomed."

One source close to DOD's front office explains the cover letter this way: the Pentagon fears that it won't get enough bids if vendors have to come up with equipment capable of meeting all the needs of all WWMCCS commands. Possibly, he says, the specialized needs of NORAD and SAC will be made "desirable" system characteristics to avoid any stigma of specification-rigging.

The preliminary specs were released by the Electronic Systems Division of the Air Force, the group that will be responsible for technical evaluation of WWMCCS bids. Shortly after the specs came out, an ESD spokesman said team proposals would be welcome, provided one member of the team assumed prime contractor responsibility. This is probably another effort to encourage bid competition.

The "alternate methods" of providing "upward compatibility" mentioned in the cover letter include sophisticated forms of emulation and automatic reprogramming, says our source. These are among the ways in which different models and makes of hardware might be integrated into the kind of system needed to handle Big Mother's worldwide workload. He added that last summer's letter from Cong. Jack Brooks to DOD, suggesting segmentation of the worldwide buy, "had a lot to do with" convincing the Pentagon that it could profitably study alternatives. "DOD is trying to explore all the possibilities," we were told, "so that it won't be hit by another Brooks letter after the procurement gets underway."

final specs out soon

A DOD source says the final specs for the worldwide buy may be out by Dec. 1. If not, they will "probably" be released by Feb. 1. Afterward, vendors are likely to be given 120 days to prepare and submit bids.

"Present planning indicates that up to 109 processing centers may be re-equipped as a result of this effort," say the preliminary specs. In each case, the basic equipment configuration to be supplied by the vendor will consist of: central processor, main memory, mass IAS (i.e. Immediate Access Storage: drum or disc memories), mag tape units, card reader/punch, line printer, typewriter keyboard, crt display, and low-speed printer. Vendor-supplied software will consist of: OS, utility, compiler, maintenance diagnostics, assembler, and routine library programs. Complete hardware and software documentation is also required.

A DOD source believes the cost of the worldwide buy, over the four years the equipment is to be acquired, will approximate $150 million. An industry source says that the cost will be $300-350 million, based on GSA price schedules, but he admits the winning vendor will have to offer a substantial discount. He adds that if DOD really has clamped a $150 million ceiling on the buy, the number of installations will have to be reduced.

According to the preliminary specs, DOD will supply the communications subsystem needed to operate WWMCCS, as well as much of the graphic display equipment. Both will come largely from the existing system, but some upgrading is likely. These follow-on contracts will be let, in most cases, by the individual military command. The preliminary specs also state that DOD will supply all application and generalized software. It is probable that some of the former, and much of the latter, will also be contracted subsequently.

According to one industry estimate, each vendor seeking to win the worldwide jackpot will have to spend $2-3 million preparing his bid—not counting eyestrain.

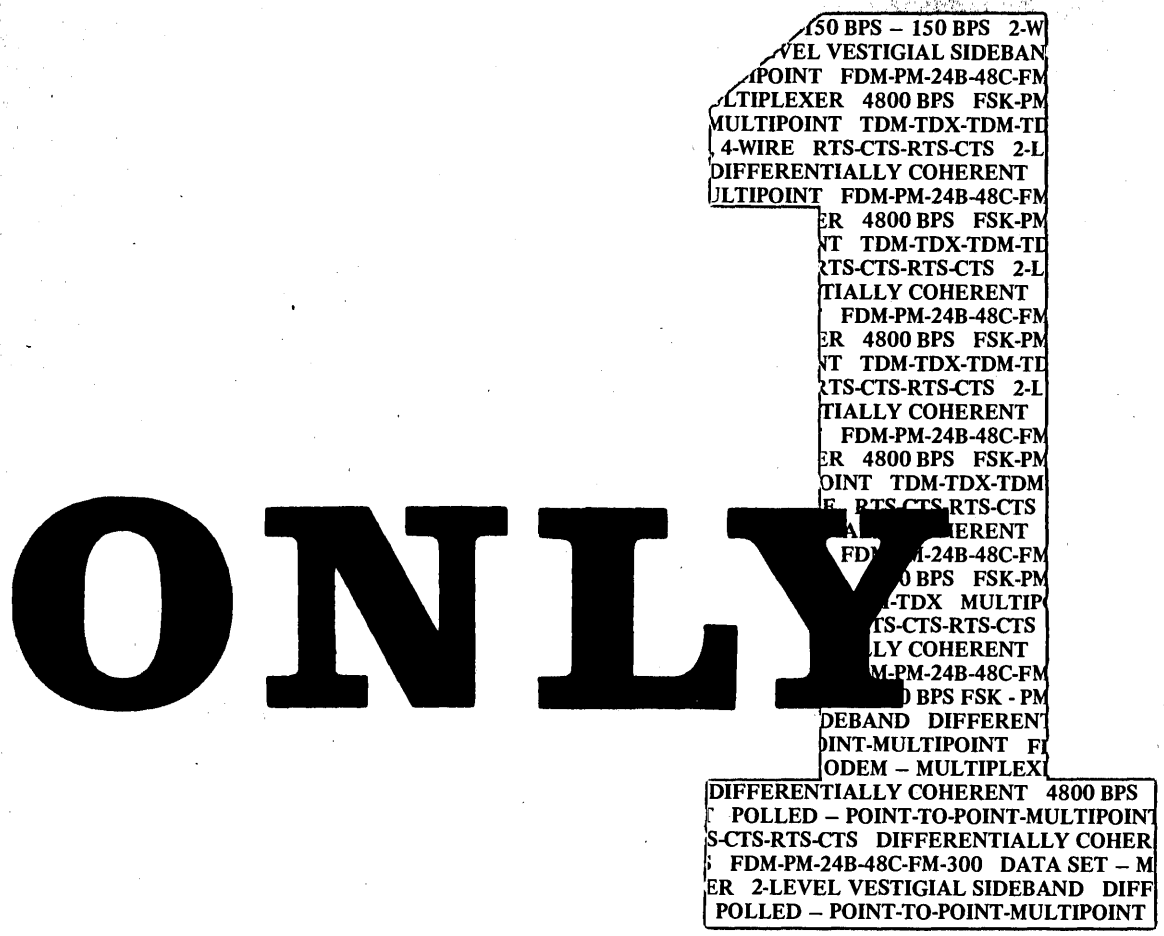
The preliminary specs, which cover more than 400 pages, separate WWMCCS into four basic subsystems—labeled, respectively, Force Control (FC), Scientific (SCI), General Staff Support-Medium (GSS/M), and General Staff Support-Large (GSS/L). The smallest is GSS/M, which requires a cpu main memory with 80K bytes of storage, exclusive of resident exec, and an expansion capability up to 500K. In addition, the GSS/M configuration must have 100 megabytes of IAS expandable to 220 megabytes; four tape drives, expandable to 16; one 800 lpm printer with provision for a second; one typewriter-equipped control console expandable to two; one card reader/punch with 800 cpm read and 250 cpm punch capability, plus provision for two more; two crt's expandable to 20, and provision for one 5-8 channel paper tape reader/punch.

the big ones

The FC subsystem, the largest one, requires 500K of cpu main memory expandable to 1 megabyte; 3 megabytes of low-latency IAS and 300 megabytes of other IAS, expandable to a total of 3.1 begabytes; 12 tape drives with provision for eight more; two 800 lpm printers with provision for one more; two control consoles with provision for two more; two card reader/punches with provision for three more; two crt's with provision for 18 more, and provision for two paper tape units.

Each bid will be subjected to a lengthy benchmark that includes 14 runs representative of the workload. The chief operations are extract, edit, sort, update, print, interpret, punch, and display. Individual files contain from 3.5K to 150K records, and up to 197 characters/record. Most of the files are stored on IAS, and the typical file structure is partial random. Printouts range as high as 12.6K lines.

Several pages of preliminary specifications describe mandatory and desirable system, hardware, and software characteristics. Many of these were given in a "preliminary preliminary" announcement last December. One major change is the addition of a JOVIAL compiler to the list of mandatory requirements. It must be based on the Air Force J3 standard. COBOL and FORTRAN compilers, each based on USASI-standardized source languages,



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are also required at the time vendors submit their bids. Other requirements include an elaborate OS, and hardware that is available completely on an off-the-shelf basis.

Among the "desirable" system features which can earn a vendor additional points from the evaluation team are:

An OS that permits the console operator to reconfigure the entire computer system under program control.

Re-entrant compilers and assemblers.

COBOL and FORTRAN compilers that contain features "over and above" the mandatory ones, provided the additional features are listed in the appropriate USASI standard.

A machine-oriented language capable of referencing common data storage among programs and subprograms generated by other compilers and assemblers.

"Information on metacompilers . . . including specific language converters which can be demonstrated during proposal evaluation."

Guarantees of conversion assistance.

Several pages are devoted to description of a data management system, another desirable feature. The specs say it should be available at the time benchmarks are performed and, among other attributes, should be capable of recording system event statistics, errors, and activities—or not recording them—at the user's option; permit testing of new files without actually incorporating them into the system, and use system exit/entry points for incorporation of specialized user routines.

PHIL HIRSCH

TRADE GROUPS ATTACK PROPOSED NEW AT&T TARIFF; FCC REJECTION URGED

The National Retail Merchants Association has asked the FCC to reject AT&T's proposed foreign attachment tariff, filed last September, because it is unresponsive to the decision the commission rendered earlier in the Carterfone case. Several other groups, including EIA, the Justice Department, and BEMA, reportedly feel the same way, and at least some of them are likely to file written objections. The EIA Data and Graphics Communication Section voted last month to object to the tariff and ask that it be rejected because it does not conform to the Carterfone decision.

The critics' chief complaint involves section 2.7 of AT&T's new offering; it bans the interconnection of most customer-provided communication systems to the public telephone network. The commission had indicated earlier that AT&T would have to demonstrate that such a prohibition was necessary before imposing it. The critics contend that Ma Bell hasn't done this.

They are also unhappy with earlier sections of the proposed tariff—specifically, those which require use of a "protective device" and a "network controller" to protect the line against crosstalk and excessive noise. The existence of hazards is admitted. But Bell's opponents argue that Bell should not be the exclusive supplier of the protective equipment.

Basically, they want a tariff which establishes interface performance standards instead of requiring the use of Bell-supplied interface components. The AT&T proposal mentions some standards but it relies primarily on the two components for line protection. Standards, say the critics, could cover any hazards created by either customer-provided terminals or customer-provided communication systems. Equipment meeting these standards would be as effective as the Bell-supplied devices specified in the proposed tariff. So, there is no public necessity for protective equipment to be supplied exclusively by Ma Bell. And, of course, letting independent firms make it would open a market that is now largely barred to them.

dialing ban

This arrangement would also remove what data processors and independent equipment makers regard as arbitrary restraints on the use of foreign attachments. One such restraint involves automatic calling and answering capability—a feature of many time-shared computer systems.

According to a dp industry spokesman, the proposed tariff, if adopted, will require calls between a remote terminal and its central computer to be dialed manually, if either or both are connected directly to the public telephone system through independently manufactured modems. "No system operator or user is going to put up with that kind of nonsense," says our source. "The result is that Ma Bell's modem will be used. That arrangement will permit automatic answering and calling, but it will also prevent many users from installing foreign attachments—the very thing the Carterfone decision was supposed to stop."

FCC's common carrier bureau has sent AT&T a letter asking whether the proposed tariff does, in effect, deny automatic answering and calling service to users of independently manufactured modems. The bureau also wants to know whether a terminal configuration that includes a multiplexor, concentrator, and similar equipment linked to multiple outlets, comprises a "communications system" or a "terminal" under the tariff. In the former case, Bell would have to be the exclusive hardware supplier; otherwise, the user couldn't connect to the telephone network. In the latter case, independently manufactured equipment could be installed.

hard questions

Inspired by a complaint from BEMA, the FCC has asked AT&T whether the proposed technical limitations on signals emanating from a customer-provided terminal aren't more severe than the limitations on signals from Bell-supplied equipment. BEMA had suggested that AT&T's Mod 602 modem would, if installed as customer-provided equipment, violate the applicable sections of the company's new offering. Another question raised by the bureau letter concerned section 2.2.1 of that offering. This provision seems to say that communication services sold by Bell can't be resold by Bell customers. Many commercial service bureaus have been doing just that for a long time; presumably, Bell could disconnect them at any time, and probably put them out of business in the process. The common carrier bureau suggested that a clarification of section 2.2.1 might be a good idea.

Many users are convinced that AT&T's proposed tariff is confusing on purpose. NRMA, when it complained to FCC about the proposal recently, said "AT&T, in effect, seems to declare that it is a law unto itself, disliking the implications of the Commission order (in the Carterfone case) and deciding not to obey it."

NRMA's petition goes on to suggest that AT&T will win the foreign attachment battle unless FCC returns the proposed tariff and tells Ma Bell to submit a new one. The petition explains that if the current offering is adopted, it will set in legal concrete many of the same prohibitions on the telephone system user that started the original argument. If the commission suspends the tariff and calls for an investigation, "such action would delight AT&T and give it the proverbial 'second bite at the apple' so as to again litigate the lawfulness of the very foreign attachment provisions just litigated in the Carterfone proceedings."

There was some indication last month that if the foreign attachment

battle drags on much longer, DP industry opposition may weaken. A spokesman for one of the groups that has been considering an objection to AT&T's tariff proposal says that some of his members are willing to "take what they have gotten so far." They feel that pressing for further concessions isn't worth the time and the effort required.

PHIL HIRSCH

UNIVERSITY COMPUTING GETS GOING ON COMMON CARRIER, PURSUES GULF PLAN

University Computing Co., the Dallas adolescent giant that startles everyone by doing just what it says it's going to, has taken the first step toward establishing a common carrier and seems likely to succeed with the proposed Gulf Insurance take-over.

In the first case, UCC has established a subsidiary called Microwave Transmission Corp. It starts out with a crew of 25 with quarters in Dallas, Los Angeles, and Washington, D.C. President is Charles Wyly, Jr.—generally credited with masterminding the financial dealings of the UCC combine—and executive vice president is Sy Joffe, former captain of the Univac group in Houston that smothered IBM at the Manned Spacecraft Center. He has hired such talent as Dave Gourley, Univac's manager of the AUTODIN project, and John Curtis—a vp from EAI.

Recent-history buffs will recall that UCC's first try at putting together a communications arm was the tender offer for 10% of Western Union stock—a deal that was squelched by Computer Sciences' quick announcement and quicker abandonment of a WU/CSC merger. Now comes the new subsidiary and the simultaneous agreement to acquire TransAmerican Microwave, Inc., of Los Angeles for $1.5 million. This company has a link between L.A. and San Francisco and feeds several cable TV outfits on the west coast. FCC approval has been requested, although it's not definite that it is required since the operation, at present, is within the state. Since this is presumably only the first in a series of such acquisitions, however, the FCC is sure to be involved eventually. (No one has started a common carrier within the memory of living man; the FCC people will probably have to hack their way through the cobwebs in the sub-basement archives to find out how their forefathers went about it.)

This piecemeal approach of picking up such companies seems to make sense. As a company spokesman pointed out, CATV itself is a growth business; the firms in that area often have microwave facilities. So why not get the ones that are already self-supporting—rather than setting out to create a network from scratch? If all goes well, UCC may indeed carry out the concept mentioned in their last annual report in reference to the test satellite link between Dallas and London: ". . . removed geography as a constraint in serving customers."

financial insurance

Just before the microwave maneuver, University took another step toward absorbing Gulf Insurance Co.

This liaison began some time ago: Gulf was one organization that had faith in UCC in the days when they were not so sure where their next million was coming from. Through Gulf, the Wylys raised $3 million from convertible debentures. Then, early this year, University traded 350,000 shares of their booming common stock for twice that many Gulf shares—thus ending up with 25% of the insurance company. Following that, UCC offered another half share each for the remaining shares in Gulf—some 2.1 million of them—via a convertible preferred issue. But this offer didn't seem enough to the Gulf directors.

So University has now upped the offer to .55 of a share and lo, the directors have now "agreed in principle on a plan . . ."

The plan calls for formation of still another subsidiary—Gulf Financial Co. It would own Gulf Insurance (property and casualty insurance), its life insurance subsidiaries, and its noninsurance assets. Altogether, this would give the Wylys another $250 million worth of assets. This all has to be approved by Gulf shareholders and a meeting is expected to take place in November.

During these machinations, the computer utility group keeps on installing 1108's, Computer Leasing leases, Computer Industries turns out a whole family of Cope 45 terminals, McCord and Assoc. consults, the acquired service bureaus process, and the software subsidiaries create. And UCC's training branch, the Academy of Computer Technology, has just hired Frank Cable, a computer education veteran who has headed such activities for RCA, GE, and Univac. He will be staff assistant to Mike Fremming, who has presided over the opening of about 20 branches of the academy since it got started at the first of this year. By the end of the year, 28 schools will have been opened.

Sam Wyly is 33.

—WR

PL/I FORUM GIVES USERS AND BUILDERS A LOOK AT PROGRESS AND PROBLEMS

In the words of Professor Robert Rosin (State University of New York at Buffalo), chairman of the 2nd Annual ACM/SIGPLAN PL/I Forum, "A significant number of dedicated people gathered to discuss this language from a sophisticated point of view, an opportunity they rarely have." The Oct. 3-4 gathering at the Statler Hilton Hotel in Buffalo, N.Y., attracted 65 carefully screened language experts representing manufacturers, software houses, universities, research institutions and users. Perhaps due to the happy coincidence of sharing the hotel with a convivial group of beer distributors, the back-corridor discussions present at any good technical session raged far into the night.

The forum (a repeat of last year's Washington, D.C. meeting) attracts people with widely diverging opinions on PL/I. One small group regards it as a philosophy rather than a usable language. Another minority sees the whole subject of a new language as inane and economically unjustifiable. Another group is concerned exclusively with the difficulties in implementation regardless of the real-world user. Still another group is concerned solely with improving a language already in use. Combine all these elements, stir with a number of professional meeting goers, season lightly with a dash of cynicism and you have a lively discussion.

A number of short papers read during the opening morning session seemed to be offered as argument starters. Perhaps the most interesting of these was Werner Thiele's (IBM Germany) paper on the development of the DOS/TOS PL/I Compiler. Building a compiler for this complex a language (even the basic PL/I language is more complicated than most other languages around) in a 10K (bytes) machine is a feat of no mean proportion. Given limited core memory to work in, the implementors appear to have succeeded in generating very efficient object code. Distributed but not

(Continued on page 147)

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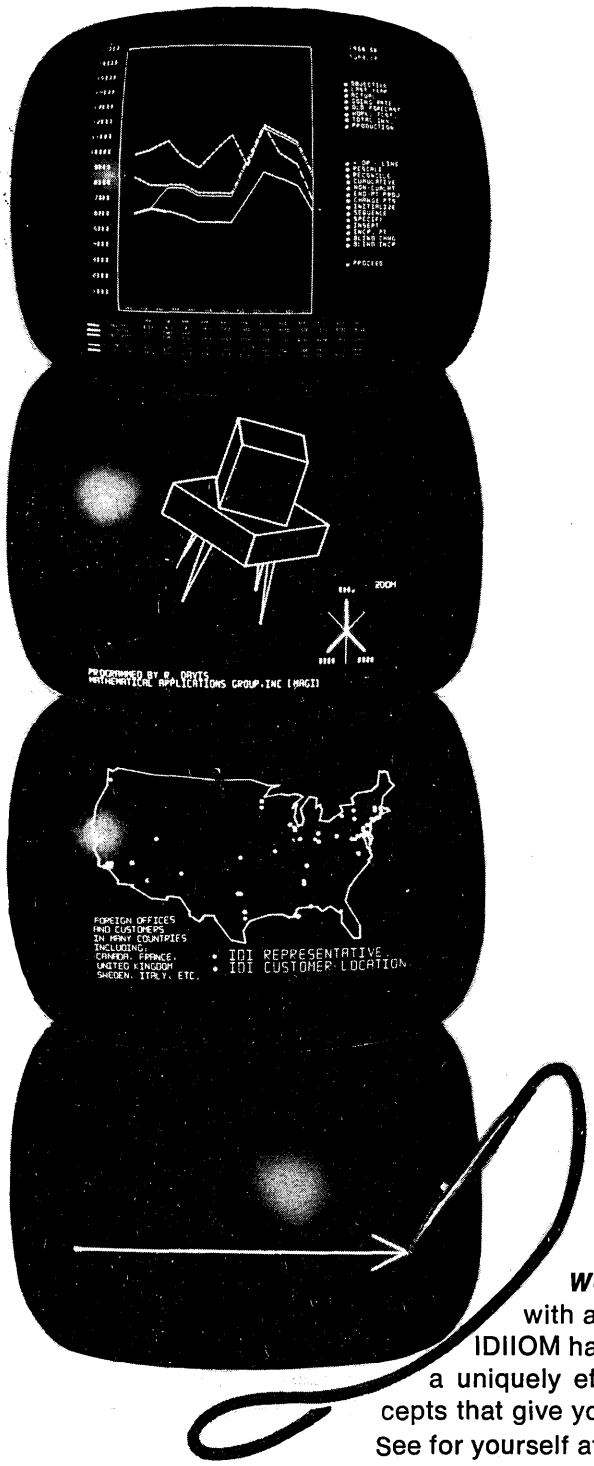

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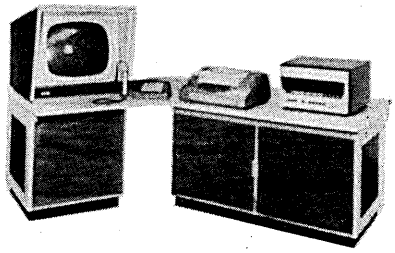

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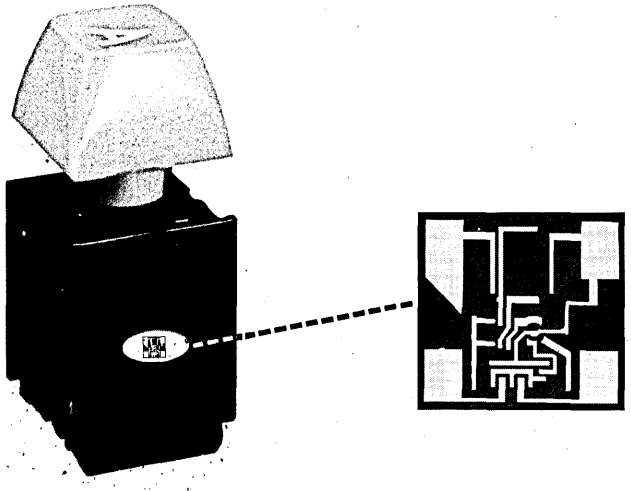

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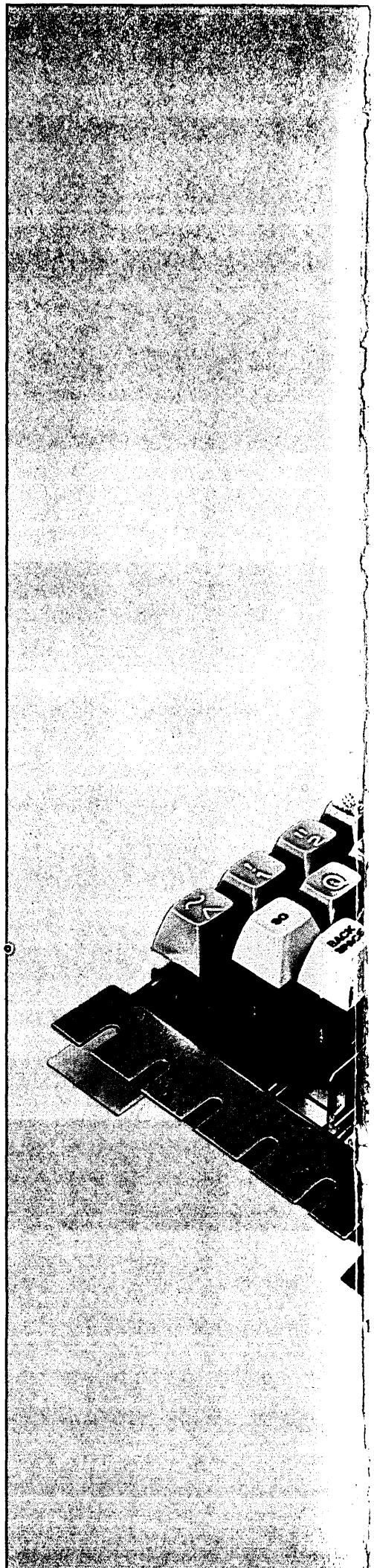

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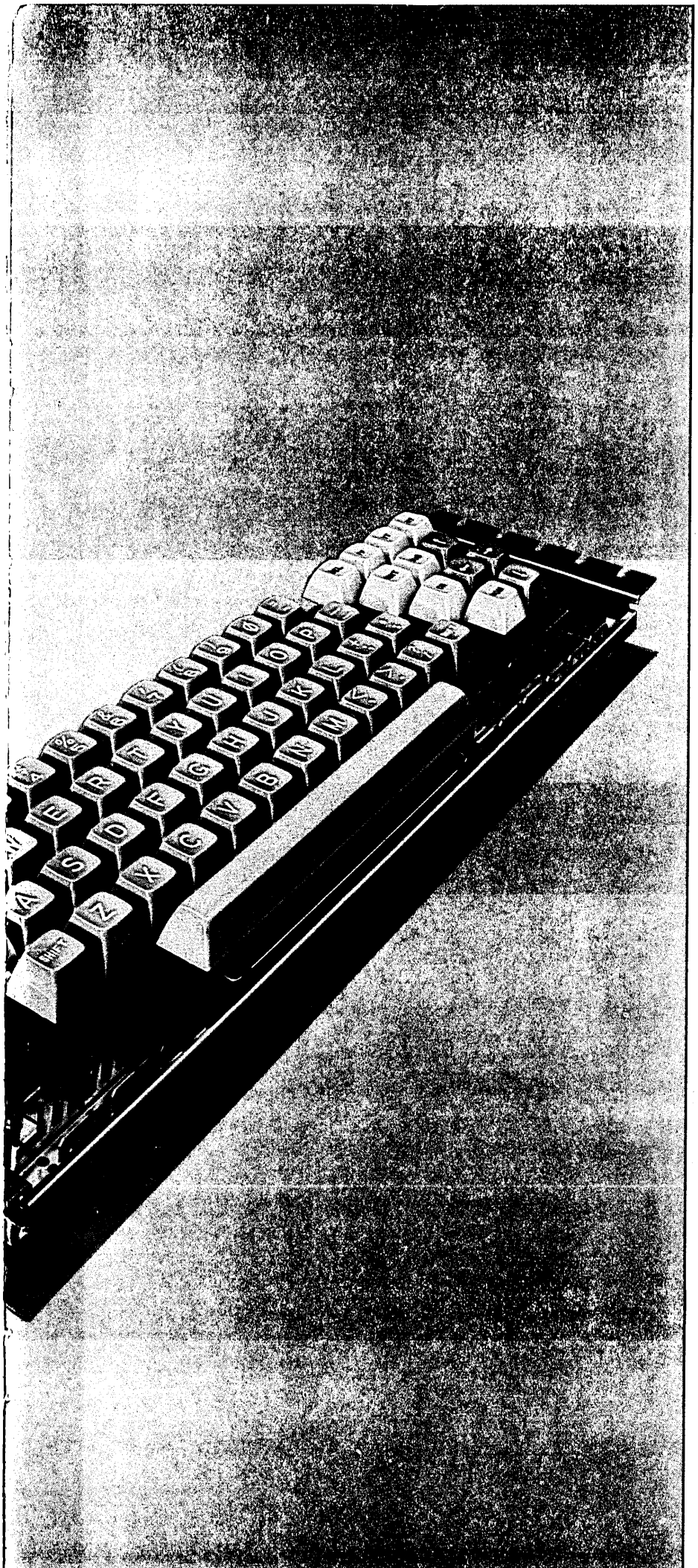

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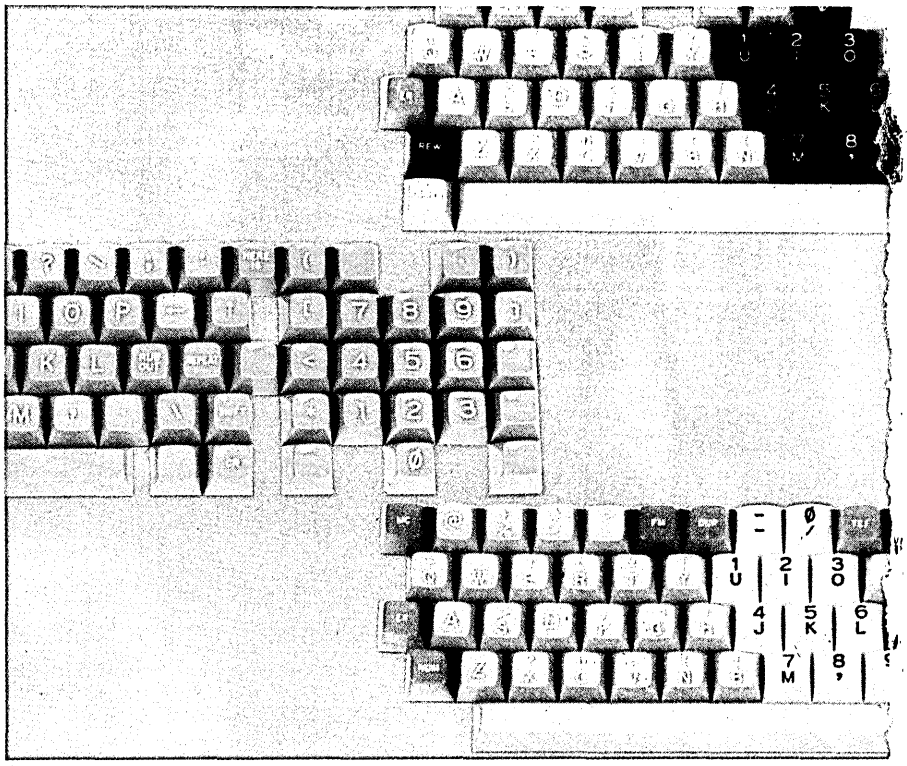

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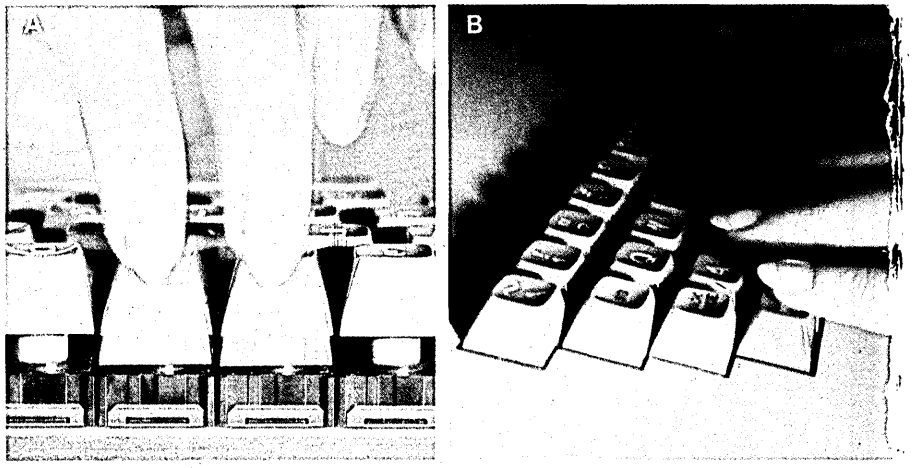

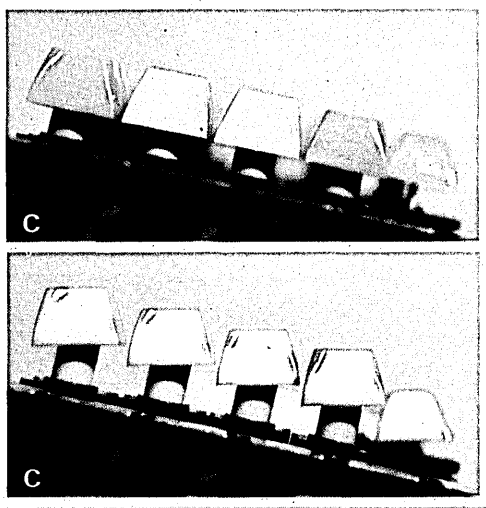

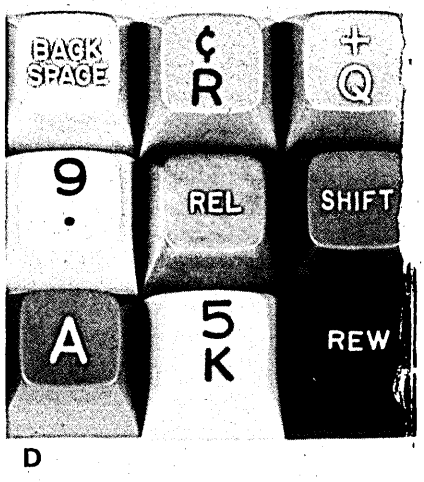

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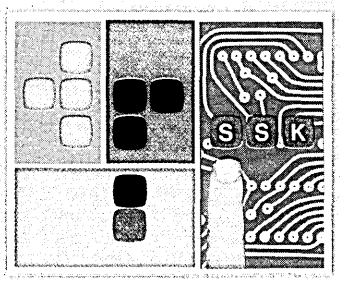

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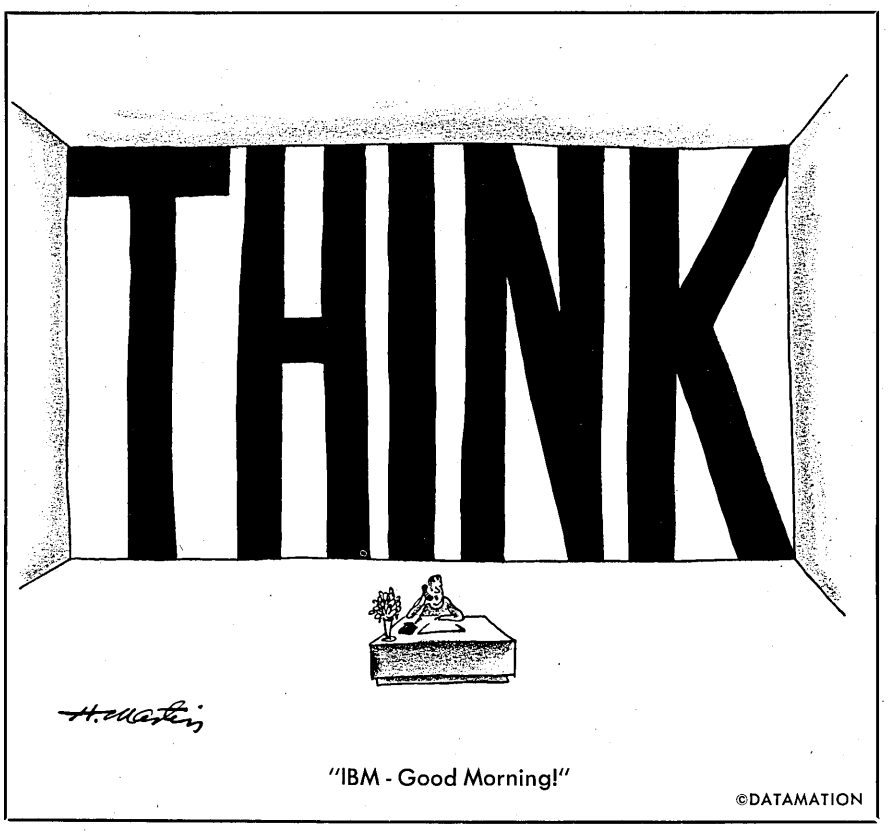

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Classroom instruction was given by IBM in San Francisco. After the formal instruction, trainees were sent for on-the-job training at local computer centers operated by the eight public and two nonprofit agencies which have since joined the Forest Service in this effort. The City of Berkeley is seeking permanent jobs for the youths with its NYC program.

Of the first 21 trainees, 10 found jobs in the computer industry. One entered the skill center; two accepted jobs outside the industry, and one dropped out. The other seven enrolled for college and worked in computer-oriented industries this summer. An additional 26 youths have enrolled in the IBM class which started in late August.

Candidates are carefully screened by NYC for the computer training. Students must take special aptitude tests and show a real interest in the program. And they are paid $1.35 an hour for the time they work by NYC, which is financed by the Dept. of Labor's Office of Economic Opportunity.

APPLIED LOGIC SIGNS DISTRIBUTORS

Five small software/service bureau firms have signed up to sell their services via the PDP-10's at the Applied Logic Corp. in Princeton, under the unique "AL/COM associate (distributor) agreement" announced last spring. The firms include Computer Dynamics Inc., Boston; Davis Computer Systems, Inc., N.Y.; John Keane Associates, Pittsburgh; KPA Computer Techniques, Inc., Cleveland and Pittsburgh; and Basic Computing Arts, Inc., Mountain View, Calif. Application software these associates are running on the time-sharing system range from civil and nuclear engineering to financial forecasting programs.

Essentially, Applied Logic, through this plan, is trying to develop a network of specialized, rather than general purpose scientific, services. While associates may opt to offer their programs privately on the system, Applied Logic is offering either to buy the associate's program outright and pay a percentage of income for maintenance, etc., or to buy the rights to the use of the program and pay a royalty. (The latter is the "juke box" program ALC announced, open to both associates and to individuals wishing to put their package on a t-s system.)

Each associate automatically becomes a member of the Applied Logic Association. In addition to the software plans, ALC provides various discounts for computer time; the associate is required to retail the time at ALC rates, however. ALC also leases the associate a concentrator (card readers and line printers are available), offers financing for software development, will make referrals on prospective business, and trains associate personnel on the system. Other optional agreements include a "port" lease contract under which very active computer users are guaranteed access to the system. "Under certain circumstances," ALC will extend insurance benefits to the associate firm.

Associate Computer Dynamics, Inc., is a professional engineering consultant closely tied with Massachusetts Institute of Technology. ALC provides a PDP-8 based concentrator, which is called an AL/COM 20.0, with 4-12 channels.

Davis Computer Systems, Inc., is a new New York firm specializing in process control and on-line computer applications. (It's headed by Dr. Robert S. Davis, ex-Realtime Systems president.) Among the packages it will offer via AL/COM is PROFORMA, an "interactive report generator for the general manager," which analyzes historical data, forecasts financial statements. Davis also has an interactive linear programming system; will later offer various analytical and statistical packages. It has bought an AL/COM 60.0, which is a PDP-8 (other small computers may be used) with line printer and card reader and 40-channel capacity.

John Keane Associates has primarily supported one major customer, Westinghouse, in nuclear engineering design. The firm plans to expand its staff, and will offer these services generally through AL/COM. A 20.0 concentrator is used.

KPA Computer Techniques Inc. will offer "scientific software" via AL/COM, which represents a major part of its activity. A 20.0 will be installed later this year.

Basic Computing Art, Inc., will spread its services around the west coast with AL/COM services. It has bought a 20.0 and will later add a 50.0 (40 channels, line printer). BCA's specialty is simulation software, particularly with hybrid computer systems.

Applied Logic has 176 customers on its two PDP-10's, most of which are its

(Continued on page 155)

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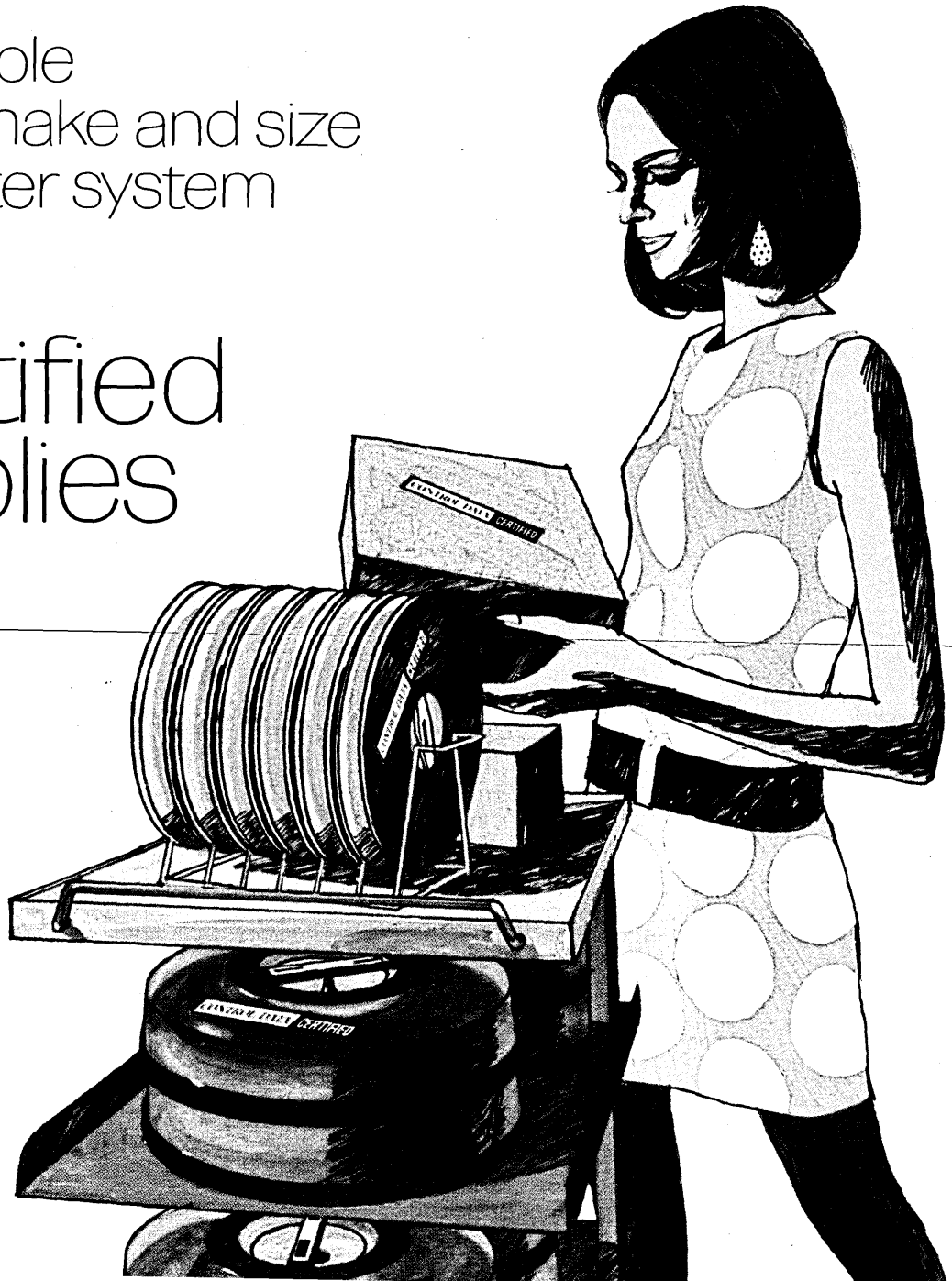

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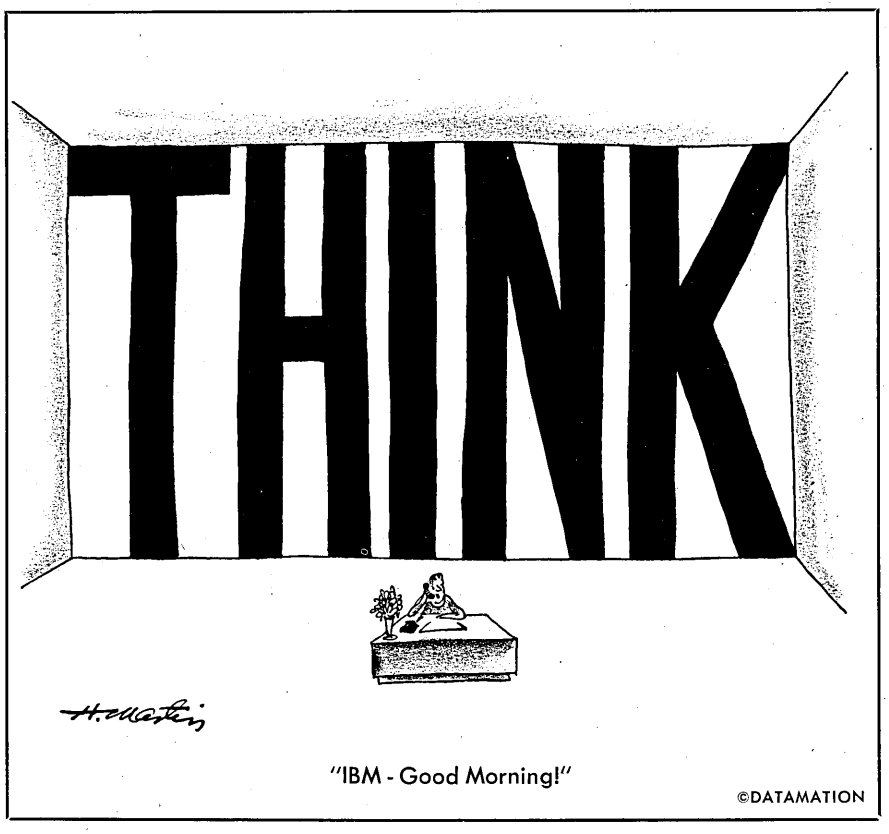

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MEANWHILE, UP IN BERKELEY...

A publicly financed program began just over a year ago, when the Berkeley Neighborhood Youth Corps assigned four youths to the U.S. Forest Service Experiment Station. Within a month they were correlating data, operating keypunch machines, sorters, and reproducers. But the Forest Service staff felt the youths needed more specialized training than they could provide. Eventually a program of individualized instruction was begun to teach a group of 21 Berkeley and Oakland NYC students about computers.

Classroom instruction was given by IBM in San Francisco. After the formal instruction, trainees were sent for on-the-job training at local computer centers operated by the eight public and two nonprofit agencies which have since joined the Forest Service in this effort. The City of Berkeley is seeking permanent jobs for the youths with its NYC program.

Of the first 21 trainees, 10 found jobs in the computer industry. One entered the skill center; two accepted jobs outside the industry, and one dropped out. The other seven enrolled for college and worked in computer-oriented industries this summer. An additional 26 youths have enrolled in the IBM class which started in late August.

Candidates are carefully screened by NYC for the computer training. Students must take special aptitude tests and show a real interest in the program. And they are paid $1.35 an hour for the time they work by NYC, which is financed by the Dept. of Labor's Office of Economic Opportunity.

APPLIED LOGIC SIGNS DISTRIBUTORS

Five small software/service bureau firms have signed up to sell their services via the PDP-10's at the Applied Logic Corp. in Princeton, under the unique "AL/COM associate (distributor) agreement" announced last spring. The firms include Computer Dynamics Inc., Boston; Davis Computer Systems, Inc., N.Y.; John Keane Associates, Pittsburgh; KPA Computer Techniques, Inc., Cleveland and Pittsburgh; and Basic Computing Arts, Inc., Mountain View, Calif. Application software these associates are running on the time-sharing system range from civil and nuclear engineering to financial forecasting programs.

Essentially, Applied Logic, through this plan, is trying to develop a network of specialized, rather than general purpose scientific, services. While associates may opt to offer their programs privately on the system, Applied Logic is offering either to buy the associate's program outright and pay a percentage of income for maintenance, etc., or to buy the rights to the use of the program and pay a royalty. (The latter is the "juke box" program ALC announced, open to both associates and to individuals wishing to put their package on a t-s system.)

Each associate automatically becomes a member of the Applied Logic Association. In addition to the software plans, ALC provides various discounts for computer time; the associate is required to retail the time at ALC rates, however. ALC also leases the associate a concentrator (card readers and line printers are available), offers financing for software development, will make referrals on prospective business, and trains associate personnel on the system. Other optional agreements include a "port" lease contract under which very active computer users are guaranteed access to the system. "Under certain circumstances," ALC will extend insurance benefits to the associate firm.

Associate Computer Dynamics, Inc., is a professional engineering consultant closely tied with Massachusetts Institute of Technology. ALC provides a PDP-8 based concentrator, which is called an AL/COM 20.0, with 4-12 channels.

Davis Computer Systems, Inc., is a new New York firm specializing in process control and on-line computer applications. (It's headed by Dr. Robert S. Davis, ex-Realtime Systems president.) Among the packages it will offer via AL/COM is PROFORMA, an "interactive report generator for the general manager," which analyzes historical data, forecasts financial statements. Davis also has an interactive linear programming system; will later offer various analytical and statistical packages. It has bought an AL/COM 60.0, which is a PDP-8 (other small computers may be used) with line printer and card reader and 40-channel capacity.

John Keane Associates has primarily supported one major customer, Westinghouse, in nuclear engineering design. The firm plans to expand its staff, and will offer these services generally through AL/COM. A 20.0 concentrator is used.

KPA Computer Techniques Inc. will offer "scientific software" via AL/COM, which represents a major part of its activity. A 20.0 will be installed later this year.

Basic Computing Art, Inc., will spread its services around the west coast with AL/COM services. It has bought a 20.0 and will later add a 50.0 (40 channels, line printer). BCA's specialty is simulation software, particularly with hybrid computer systems.

Applied Logic has 176 customers on its two PDP-10's, most of which are its

(Continued on page 155)

direct customers since the associates have just begun AL/COM in the last few months. ALC expects the number of associates and customers to increase rapidly as it already has contracts pending with firms in Washington, Boston, and Los Angeles. A significant addition expected to come with one contract is an interactive APT program. ALC is rumored to be planning installation of 10-12 PDP-10's, all in Princeton.

HANDS-ON TS WORKSHOP OFFERED BY NIRI

NIRI (National Information Research Inst.) will house a 3-day hands-on workshop in Los Angeles for potential t-s users. At least six different time-sharing services will be sampled, choosing from those running with IBM, GE, SDS, and Burroughs equipment. Sessions will be held on application-oriented software, terminals, operating systems, etc. Actual runs of what NIRI claims to be standardized, impartially structured benchmark programs will be made during the course of the workshop. Evaluations will be made of efficiency of operation, ease of access, conversion effort, diagnostic aids, operation expense, and other features. All necessary services and facilities will be leased by NIRI at regular rates under uniform conditions. The sessions are to be held at the Airport Marina Hotel, November 25, 26 and 27. Cost of enrollment is $300; additional copies of the proceedings and analysis tables will be available at $100. To register, contact NIRI at 8939 So. Sepulveda Blvd., Los Angeles.

GUN REGISTRATION COULD CREATE AN EDP MONSTER

National compulsory gun registration would require "one of the most gigantic computer operations ever undertaken," and "would be second only to the Social Security and income tax systems in overall size and complexity," according to statements made last month by H. Richard Cossaboon, president of Management Concepts, Inc., Bala-Cynwyd, Pa., management information consulting firm. Cossaboon disclaimed any personal, political, or business interest in gun registration, but said that he had studied the problem simply as an "academic exercise" since the question of gun registration per se is being so frequently discussed, while no one has mentioned how the government would go about undertaking the task.

Cossaboon stated that the problem "would require the solving of at least five completely unique systems problems: data collection, data conversion, data storage and retrieval, data dissemination, and data communications, as well as providing a real challenge in overall data systems management." He estimated that "it would take at least two years to complete the project and would involve a staff of several hundred people." It would require "a team of qualified experts at least six months just to devise a workable system."

Calculations were based on estimates that there are 200 million guns in the U.S., that three million new guns are purchased every year, and that registration of each individual gun would require more than 130 characters. Each time a gun were sold, bought, or an owner moved, the information would have to be changed and updated.

SRC BUILDS EMPIRE THROUGH ACQUISITIONS

Scientific Resources Corp. is the result of the merger of Sunasco, Inc., Melrose Park, Pa., and Mauchly Associates, Inc., Montgomeryville, Pa. Sunasco formerly dealt in real estate and home improvement financing, but has been selling these interests and purchasing edp firms in an effort to build a "technological empire" in the dp field, which is a more lucrative area of investment for their equity base. SRC estimated its assets to be "in excess of $125 million." Hopefully, the marriage of Sunasco and Mauchly will result in an improved profit picture, as Mauchly lost $224,354 in the year ended April 30, while Sunasco lost $1.4 million in the nine months ended June 30.

It is an irony of the computer industry that Mauchly Associates, founded by Dr. John W. Mauchly, co-inventor of the Eniac computer, has never made a profit since its inception in 1959.

SRC intends to provide "sole-source responsibility" hardware/software packages in such applications as data acquisition and management information systems in diverse industries, including petroleum, nuclear utilities, banking and finance, and aerospace. The SRC "computer technology group" now consists of 17 entities, several of which were acquisitions of Mauchly, and plans call for acquisition of still more firms which will fit in with the overall corporate strategy. Sunasco acquisitions prior to the merger included the computer division of Geo Space Corp., Houston, now known as Hybrid Systems, Inc., which will continue to produce the SS-100 analog/hybrid computer and plans to offer a wide range of new services and products, including several new computers; and International Data Products Co., Cleveland, a software/hardware leasing firm.

Mauchly Associates, Inc., includes the following divisions: the Information Sciences Div., which includes Mauchly-Wood Software Corp., dealing in software and hardware development; Honig Time Sharing Associates, Inc., which specializes in software for on-line, real-time, and time-sharing systems; Computer Sharing, Inc., a time-sharing service bureau; Mauchly Techniques, Inc., which provides work scheduling and control systems; and Digital Seismic Corp., which specializes in software/hardware development for seismic data processing.

Other divisions are: the Project Management Div., which deals in project management based on the Critical Path Method, which it originated; the Systems Leasing Div., which offers development and leasing of specialized hardware/software packages; and the Financial Automation Div., which provides integrated hardware/software systems for the financial community under a leasing program.

Mauchly subsidiaries are: Paragon Systems, Inc., a peripherals manufacturer; Magnetape Investment Corp., a service bureau for geophysical, well-logging, and seismic data analyses; Nuclear Associates International Corp., which develops computer systems for the control of atomic plant nuclear fuel utilization; Analytical Mechanics Associates, which assists in operations research; and Julien Green Associates, which deals in applications for time-sharing systems and specializes in compiler software.

JAPANESE SHORT ON PROGRAMMERS

The Japanese Ministry of International Trade and Industry recently began training edp technicians to overcome a shortage that is already apparent. Japan has about 25,000 computer professionals, including systems engineers, programmers, and operators. They estimate a need for at least 48,000 in three years. The Ministry of Education is expected to establish large scale computer centers in the Hokkaido and Nagoya Universities to help train more computer personnel.

SDC SPLIT-OFF MAY TAKE OVER CORNELL AERONAUTICAL

While some software houses worried about who was going to buy the giant "non-profit" System Development Corp., a fledgling firm of SDC alumni went out and bought Cornell Aeronautical Laboratory for $25 million. If and when the acquisition is completed, EDP Technology Inc. will be a firm

(Continued on page 158)

"all set" for ASCII plus...

Think about it. A new heavy-duty terminal that forms and shapes some of the most complex shapes and forms in data communications. It's the Model 37. Another answer from Teletype R&D for moving data efficiently, at very low cost.

* * * *

Soon, the simplest of language communications to the most complex forms, formulae, charts and graphs will be printed (or punched in paper tape) at 150 words per minute. On-line or off, the Model 37 ASR (automatic send-receive) set from Teletype will give you complete control of just about any data handling situation. And it generates all 128 ASCII (U.S.A. Standard Code for Information Interchange) characters making computer dialog easier than ever before.

Features Galore

The Model 37 types in upper and lower case. Will print two colors if desired. In time sharing situations the terminal's capability in printing graphs, equations, text material and tables is uncommonly fast and efficient. It will have half-line feed—both forward and reverse. Puts everything you need for programming, problem solving, cataloging, and information retrieval at your fingertips. And you get all this flexibility from a keyboard arrangement that is similar to the familiar keyboard found on a typewriter.

Traveling Tabs

Helping you speak the computer's language is only one of many new and important capabilities built into the Model 37. The terminal can be used to produce multiple copy business forms on-line. It has a vertical and horizontal tab stop for every place on the page. Operator will be able to set tabs from the keyboard on-line and off. Or, tabs will be able to be set on-line by a computer—or any remote terminal that uses the ASCII code. Operator can advance and fill in forms in any number of

TELETYPE

remote terminals. The on-line tabbing capability also will be useful for programming large volumes of tabular data.

The Line's Complete

The Model 37 line consists of the ASR shown here, KSR (keyboard send-receive) sets, RO (receive only) sets, plus paper tape punches and paper tape readers housed in modular units. You will have a completely integrated data moving system with all the important options you've been looking for.

The Model 37 is one of many exciting moves being made by Teletype R&D *in moving data at very little cost.* That's all we're really concerned with. Providing equipment that keeps data on the move quickly, reliably, economically . . . machines that can help you move data a mile, thousands of miles, or just down the hall. If you would like more information on the Model 37, write Teletype Corporation, Dept. 81L, 5555 Touhy Avenue, Skokie, Illinois 60076.

made up of 1650 people (1600 from Cornell) and grossing probably a little over $32 million ($32 million from Cornell). Actually, Cornell Univ., which owns the Buffalo, N.Y., research center, has only accepted EDPTI's letter of intent and must still negotiate a contract and method of payment.

Since the financial arrangements have not been announced, observers can only surmise that EDPTI, formed just last February, has strong support in this acquisition from its original backers: Western Union International (through American Securities Corp.) and White, Weld, & Co. EDPTI, privately held, reportedly received $2 million to get started. The firm specializes in design and implementation of executive systems and compilers, management information systems, and space systems applications.

In line with some of EDPTI's interests, Cornell Aeronautical Laboratory lists its major areas of research for government and industry as aeronautics, astronautics, electronics, applied physics, and transportation. And naturally, much of its research involves computers. It was Cornell that in the early '60's developed the Perceptron, reputedly the "first pattern recognition machine." The laboratory has continued such work, having developed a special pattern recognition computer with the programming and peripheral devices to study various techniques involving fingerprints, voiceprints, handwriting, etc.

Cornell has about 100 people involved in its Computer Research Dept. (on computer applications), Computer Mathematics Dept., and Computer Services Dept. (servicing the whole laboratory). The center has what's described as a "very large" 360/65 with a "full complement" of peripherals, as well as several experimental computers. Other computer-related projects include both an Air Force and commercial contract for development of a Total In-Flight Simulator to aid in aircraft design and pilot training in handling such aircraft as the upcoming giant SST's. The laboratory is also developing research techniques for use in computer-based weapons control systems and computer-aided engineer control of train.

The laboratory, as a non-profit under the university, averaged a 6% fee for $32 million worth of contracts last year, or what would commercially be interpreted as 6% net profit, all of which is poured back into projects.

The university expects that if negotiations go well the sale should be completed by early next year.

In addition to its CAL purchase, EDP Technology also made the news when it announced that Secretary of Agriculture Orville Freeman would join its new EDP Technology International, which will be devoted to study of various industrial, agricultural, economic, and social problems of the developing nations.

DENMARK SENDS A SOFTWARE PACKAGE

Parsons & Williams, a Copenhagen firm, has installed its production control program package in five major Scandinavian factories and is ready to tackle the U.S. market. Their product, IMP (for Integrated Manufacturing Planning), consists of six modules: (1) a capacity planning module which is a simulator for matching long-term sales planning with resources; it includes a model for making optimal buy/make decisions, (2) a production planning module for scheduling and dispatching, (3) an inventory control module which calculates economic lot sizes, (4) a purchasing module in which orders are automatically printed . . . and followed up, (5) a dispatcher for day to day planning which uses "parallel smoothing" to switch the workload to unloaded machines, and (6) a cost controller which compares output results and variances against a standard.

IMP is used in Scandinavia to produce items as small as sporting guns to items as large as fork-lifts, tractors, and even locomotives, and is available so far in versions for the IBM 360 (model 30 or larger) and the Univac 1107/8. U.S. representatives are located in Los Angeles. For information:

CIRCLE 238 ON READER CARD

GE HAS CONTROLLER FOR COMPUTER-DIRECTED N/C

A year ago, General Electric was touting its leadership in the process control industry. Recently, it held a press conference on a major subgroup of that industry, numerical control, where it announced a controller that would link, with minor modification, machine tools to a computer—the first step toward making GE "the dominant factor in the computer-directed N/C arena," according to Dr. Louis T. Rader, vice president and general manager of the Industrial Process Control Div.

There are 14,000 numerically controlled machine tools at 3,000 installations—few directly linked to a computer. "The large investment in N/C machines and facilities is changing discrete parts manufacturing (which accounts for ⅛th of GNP) into a capital intensive industry," said Rader, but "as great as are the present use and value of N/C to industry, their future and potential are so vast as to literally stagger one's imagination."

"The parts-making operation has been largely isolated from the information system . . . The result is that today the average discrete parts making plant is made up of a series of parts processing islands that range from the highly automated down the scale through intermediate mechanization to those that are strictly manual," explained Paul Ross, manager of the N/C department.

"What is needed," said Ross, "is an integration of the input and output of these islands to develop an effective, well modulated flow of components that produce the final assembly on an appropriate schedule at a cost commensurate with market demands."

But, acceded Ross, "From the studies we have made it does not appear that any one system will be the answer largely because of the variations in requirements from process to process and industry to industry."

The controller GE announced is a $7500 package "that will allow customers to transfer parts programming data directly from a computer memory to a numerically controlled machining unit." It can be applied to existing N/C equipment, giving users an "opportunity to make performance and economic evaluations of computer-directed systems on a step-by-step basis before making the substantial investment that will be necessary to put an entire parts-making system on-line."

The data controller, although demonstrated with a GE-Pac 4050 process computer, reportedly can be used with any real-time system, and a GE spokesman estimated that 80% of the 3,000 plants using N/C also have computers. (He did not know how many were "real-time" systems.) GE also offers the modems for the unit, either TDM 220's, which can be used for any distance, or a new modem GE has not yet announced which costs $500, operates at 2400 bps, but can only be used for transmission up to 3 miles.

One controller is used for each machine tool. Although the parts-making process is computer-directed, the controller provides for operator intervention. Features include automatic error checking, part program selection and verification, sequence number selection, synchronous full-duplex transmission (USASCII code), typical data transmission rates of 300, 600, and 1200 cps, wind forward on a block-by-block basis, and alterations for machine tool controls. The system will use standard numerical control part programs, so that the user need not invest in program conversion.

(Continued on page 162)

that you'll want to live with a long, long time

Some computers come and go. And when they go, you're out of luck if you own one and want to extend the system to keep pace with your expanding needs.

No problem when you own a member of the Honeywell Series 16 family of real-time integrated-circuit computer systems. This prolific brood includes standard computer mainframes like the DDP-516 and DDP-416, many peripherals, a mature and expanding software library plus support services tailored to stretch the life of your investment. Special systems, functional application packages and new configurations like our Ruggedized and Ruggedized/EMI suppressed models give you even greater flexibility. No wonder Series 16 systems are being used so much in applications like communications, research, medicine, industrial control and flight simulation.

And Honeywell's Series 16 family will continue to grow — investment today in time, money and effort will not go down the drain because of sudden obsolescence tomorrow.

For more information about the Series 16 family and some of the ways Honeywell computers are being used, write: Honeywell, Computer Control Division, Framingham, Massachusetts 01701.

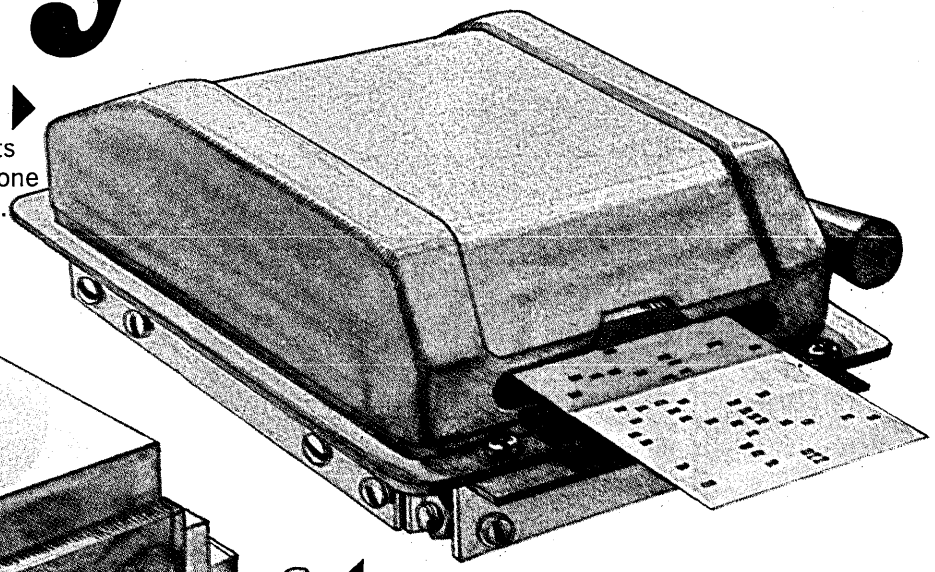
Honeywell

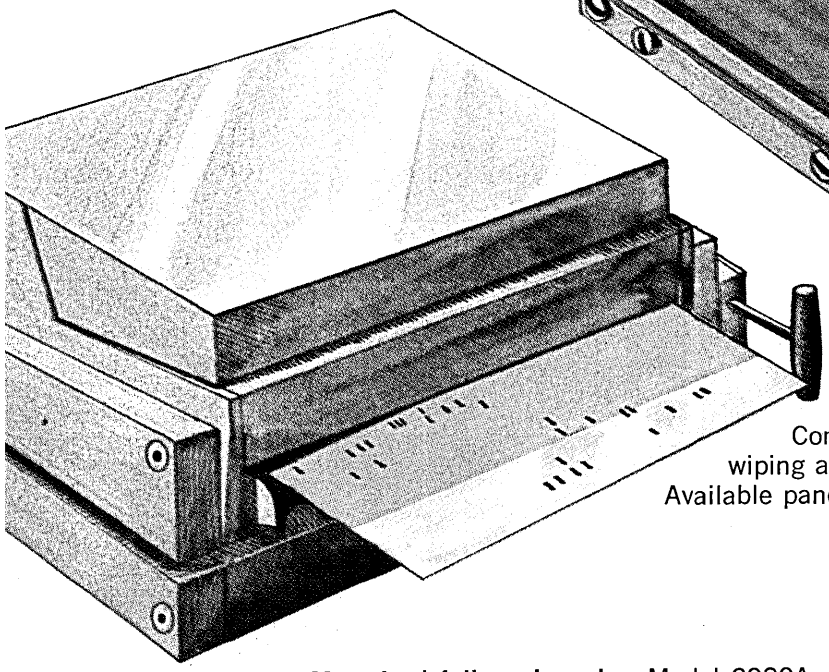
COMPUTER CONTROL
DIVISION

CIRCLE 72 ON READER CARD

For your in

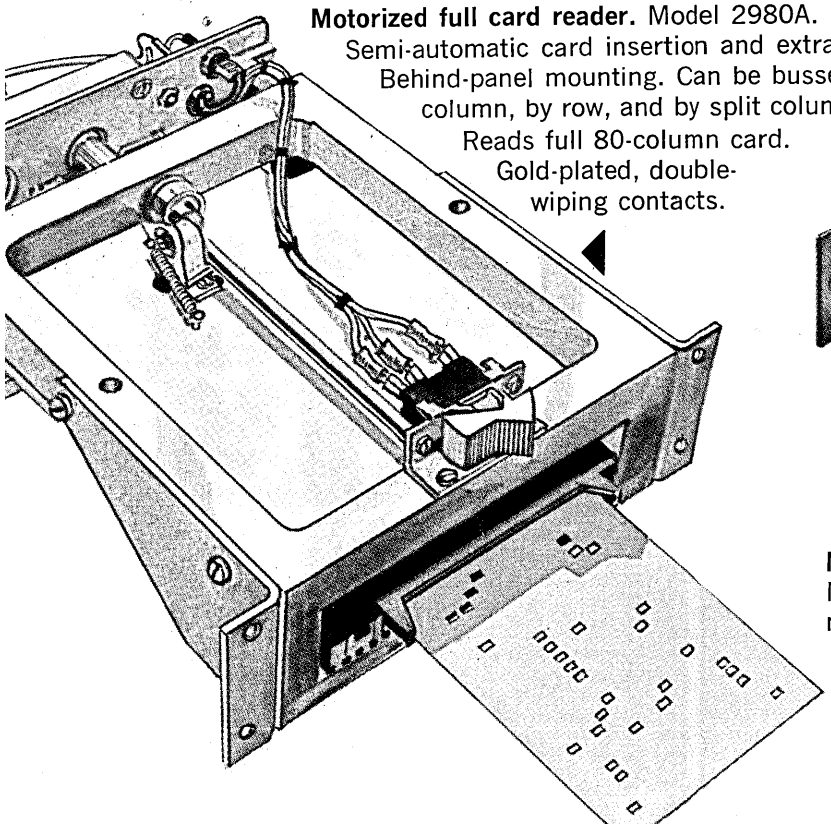
Industrial programmer. Model 2924. Isolated switches. Remote switch contacts. Precious-metal-clad contacts take 2 amps DC. Contacts tested to one million cycles. Full 80-column reader.

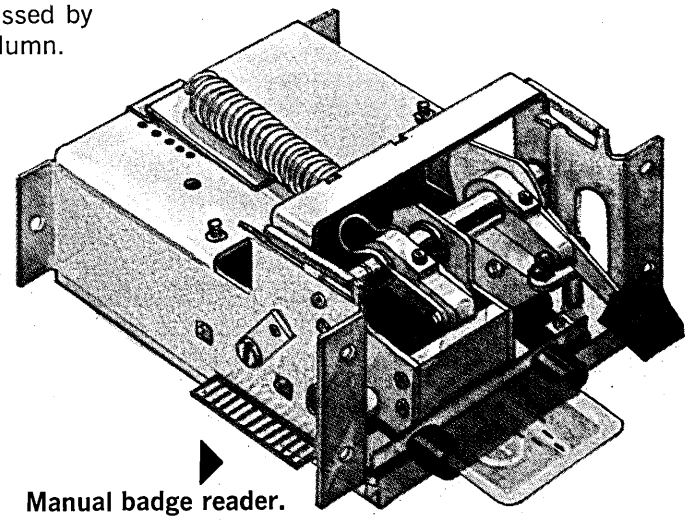




Desktop card reader. Model 1040. Up to 960 switches, 80-column format. Available in matrix or isolated outputs. Contact rating of 0.25 amp DC. Double-wiping action cleans contacts at each use. Available panel mounted.

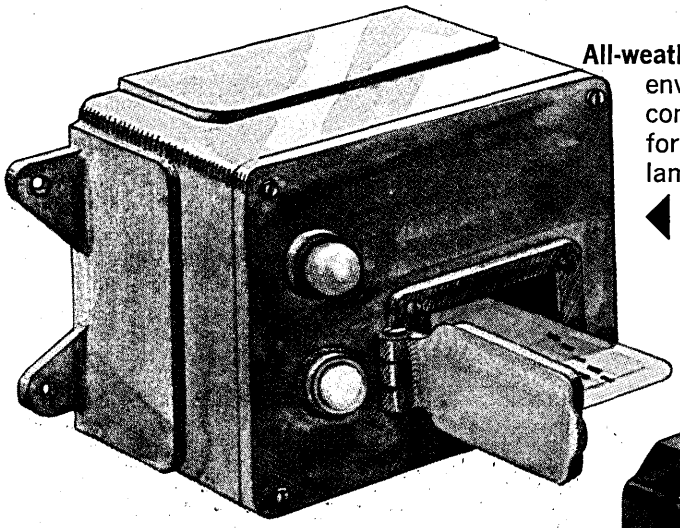
Motorized full card reader. Model 2980A. Semi-automatic card insertion and extraction. Behind-panel mounting. Can be bussed by column, by row, and by split column. Reads full 80-column card. Gold-plated, double-wiping contacts.





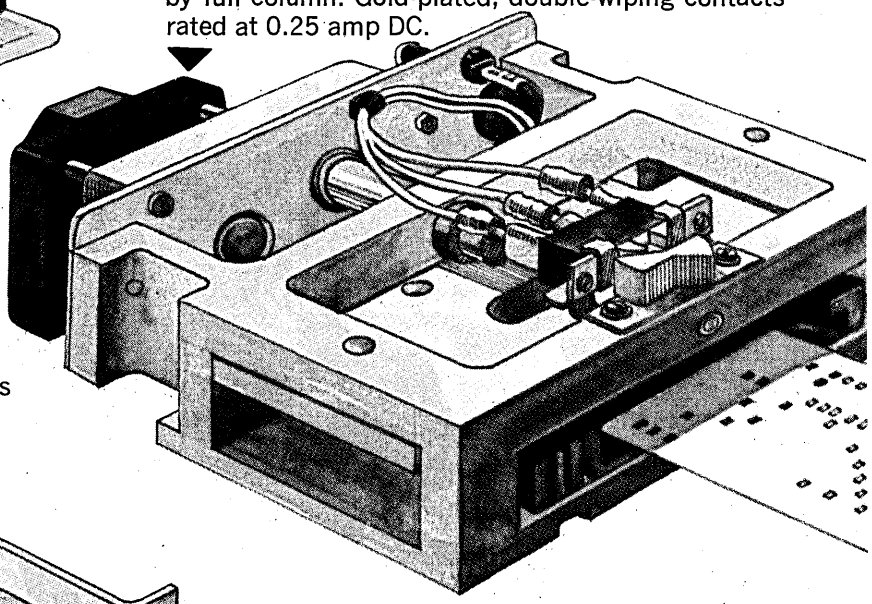
Manual badge reader. Model 361. Cross-matrix or individual outputs. Takes 15-, 20- or 22-column badge up to 0.040″ thick. One-hand operation. Up to 264 switches. Designed for one million cycles.

formation:

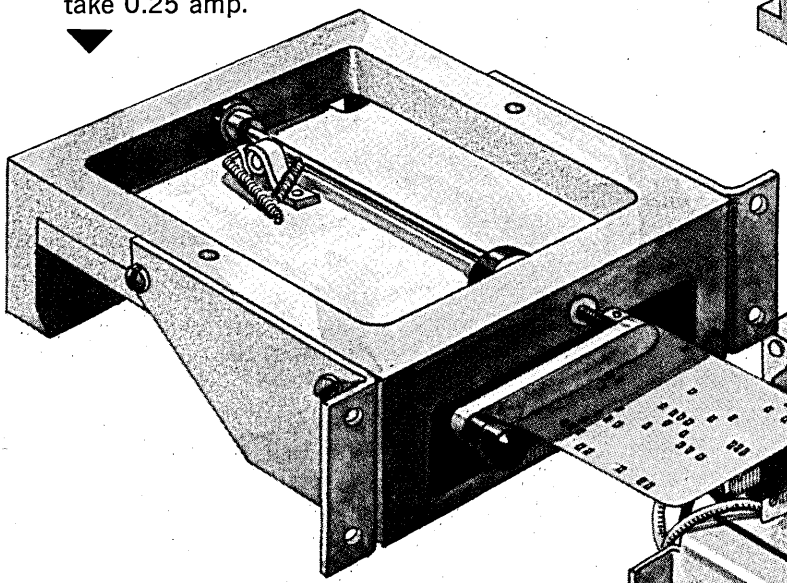


All-weather reader. Designed for outdoor or industrial environments. Suitable for air purge system. Bifurcated contacts — up to 264 cross points. Credit card format up to 12 x 22, matrix or individual. Indicator lamps and card release switch available.

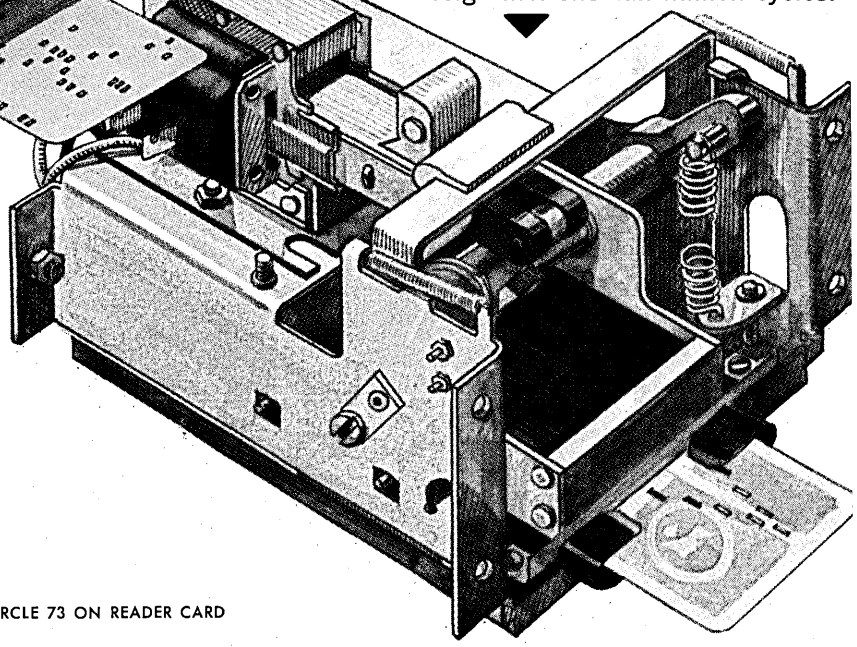
Low-cost industrial reader. Model 2900A. Motor-operated or manual model 2901A. Up to 264 switches, 80-column format. Bussed by row, by half-column or by full column. Gold-plated, double-wiping contacts rated at 0.25 amp DC.



Behind-panel reader. Model 2981A. Industrial full 80-column card reader. Complete alphanumeric coding and 160 six-bit word capability with only 160 diodes. Can be bussed by column, by split column, or by row. Gold-plated contacts take 0.25 amp.



Solenoid badge reader. Model 360. Reads 15- 20- or 22-column badge — up to 264 switches. Operates similar to time clock. Models for 115 VAC and 28 VDC. Design life: one-half million cycles.



Put your data here . . . for process control, test programming, computer input, machine control, production control, status indication, access limitation, credit validation. The biggest and most versatile card reader family around. For more information, write **AMP INCORPORATED, HARRISBURG, PA. 17105.**

AMP
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CIRCLE 73 ON READER CARD

news briefs

AUSSIE CENSUS SHOWS SLOWDOWN

The rate of increase in computer installations in Australia declined over the 12 months to June of this year compared to the previous year, according to the annual computer census taken by the Dept. of Labour and National Service, which compiles computer statistics as part of its program of research into the employment effects of technological change. The department reported that 665 digital machines were in operation on June 30 and 155 were on order, compared with 410 in use and 176 on order in June '67. Analog computers numbered 120 in use with three on order, as against 102 in operation and nine on order in '67. However, the department said the number of digital machines to be delivered during the current calendar year seemed likely to exceed the '67 figure and could be higher than in record '66. 83 digital computers were delivered in Australia in the first six months of this year compared with 159 in the previous 12 months.

Slightly more than 60% of the digital computer installations were in manufacturing and commercial organizations, nearly 20% were in government administration or research operations, and about 10% each in educational institutions and data processing bureaus. 80% of the computers on order are for manufacturing and commercial enterprises.

GE'S MEDINET ON THE AIR

Medinet, General Electric's hospital information service, has put an inpatient billing system into operation at Ellis Hospital, in Schenectady. After a long preparation period, Medinet began several months ago to market programs ready for use by hospitals. Two separate systems are involved at Ellis, one for admissions/census reporting, and one for inpatient billing/accounts receivable; both were made operational within two months.

Meanwhile, back at the Melrose-Wakefield Hospital in Melrose, Mass., Medinet is busy putting a payroll/personnel accounting system to work. For the complete hospital information system that Medinet plans to offer within the next two years these applications will be augmented with programs for: laboratory testing ordering/reporting, medical record statistics, automated mental status examination, medication ordering, x-ray test ordering, nursing staff allocation, nursing staff scheduling, accounts payable, purchasing, inventory control, and general accounting. Both of the hospitals above will implement complete MIS systems, GE claims.

Medinet also claims to be the only nationally available hospital information service, although it will initially serve only the New England-New York areas from its Watertown, Mass., headquarters.

Medinet presently has 90 employees —mainly dp professionals—backed by a GE 435 with 64K, four DSU 20 discs (with 18 million words each), and a Datanet 30.

NEW WORD, TERMINAL ANNOUNCED BY AC&C

Contrary to the development procedures of most companies, American Computer & Communications Co., a Newport Beach, Calif., company formed in March '68, has decided to diversify from the start. To further perpetrate its image of being unique, it has also invented a new word—computor—to describe one of its three divisions. Head of the Custom Computors Div., Frank Quass (formerly with Univac) defines the word as "one who applies computer technology to the needs of man." Custom Computors plans to carry out this philosophy by opening a series of service bureaus in the greater Los Angeles area. The division, which currently employs 12 people (there are 40 in the entire company) has ordered $1.5 million worth of computers from Univac: the first, a 9300, has already been delivered. The remainder of the order—five additional 9300's and a 9400—are scheduled for delivery in '69.

The two other divisions of AC&C, engineering and production, and systems and applications, have announced their first product: the 1041 data terminal. The basic 1041 reads up to 24 (8-bit) ASCII characters from a magnetic card and accepts input from a 10-key keyboard. It is also capable of bit serial transmission via telephone lines of information read from the card or keyed-in data. Expansion capabilities allow for printer interface, crt, any other keyboard configuration, common carrier interface, and wait station for the document. AC&C says it will license an OEM to make and market the terminal and its future proprietary products.

At some later time, AC&C hopes to integrate the activities of its divisions: for example, using the terminals as real-time source data acquisition (in business or industrial environments) by the customers of the Custom Computors Div.

RCA UNVEILS SECOND CORPORATE DATA CENTER, AMBITIOUS MIS PROGRAM

RCA trotted out a high-powered crew of executives to dedicate a new data center in Los Angeles in mid-September. Giving brief talks were president Robert W. Sarnoff, Howard L. Letts, exec. vp, finance, and Information Systems exec. vp Jim Bradburn.

Sarnoff predicted that by the end of the 70's, "the everyday use of the computer in the American home will become commonplace," with home terminals linked to "a computerized central information utility providing a multitude of personal, business and educational services on a time-sharing basis."

He said that "tens of thousands" are engaged in making computers, plus some 250,000 programmers and operators working with those installed. "By 1975," said Sarnoff, "the total number of jobs directly related to computers may reach two million."

The center is the second of seven planned by RCA to serve as backup to RCA computer customers, for demonstrations to prospective customers, and as a network for an ambitious RCA corporate Management Information System, now being developed at a cost of 50 megabucks a year by a staff of 160. The MIS is scheduled to be operational "before" 1972, according to one RCA source. The data centers report to RCA corporate HQ.

The L.A. center presently includes a 262K Spectra 70/45G, 1401 and 301 emulators, 18 tape drives, two printers, card reader/punch, four disc units, and mass storage of approximately 5½ million bytes.

A Spectra 70/46 is due in January, and the center will be going into the time-sharing business. Another 45, due in about a year and a half, will complete the planned three-cpu installation.

CDC CITES LOW JOB COST AT 6600 DATA CENTER OPENING

CDC's Waltham, Mass., data center held a press conference recently to show off a 6600 batch-processing system installed there a short time earlier; another purpose was to persuade potential customers that the 6600 can cut their dp costs significantly even though CDC's charge for a "system hour"—$865-$1200—is probably higher than the corresponding rates of competing service bureaus.

A "typical job" for which a competing service bureau charged $40 was done at the CDC center for $5, district sales manager Howard Levin told the press conference. Later, he told us the job cited was a standard program compilation and that $40 was the

price quoted by a nearby competitor to compile the program on a 360/75. The service bureau wasn't identified but it was probably Avco's shop in Wilmington, Mass.

CDC charges less, explained Levin, because the 6600 "is the fastest machine in use today," and because it utilizes a parallel central processor which telescopes processing time significantly compared to serialized cpu's. He cited a number of examples in which time saving amount to more than 50%.

Since CDC's Boston-area 6600 went on the air last August, it has been operating on a single shift, five days per week. Although "several" new customers have been signed up, Levin admitted that utilization is less than 50%. He implied that this figure was more a testimonial to the 6600's capabilities than an indication of marketing problems.

It is expected that half the available time will be committed by the first of the year, Levin added. By then, more users may also be communicating with the center through remote terminals. At present, "more than 50%" of them hand-carry their work to Waltham. The others are equipped with CDC 160-A terminals. Among these latter customers is a "user cooperative" in Rochester, N.Y., encompassing several members, who share the cost of a single terminal. Software for a new terminal configuration, the UT 200, which features a video display, should be ready for installation about the first of the year.

The other press conference speaker, CDC's Boston district manager, B. T. Von Schmidt Pauli, described how the newly installed 6600 would expand the company's burgeoning nationwide data center network. New York City, Los Angeles, and Houston have already been equipped with 6600's; Washington and Minneapolis are, or soon will be. One more 6600 is earmarked for Palo Alto, and another one may go into Chicago. All of these locations will be interconnected via wideband 40.8K-bit private lines, permitting overloads to be shifted and software to be shared. Smaller cities will tie into the network through CDC 3300 systems, which are being modified to operate as message concentrators as well as local data processors.

COMPUTERIZED TYPESETTING OFFERED BY DONNELLY

R. R. Donnelly & Sons Co., Chicago, has put into operation a new computer-controlled typesetting system that operates with an RCA Videocomp 832 electronic composing machine to produce complete pages in 10 seconds or less. The 832 is a high-speed character generator that can set type on film ready for plate making at 1K or more cps. It operates by mag tape input from an IBM 360/40 combined with coded graphic arts instructions that determine the form and arrangement of the page, size and style of type, spacing and other format requirements.

The system, called "Electronic Graphics" by Donnelly, will be used primarily for publications with existing data banks, such as directories, parts and price lists, catalogues and other large volume periodicals requiring recurrent update. The company used the system to perform the typesetting for the '68 edition of Dun and Bradstreet's Reference Books, which have 2,400K separate listings, and will use it to typeset the Official Airline Guide.

PROCESS CONTROL PROGRAMS CAN BE IN ENGLISH

AUTRAN (Automatic Utility Translator) permits engineers to write program statements in English, then converts them to FORTRAN for compilation. The new "language" was developed by Merck & Co. and implemented by Control Data's Analog-Digital Systems Div. Five types of programs may be written in AUTRAN: (1) specifications programs for defining motors, values and switches, (2) action lists which define sequences of operations, (3) alarm lists which specify which conditions constitute an emergency, (4) display lists to call the operator's attention to a condition, and (5) data lists to specify messages for reports.

The two companies collaborated on a "totally automated" pilot plant using a CDC 1700 computer which will go into operation at the Merck Sharp & Dohme Research Labs in Rahway. The firms are still working on a control system for designing facilities capable of handling batch processing of many chemical products simultaneously. In addition, CDC is developing programs in AUTRAN for application in other fields, including air frame and engine testing, and telemetry checkout and monitoring.

WESTINGHOUSE OFFERS EDP SERVICES TO OUTSIDERS

Westinghouse has begun offering remote batch processing service to outside users through its Information Systems Laboratory. An IBM 360/50 and a 360/75 have been installed in Attached Support Processor configuration at the Westinghouse Tele-Computer Center in Pittsburgh, and can be accessed by outside users through IBM 1050 and 1130 terminals or smaller 360/20 or /30 cpu's at user locations. Certain Westinghouse-developed engineering design analysis programs will also be made available to outsiders. Plans call for time-sharing service to be initiated by next month.

Westinghouse operates an in-house system of more than 500 typewriter terminals at locations throughout the country, linked by leased lines to a Univac 490 and two 494's in Pittsburgh. This equipment will not be available to outside users, however.

SB EXPANDS, OFFERS ON-LINE SERVICE

Fedder Data Centers, Inc., Baltimore, began offering on-line remote and regular batch processing in September, using a PDP/8, GE 235, and an IBM 360/30. Future plans call for installation of a network of 25 NCR Century Series 100 and 200 computers throughout the U.S. and Canada, using Mohawk terminals with buffered printers for data transmission. The first four NCR cpu's will be installed in Baltimore, New York City, Chicago, and Los Angeles in 1969.

The firm provides commercial dp services, including packages which generate journals, ledgers, trial balances, statements, W-2 forms, etc. Fedder maintains 17 regional sales offices, with plans to expand to 25 next year. The first Mohawk terminal was installed in the Toronto office last month. A variety of terminals will eventually be implemented, including crt's and a special terminal for off-line recording and editing.

Fedder also offers its own high-level, parameterized computer language, designed for use by non-technical personnel. The language is said to be easier to use than RPG, while providing extensive formatting, and report-writing capabilities and using less main memory.

HONEYWELL "LEADS" IN PLATED-WIRE MEMORIES

Honeywell's Aerospace Div., St. Petersburg, Fla., reports that orders for plated-wire computer memories have given them "an encouraging lead" in the fledgling military and aerospace memory market for these products. Industry sources report the market to be only about $5 million, of which Honeywell has perhaps $4 million. Honeywell states that they are "the only company producing volume quantity orders" at present and that the market "will exceed $200 million by 1971."

Honeywell customers for plated-wire memories include Raytheon Co., Space Craft, Inc., the Air Force's Rome Air Development Center, and NASA's Electronic Research Center. The firm refused to reveal the value of these orders.

news briefs

Aerospace Div. vp John W. Anderson stated that "plated-wire has moved from the research and development laboratory to the marketplace," and "plated-wire memories are replacing ferrite-core memories in many military and aerospace computer memory applications because of greater speed, non-destructive readout capability, lower power consumption and higher reliability."

EG&G SPAWNS NEW GRAPHICS FIRM

EG&G and a group of "highly qualified people" headed by Ian H. H. Smith, former vp and general manager of Muirhead Instruments, Inc., have executed a joint venture agreement resulting in the birth of Data Graphics, Inc. The new firm will be staffed primarily by former EG&G and Muirhead employees, and will have a plant in New Jersey. Data Graphics will manufacture and market graphics communications and computer graphics products and proprietary bandwidth compression systems. The first bandwidth compression system is scheduled for production early next year.

EG&G stated that the reason it had formed a new company, rather than a new division, was to create "incentive" for the new organization to rapidly prosper. Data Graphics will be privately held, with ⅓ ownership by EG&G, and the remaining ⅔ in the hands of EG&G and Muirhead employees.

JAPANESE BROADCASTING COMPUTERIZED

The Japan Broadcasting Corp. (NHK), a complex including a large TV network, an educational TV network, plus one FM and two AM radio stations, has installed an edp system said to be the "most advanced information and control system in the broadcasting industry." Developed jointly by NHK and IBM, TOPICS (Total On-Line Program and Information Control System) went into operation in September. The system coordinates "all production and broadcasting activities," aiding in the simultaneous production of some 1800 programs in 26 TV and 33 radio studios and on location.

TOPICS has two major functions: supporting planning and production, and on-the-air broadcasting. A pair of duplexed 512K 360/50's are employed, one being on-line, the other standing by. The standby machine, which can take over primary functions in less than 10 minutes, normally works on payroll and other conventional tasks. The cpu's share two IBM 2314 disc drives, each with a capacity of over 200 million bytes, containing the data files and OS programs. Two IBM 2303 drums, also shared, store on-line transmission control and transaction information; they also provide "fast response" to the terminal communication links. On-the-air broadcasting is controlled by the Automatic Broadcast Control System (ABCS), based upon an IBM 1800 Data Acquisition and Control System.

In supporting planning and production, the system serves as a central file containing information about NHK's production and broadcasting activities; all schedules and assignments are negotiated through the on-line cpu, so that its files are always up to date. This information was previously the substance of nearly all telephone and memo exchanges during production. Now, NHK personnel communicate through TOPICS; anyone can access information through one of 184 IBM 2260 crt's. Scheduling which once required several days is now completed in a few minutes. The system also keeps track of budgets and informs personnel where and when to report for work, by means of the crt's. It also calculates payments to vendors and wages to workers, and prints pay vouchers on typewriter terminals. TOPICS has thus caused paperwork to be "just about eliminated."

In controlling on-the-air broadcasting, the ABCS connects cameras and microphones to video and audio tape recorders through control rooms, through complex arrays of switches, and finally to the transmission tower. The ABCS controls the broadcasting of programs, station-breaks and other announcements.

An IBM Data Link Subsystem operating at 40.8K bauds provides communication between the 1800, located in the NHK head office, and the ABCS at a facility five miles away. The 1800 and DLS are completely duplicated and always in dual operation, one being prime, the other paralleling its operation, ready to take over when the other is undergoing maintenance.

TOPICS is thus performing the functions of several different kinds of systems. As a communications system, TOPICS conveys scheduling and assignment information between NHK's Broadcast Control Center and the studios; as an information retrieval system, TOPICS stores and retrieves information on broadcasting production; as a simulator, TOPICS enables managers to work out acceptable schedules and assignments; through the ABCS, TOPICS acts as a master switching control.

CII UNVEILS NEW COMPUTER MANUFACTURED IN FRANCE

Compagnie Internationale pour l'Informatique (CII) introduced its new computer, IRIS 50, at the French business equipment exhibition, SICOB, in Paris in September. It is the first of a family of computers and was designed and built in France under the aegis of the French Government's "Plan Calcul" (see Sept., p. 74).

IRIS 50 is a medium-sized IC computer whose central processor functions are shared by three autonomous modules: the command and control module, the main core memory, and the data exchange modules (from one to four). The command and control module provides 102 instructions, including decimal and floating point arithmetic. Each instruction requires four bytes, and addressing is direct, indexed, or indirect in cascade. 16 four-byte registers and up to 96 levels of interrupt are available for real-time and multiprocessing operation.

The memory is 16K bytes, expandable to 256K bytes in increments of 16K bytes. It can be split into four blocks accessible independently or simultaneously with a maximum I/O rate of 8 million bytes per second. The memory uses lithium ferrite cores and has a cycle time of 0.95 usec. It is addressable by byte or by groups of 2, 4 or 8 bytes.

The data exchange modules effect the data flow between the main memory blocks, the command and control module and peripheral devices. Up to four modules of 32 channels each can be connected with a total transfer rate of up to 10,500K bytes per second. A multiplexor with a transfer rate of 400K bytes per second is also available.

The software for IRIS 50 includes a disc-oriented operating system, SIRIS 2, which requires 32K of memory in a complete configuration. It is modular and can be adapted to the hardware configuration as it grows. FORTRAN IV, COBOL and a Report Program Generator are provided with a "complete" package of utility routines for business and scientific applications.

An IRIS 50 with 131K bytes of main storage, console, five magnetic tapes, 24 million byte disc auxiliary storage, reader/punch and printer will rent for about $16K per month. First deliveries are expected in the fourth quarter of '69.

HONEYWELL INCREASES SCOPE OF HOSPITAL SERVICES

Another company ready to play a larger role in providing services and machines to the largely untapped hospital automation market is Honeywell,

Moore Ideas for Data Processing

Consolidate disbursements without losing identity

Schools, hospitals, small businesses can use public computer services for disbursements such as payroll and purchasing. Subscriber sends own check to computer center for total amounts due. This retains banking identity. New Moore standard check form is prepared as computer print-out. Avoids special imprinting and encoding for each bank. Form also can be stapled to provide envelope. Saves cost of envelopes and stuffing.

Speed collections two ways

At the computer and at the customer's end. Moore has designs for invoices that can be printed two-wide and three-wide by your high-speed printer. This gets the billing done faster. Design includes self-addressed, postage-paid envelope for remittance. Envelope encourages customer to pay now.

Cut bad-debt loss

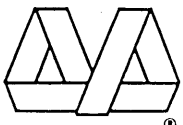
New Moore system anticipates slow accounts to reduce collection costs. Idea is to prepare a series of collection letters as computer output. System provides as many follow-ups as needed. Eliminates separate typing of letters. Prevents peak typing loads in credit department. Increases collections. Impossible for letter to be sent to wrong account.

Avoid cost of hand operations

Couple a Moore Interstacker to a Moore Detacher and you can eliminate several machine and/or manual operations. You can mechanize interspersing of detached forms. Or slit two-wide forms. Overlap strips. Imprinter attachment available, too.

Ideas can help you grow

Let Moore keep feeding you ideas to cut costs, improve control, better inform management. Ideas are the key resource of the 2407 Moore specialists who constantly exchange ideas with each other and with businessmen all over North America. One Moore idea may be what you need. Find Moore in the Yellow Pages.



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CIRCLE 74 ON READER CARD

news briefs

which announced several new developments at the recent convention in Atlantic City of the American Hospital Association. In a luncheon address, Dr. John W. Dempsey, vp for science and engineering at Honeywell, stated that average costs per patient-day tripled from 1950 to 1965, with salaries, which account for ⅔ of all hospital costs, the most important factor. He stressed the need for increased automation to free skilled personnel to spend more time at their specialties, and said that automation can be an effective cost-control tool in hospitals.

Toward those ends, Honeywell's Commercial Div. is offering an environmental control system called the DataCenter, which can monitor and control up to 2K remote points throughout a hospital. It is operated from a console, where a special digital display screen indicates any abnormal conditions pinpointed by an alarm scanner module, which can run through 1K checkpoints in less than a minute. The scanning operation can be preset and gives both critical and maintenance alarms. The DataCenter can control corridor and exterior lighting, music, remote door locks and temperature, as well as mechanical equipment. A multi-station intercom enables the console operator to communicate with personnel in remote locations. The modular system is expandable and the company claims it is economically feasible for hospitals with from 20 to 500 beds.

A new series of business application programs was announced by Honeywell's EDP Div. at the convention. The applications are in seven key administrative areas: Medicare cost allocation, inventory control, hospital equipment maintenance, general and property ledger accountability, accounts payable, personnel, and payroll. The first three will be available in March '69, with the others scheduled to be ready by next summer. All are undergoing field tests on Honeywell computers at various medical centers. The programs are designed to operate on computers serving several hospitals at once, and were developed as cost effectiveness aids for hospitals, which now spend 35-40% of their revenue on processing or handling of data.

And, of course, the "other computer company" sells computers and is after a larger share of the hospital market; a recent survey showed Honeywell in second place with 25% and a $50 million volume, according to the company. A spokesman for the Computer Control Div. predicted that more than 500 hospitals will be using small computers for laboratory automation and monitoring of patient by 1975, and stated that small computers, which he classified as being in the $10K to $50K price range, will also be in widespread use in hospital information systems and medical research facilities. The number of hospitals using computers in some form is expected to double, to more than 1,500, he said.

SPECIAL MEETINGS TO FOLLOW FJCC

Most of the member societies of AFIPS will take advantage of the attendance at the Fall Joint Computer Conference to hold meetings on topics pertinent to their special interests.

The Assn. for Computing Machinery will present two seminars. The first, a two-day seminar scheduled for Dec. 12-13 at the San Francisco Hilton, is entitled "Computer Systems Analysis Techniques." (It will be repeated Dec. 16-17 at the Airport Marina Hotel in Los Angeles.) This session will be tutorial, and will discuss techniques of data base organization and design, documentation, systems testing, conversion and control. Fees are $75 for ACM members; $100 for non-member employees of ACM corporate members; and $125 for other non-members.

The ACM will also sponsor a one-day seminar on "Aerospace Software" Dec. 12 at the San Francisco Hilton. It is planned as a foundation survey of operating environments, specification, design, development, validation, and evaluation of aerospace software. Course fees are $40, ACM member; $55, non-member employee of a corporate member; $70, other non-members. Additional information on both seminars is available from J. M. Adams, Jr., ACM, 211 E. 43rd Street, New York City, 10017.

A workshop on "Social Responsibilities of Computer Professionals and the Computing Industry," sponsored by the IEEE Computing Group, is scheduled for Thursday, Dec. 12, 9:00-4:00, in the Toyon Suite at the Hilton Hotel. Chairman of the workshop is Harry T. Larson of TRW Systems.

The Association for Computational Linguistics will also meet on Thursday, Dec. 12, 9:00-4:00; they will sponsor a panel discussion in Continental Parlor #1, on "Computer Systems for Testing Grammars." Chairman is Donald E. Walker of The MITRE Corp.

Simulation Councils, Inc., will meet in Continental Parlor #4, Hilton Hotel, on Dec. 12, 9:00-1:00, to discuss "Impact of Recent and Possible Future Electronic Circuit Developments in Analog/Hybrid Systems." There will be a $5 registration fee for this session;

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For fast, direct plotting from a small or medium-sized computer, you can't do better than the CØMPLØT$_{tm}$ DP-1 Digital Plotter. It plots up to 300 increments of data per second on 11" x 144' Z-fold chart paper. Used on line, the DP-1 plugs directly into your existing computer interface without modification. Housekeeping software provided and updated for five years free of charge.

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Here is the off-line digital plotting system for fast, accurate plots. Designed to accept 8½" tape reels directly from your computer, the MTR-1 is a "load and go" unit using single capstan drive, that plots quickly on 11" x 144' Z-fold chart paper. You eliminate data interpretation when you plot in easy-to-use graphic form. Housekeeping software is provided for no additional cost. "CØMPLØT$_{tm}$ WITH US."

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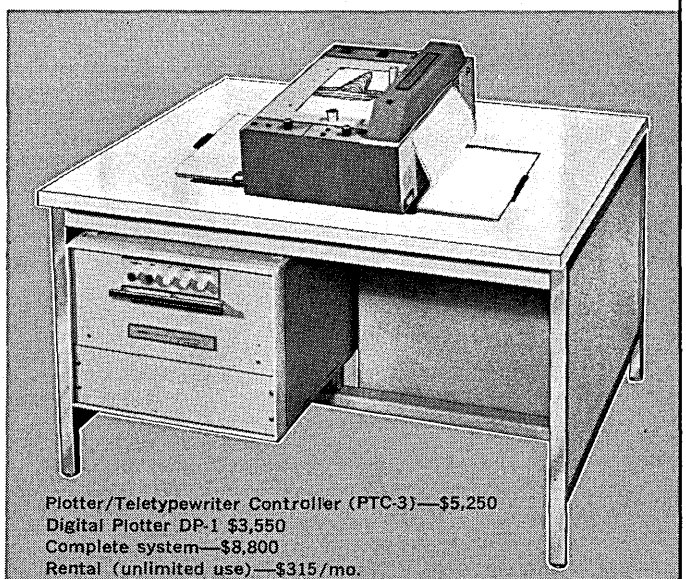
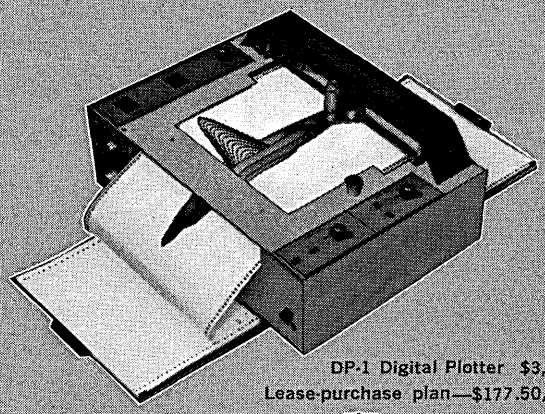
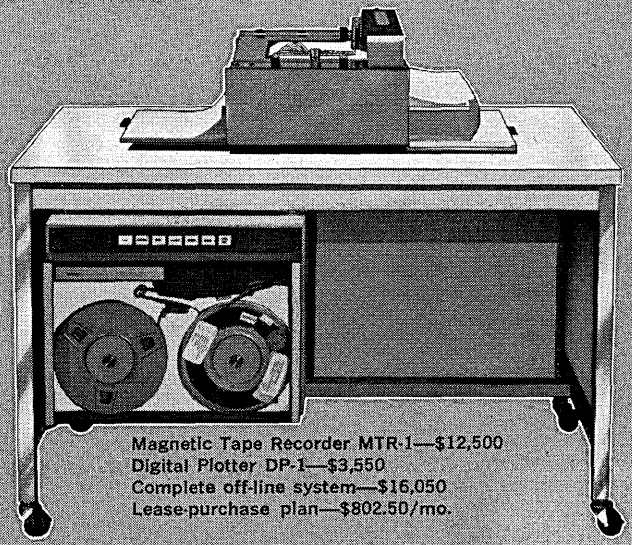


Plotter/Teletypewriter Controller (PTC-3)—$5,250
Digital Plotter DP-1 $3,550
Complete system—$8,800
Rental (unlimited use)—$315/mo.
Full maintenance.



DP-1 Digital Plotter $3,550
Lease-purchase plan—$177.50/mo.



Magnetic Tape Recorder MTR-1—$12,500
Digital Plotter DP-1—$3,550
Complete off-line system—$16,050
Lease-purchase plan—$802.50/mo.

CØMPLØT$_{tm}$
DIGITAL PLOTTING SYSTEMS

CIRCLE 156 ON READER CARD

chairman is A. Rubin, of The Martin Co.

"Large Machine-Readable Bibliographic Data Files" is the subject of the American Society for Information Science's session, scheduled for Thursday, Dec. 12, 2:00-5:00, in the Hilton's Continental Parlor #1. The session, featuring a panel of speakers, is chaired by Gary Gerard of Kaiser Aluminum.

OCR TRADE ASSOC. PREDICTS $400 MILLION MARKET BY '72

The market for optical character recognition equipment, now about $70 million a year, will reach $400 million by 1971 or 1972, according to an "OCR Fact Sheet" issued by International Business Forms Industries, a Washington-based trade association.

IBFI states that users of 15 or more card punch units can generally effect a savings of about $1000 per month by converting to OCR: "The monthly input costs of a 15-unit card punch operation is approximately $10,950," whereas "certain OCR systems . . . would cost $9,700, including manpower, overhead and supplies." (Ed. note: The association would not identify what the "certain OCR systems" were, but the economies stated could only be applicable to single font systems, and not to multiple-font readers, which the report says cost about $750K.)

The "greatest immediate market potential of OCR is among the large banks, insurance companies, large manufacturers, and commercial credit companies" which are still using key punch. In addition, "requirements in medical research, education, government, transportation, law enforcement and other areas suggest extremely broad demand within the next decade."

COMPUTER SIMULATION ANALYZES VIETNAM WAR

"U.S. leaders have not been adept so far as predicting Communist responses to changes in American military and diplomatic actions in the Vietnam war. Neither have the North Vietnamese been able to foresee U.S. response to Communist moves. Both sides seem to lack an adequate understanding of the dynamics of war," says Jeffrey S. Milstein, a Michigan State Univ. political science assistant professor.

Dr. Milstein, while a doctoral candidate at Stanford, worked with computer scientist William C. Mitchell in doing a computer analysis and building a simulation model of the war. The continuing research covers 33 months since January 1965 and uses an extensive collection of publicly available data on the war.

Inconsistencies between policymakers' goals and the results of their policies led to the construction of a model which would better predict behavior and outcomes in the war. The variables used in the project include: troop commitments, bombing and casualties (military); American public opinion support for the war; the number of Vietcong and North Vietnamese defectors; the black market value of South Vietnam's pieastre (public support indicators); and public statements by leaders of the U.S., South Vietnam, North Vietnam and the Vietcong.

About 20 variables for each year are analyzed and their interactions noted. An important characteristic of the war, Milstein says, is that each side responds largely to its perceptions to changes in the war rather than to the whole war. He points out that the most significant data in a quantitative analysis of the war may well be these differences in behavior over periods of time.

Milstein says that policymakers should be operating with computer analysis and simulation to evaluate ongoing policy, since these tools are available to them. "Once you develop a valid model of the conflict, you can

use it to make forecasts as long as relationships among variables remain as they have in the past. Such a model would enable planners to experiment on the computer with alternative strategies without actually implementing them on the battlefield or at the negotiating table."

Conclusions drawn from the study include: the more the U.S. bombs North Vietnam, the less the Communists wish to negotiate (this finding conflicts with the notion that the allies can bomb the Communists to the conference table); bombing escalations by U.S. result in increasing Communist troop commitments in South Vietnam (bombing increases, while inflicting damage and impeding troop movements, psychologically spur the Communists); troop increases by the North Vietnamese and Vietcong lead to further troop buildups by U.S.; the greater the rate of U.S. troop increases, the higher the rate of increase of U.S. casualties. Other findings are: that contrary to North Vietnamese predictions, there is no relationship between changes in U.S. popular support for President Johnson and the administration's publicly expressed wishes to negotiate; changes in popular support for Johnson and his Vietnam policies are also generally unrelated to U.S. bombing in North Vietnam; contrary to Communist expectations, the U.S. bombs the North more when the U.S. is doing better on the battlefield, not out of desperation because it is losing (based on records comparing Communist casualty to allied casualty ratio with U.S. bombing missions over the North).

The research indicates "escalation of the bombing provokes a subsequent counter-escalation of North Vietnamese troop commitments. This buildup leads to increased U.S. troops in South Vietnam, which results in more casualties on both sides. Thus neither side gains an advantage in escalating the war, and both sides have greater costs in lives and resources."

Milstein also says that bombing de-escalation has led to increased North Vietnamese willingness to negotiate (as in the start of Paris discussions) and the decreased rates of Communist troops that have followed America's reduction of bombing of North Vietnam.

Milstein and Mitchell presented a paper on their research last spring at the International Peace Research Society Conference on the Vietnam Conflict and will present further reports on the war at the Nov. 11-12 meeting of the IPRS in Cambridge. Milstein will also give a paper at the April 3-4 meeting of the Western Political Science Assn. in Honolulu.

DOMESTIC COMPUTERS SHOW GAINS IN JAPAN

The Japanese computer industry has taken a big jump in computer sales for home use, both in units installed and dollar volume, according to the Japan Economic Journal.

Ten years ago there was no Japanese computer industry; at the end of March this year its sales volume came to the equivalent of about $241 million. And the graphs show that the value of domestic units is just about to catch up with that of computers made by non-Japanese companies ("foreign-capitalized firms" is their phrase).

As of March, Japanese computer makers had 48% of the domestic market. A total of 3559 computers from all sources were installed, representing a purchase value of about $837 million. Of these, domestic machines accounted for 2484 units, 69.8% of the total number and 48% of the value.

The domestic producers are strongest in the very-small-scale market, where they have 99.3% of the market. Their proportion declines as the machines move up the size range, but even in the big-time area they have captured 30.3%.

Japanese computer companies are also moving aggressively to get sales abroad. Fujitsu, Ltd., for example, has

already racked up sales of 20 systems to Bulgaria and another 30 to the Philippines, France, and the Soviet Union. Their marketing men are active in Southeast Asia and they expect to make sales in Australia, New Zealand, and South America. Nippon Electric Co. has plans for Taiwan and Rumania; Tokyo Shibaura Electric Co. is after sales to the Soviet Union.

Two recent developments in Japan are an optical character reader at Nippon Electric and an optical mark reader at Tokyo Shibaura.

N.C. COLLEGES USE 360/75 IN JOINT EDP PROJECT

The North Carolina Computer Orientation Project (NCCOP) has enabled 35 smaller colleges throughout the state to access an IBM 360/75 via remote job entry and time-sharing. Most of these schools would not otherwise be able to afford or operate third generation equipment, but are now using the machine owned by the Triangle Universities Computation Center.

TUCC was organized in 1966 as a non-profit corporation by the three largest universities in North Carolina—Duke, UNC, and NC State—under a $1.5 million grant from the National Science Foundation. The NCCOP program, sponsored by the State Board of Education, provides schools with Teletype communications, a quota of machine time, faculty instruction, and technical assistance on a one-year free trial basis, using the resources of TUCC. Ten colleges have now completed the first year and are paying their own way; the remaining 25 are expected to follow suit. Altogether, more than 100 institutions—colleges, junior colleges, and technical schools—are eligible to participate and are expected to eventually join the program.

Terminals in use at participating schools include about eighty Model 33 Teletypes and several IBM 1050's. In addition, Duke has its own 360/30, while NC State employs two IBM 1130's and a 360/40; UNC also has its own 360/40. The central TUCC configuration consists of the following IBM equipment: the 360/75, two 2314 direct access storage facilities, one 2361 large core storage, five 2402 magnetic tape units, four 2701 and 2703 transmission control units, one 1403 printer, and one 2540 card read punch.

Prior to the inception of TUCC, only a handful of North Carolina colleges had computers, and only second generation machines. TUCC made computer science departments feasible for the three founding universities, and NCCOP has made it possible for the smaller participating schools to incorporate computer science into their curriculums. UNC now offers MS and PhD degrees in computer science, and NC State has an undergraduate program, while Duke is planning a computer science department. None of the smaller schools has yet established a degree program in computer science, however.

According to TUCC president and director Morris S. Davis, the availability of the 360/75 has particularly benefited the original TUCC universities by attracting several top educators, many outstanding graduate students, and millions of dollars in grants for research which would be impractical or impossible using a smaller computer. TUCC itself has made possible increased inter-university cooperation to the point of establishing a common program library.

PATIENT MONITORING SYSTEM ANNOUNCED

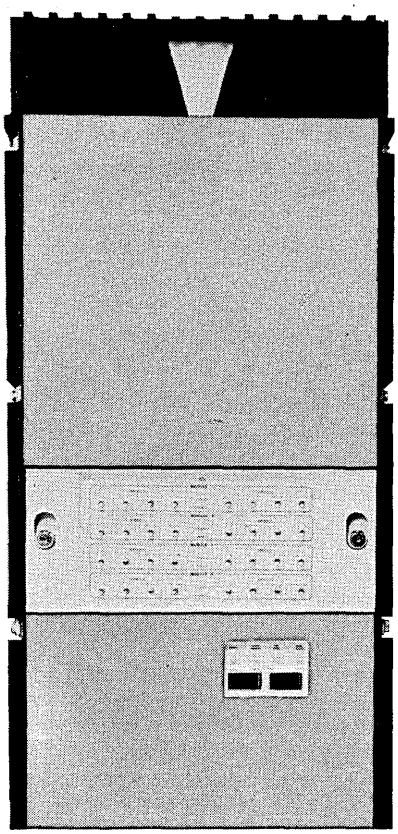
A patient monitoring system designed for continuous watch over heart performance, blood pressure, temperature and respiration has been developed by

(Continued on page 173)

Peripheral quiz for computer manufacturers

How many bits of head-per-track fast access disc memory in this sleek, compact matched companion for your computer?

- ☐ *25 Million*
- ☐ *50 Million*
- ☐ *75 Million*
- ☐ *100 Million*
- ☐ *125 Million*
- ☐ *150 Million*
- ☐ *175 Million*
- ☐ *200 Million*

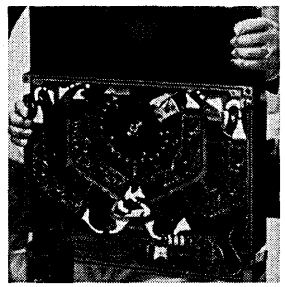


40" high, 24" deep to mount in your 19" rack. Decorator Colors to match your computer.

All 8 answers are correct:

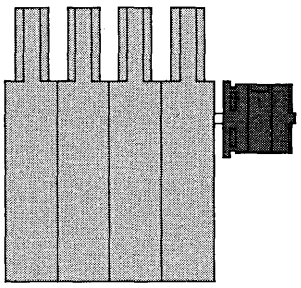
Reason? The new CPC model DSU-8100 is a truly modular fast access disc memory system. It's designed for today's sophisticated computers. Ideal for real time response, program swapping, and message switching.

Four Sealed Disc Modules to Choose From



Fast access modules with individual heads for each track can locate data in 16.7 ms average. Available with 25 million or 50 million bits. In the two economy modules each head services 4 data tracks with positioning time of only 25 ms.

One Drive Serves Up to Four Modules



Because from one to four CPC memory modules are served by the single drive, 25 million to 200 million bits of ultra-reliable disc memory fit comfortably in the compact chassis designed for slide-mounting in your 19-inch console. Field expandable to billions of bits.

Fail Safe Protection

No head avalanche possible here. Modules are ultrasonically cleaned, clean-room inspected, then sealed. The flying heads never touch the recording surface and automatically retract if motor speed, internal voltages, or air pressure vary. Tamper-proof lockouts protect your data too.

Small Size... Low Cost

A unique recording system with higher packing densities plus T^2L integrated circuit logic means small size, light weight, and low power. Standard "off the shelf" modules reduce inventory and make it possible for computer manufacturers to quickly supply the right amount of memory for every job.
A full system with logic level interface sells at less than 1/10th of a penny per bit. Contact Dick Baker, V.P. Marketing, for more information.

computer peripherals corp.
5037 Ruffner St., San Diego, Calif. 92111, (714) 279-7500

See the DSU 8100 at the FJCC, Booth 503, San Francisco

Why are we running an ad about BASIC for people who know all about BASIC?

*Another major step in the continuing development of our Reactive Terminal Service.**

RTS Progress Report #2.*

SURE, you know BASIC inside and out. You know it's easy to learn and just as easy to use. You also know it's a simple 17 statement language, and that it's probably the most widely-used language in time-sharing today.

What you didn't know is that BASIC is now part of the ITT Reactive Terminal Service time-sharing system.

Which means that RTS, which was the most advanced time-sharing service you could buy before, is the even more advanced service you can buy now. Beautiful?

Now the infrequent user with limited EDP knowledge can use BASIC to solve engineering, business, or scientific problems with our System/360 computers from remote terminals. And get the answers to these problems within a few seconds.

And the sophisticated user gets the advantages of BASIC's very powerful command structure for manipulating matrices.

There's a little something for everyone now in RTS, you see.

Like the ability to write OS-compatible programs using FORTRAN-G. Unlimited on and off-line program storage. Line-by-line debugging. 2.4 million bytes of work file capability for every user program. Plus a new update text editor that lets you change single or multiple characters in both data and programs.

What's more, when you check our new prices against those of other services, you'll find that dollar for dollar RTS gives you more capability, flexibility, and computer power than any other time-sharing service in the nation.

And RTS is available in all those places listed at the right. With more than 15 other cities to go. For a demonstration, call or write the ITT Data Services center nearest you. Maybe you'll see BASIC in a completely new light. We're sure you'll see time-sharing as you've never seen it before.

**Service marks of ITT Data Services, a division of International Telephone and Telegraph Corporation.*

ITT
DATA SERVICES

news briefs

Honeywell Test Instruments Division. In this system, monitored information is simultaneously displayed on a bedside unit and at a central station, enabling the medical staff of a hospital to respond quickly to critical changes in a patient's condition. The basic bedside unit includes an electrocardiogram monitoring channel, an oscilloscope for data display, a beat-to-beat cardiotachometer, a meter display with adjustable high and low alarm settings, and a keyboard.

Alarm circuitry in the unit sets off a visual and audible signal when a patient's heart exceeds preset high or low limits. The audible signal can be silenced at the bedside and heard at the central station only. An indicator button flashes with each heartbeat and can be activated to provide an audible beat with each portion of the EKG waveform.

The central station consists of one or two large multitrace oscilloscopes to display data from up to eight bedside units, a direct-write recorder with automatic selection, control and identification features, and a keyboard and meters similar to those in the bedside unit.

A special feature of the system is lead-fail circuitry which prevents faulty lead connections and malfunctioning electrodes from causing unnecessary alarms or false signals as a result of circuit failure. The system can also distinguish between alarms set off by "true" heartbeat activity and those set off by noise interference, electrical or mechanical trouble.

The standard monitoring system with a central station and four bedside units is priced at $3,200; deliveries will begin in first quarter '69. For information:

CIRCLE 235 ON READER CARD

RETAIL SYSTEM OFFERS ON-LINE CREDIT VERIFICATION

A new on-line system which offers credit verification as well as inventory control and sales slips has been developed by Ricca Data Systems, Santa Ana, Calif.

The system connects a RDS-designed terminal to a Raytheon 703 and an IBM 2311-compatible disc unit. The terminal includes a unit which reads merchandise tags as well as credit and sales personnel cards, and includes keyboard, electronic digit and printer.

Sales which exceed credit limits trigger a message to a terminal in the credit manager's office; bad or missing cards do the same, but such cards are locked into the reader. Purchases are logged on the disc against the customer's account, and subsequent purchases at other departments or stores are referred to this file to prevent exceeding of credit limits.

Currently most stores work on a floor or department limit, which permits hop shoppers and bad guys to run up bills above their credit ceiling. Bad debts can run up to 3%, and for chains which log multimegabucks in sales, that's a lot of dollars.

At the end of the day, disc contents are transferred to the store's central edp system, which updates master files and the disc for the next day's activity.

The terminal, which replaces a cash register, costs $4K; the 703 and disc unit are available at regular retail prices. RDS developed the terminal, computer-disc interface and software out of company funds, and is attempting to close its first deal with a large southern California department store chain.

The 12-man company, formed in Feb. by ex-Raytheon Computer general manager Joe Ricca, also has a contract for development of a computerized information retrieval system.

ARTIFICIAL SPEECH WORK REPORTED

A report describing work done on mechanical and electronic speech simulation was given by the Industrial Technical Electric Laboratory at the recent International Acoustic Conference held in Japan.

Mechanical speech synthesis is accomplished by means of an open-ended chamber. At one end, representing the vocal cords, a phrase is introduced; a sound is emitted from the other end, which represents the mouth. To produce the sounds, the shape of the chamber is mechanically altered to the shape of the human vocal track. Nasal sounds—such as "n" —are produced by an auxiliary chamber in the shape of the nasal passage. Differences in child and adult speech patterns can be simulated by shortening the acoustical chamber in about the same ratio as these vocal tracks differ from one another.

The electronic simulator described at the conference uses mag tape input that is produced on a 360/75. The text of the speech to be synthesized is punched on cards, and the cards are read by the /75. The words are looked up in a 1K-word "dictionary" and changed to a phonetic character string. The text is then processed for vocal simulation.

The program, which checks the syn-

tax of the sentence to add intonation, stress and breath control to the simulator, is composed of about 4,000 PL/I statements. The output is a control tape; the tape is fed from a simulator through speakers to produce the sounds.

An English reading of "Sleeping Beauty" was given in a conference demonstration. Stress, breath control and general quality of the speech output was good, but the intonation was reportedly "a little strange." This was attributed to the fact that English is not the native language of the simulator's designers.

NEW FIRM TO PROVIDE MANAGEMENT GUIDANCE

Laird Systems, Inc., has been formed with headquarters in Century City, L.A., and has named Dr. Marvin Stern, former vp with the RAND Corp., as president. An affiliate of Laird, Inc., a N.Y. investment banking firm, the well financed company is interested in investing in technological firms that are not realizing the potential of their system and personnel resources. Laird will also become actively engaged in the management of such firms by placing its own people on the boards of directors. Stern said that Laird Systems is not interested in instant profits, preferring instead to help an ailing company prepare for and achieve long-term growth and then reaping the larger returns. Laird, Inc., the N.Y. parent company, has become noted during the past year for rescuing moribund businesses, and Laird Systems constitutes its move into the computer industry.

UNIVAC JAPAN IN JOINT VENTURE FOR WIRE MEMORIES

Oki Univac Kaisha, Ltd., a combination company of Univac and Oki, has gone in with Toko Inc. to produce woven plated wire memories for the OUK 9200 and 9300 models to be offered for sale this fall. Incorporation of the home-built component would qualify the 9000 series as "domestic machines" for favorable government treatment.

The technology was developed by Toko, which has been working on the production process for five years and holds patents on it covering licensees in other countries. Initial production rates have been set at 20 units per month.

SYSTEMS HOUSE TO MAKE BLOOD INVENTORY STUDY

International Computing Co. (ICC), new Bethesda, Md., systems and software engineering firm, is under subcontract to the Milwaukee Blood Center to develop, install and operate a prototype on-line blood inventory control system, a National Heart Institute-sponsored project. Principal purpose of the project is to determine whether automation in the management of a central blood bank can improve the efficiency of utilization of blood resources in the U.S.

ICC has also developed a medical business data system which is being franchised nationally, and is now developing a computerized inventory management system. ICC is headed by Isaac D. Nehama, former director of the Analysis and Computer Sciences Div. of Bellcomm.

NEW T-S FIRM TO INSTALL 360/50

Princeton Time Sharing Services, Inc., founded in June, plans to offer conversational time-sharing, remote batch processing, and service bureau operations, in the New York, Philadelphia, and Washington areas. An IBM 360/50 will go into temporary quarters in Princeton, N.J., this month. The firm intends to relocate to a new 10,000 square foot building in South Brunswick, N.J., as soon as construction is completed.

PTSS is headed by Dr. Theodore A. Dolotta, formerly associate director of the Princeton Univ. Computer Center. Co-founders and vice presidents include ex-IBM marketing managers John J. Leahy and Carl S. Witonsky,

(Continued on page 177)

and Joel Leichter from F. W. Dodge Construction Information Services.

COMPUTING AND SOFTWARE ENTERS PERIPHERAL MARKET

The acquisition of Troy Computer Products, Santa Ana, Calif., manufacturers of a drum for high-speed impact line printers, is Computing and Software's initial entry into the peripheral equipment market. The drum is all Troy makes right now, but they are designing new products and concepts, predominantly for low-cost printers. "Presently we are in the research and design phase and anticipate introducing several products during 1969," says Paul Hachigian, vp in charge of the new C&S Industries Group formed to direct the company's expansion into computer-related industries.

Troy, a privately held firm founded in 1963, will continue under present management. Acquisition was through an exchange of common stock valued at approximately $4 million. Computing and Software is considering additional acquisitions in the peripheral market but has made no other definitive agreements at this time. However, they feel that it is important that they have the capability to supply specialized data terminals which could be used in their expanding network of computing centers.

INVENTORY CONTROL SOFTWARE DEVELOPED

A software technique to manage inventory for Martin-Brower Corp. has been developed jointly by the firm and Honeywell. Since last January the company has improved customer service by using PROFIT (Programmed Reviewing, Ordering and Forecasting Inventory Technique). PROFIT consists of 13 computer programs used with an H200, 20,480 ch. memory, four mag tape drives, 650 lpm printer, card reader, card punch, paper tape reader and punch.

PROFIT's principal services are in preparing item usage forecasts and stock status reports on a 5,000 item inventory of customized paper products and non-perishable foods which go to 10,000 outlets from 10 warehouses about the country.

PROFIT extrapolates from previous demand on the items and estimates futures by figuring in current market trends and seasonal fluctuations. The forecast is printed once a month and each of the 10 warehouse forecasts are figured individually to factor in variables peculiar to its section of the country.

Two or three times a week PROFIT reports on demand rate for each item in inventory. Demand for some items may vary as much as 100% from one week to another, due to weather changes, school closings or other reasons unforeseen in forecasting. The status report prints asterisks beside items in critical supply and answers questions of whether immediate re-ordering is necessary or can be delayed. If the answer is "order," the computer recommends the amount based upon the forecast for the rest of the month. The program also runs daily status reports on the inventory level in each warehouse.

The operation is controlled from corporate headquarters in Chicago. Data comes in from the warehouses by Teletype.

NEW CHEMICAL INFORMATION SERVICE OFFERED BY CAS

Chemical Abstracts Service (see March, p. 33), whose journal annually covers some 200,000 articles selected from 12,000 publications plus 40,000 chemical patents issued by 25 nations, has announced a new information service that makes it possible to search by computer across the full range of the world's current chemical literature.

CA Condensates consists of machine-searchable tapes containing the title, authors' names, complete bibliographic citation, and key descriptive indexing terms for each article and patent abstracted in current issues of *Chemical Abstracts*.

The system functions by matching terms selected by the inquirer to describe his interests with terms appearing in the data recorded on the tape. These terms may be whole words or fragments of words, author's names, or the coded names of specific journals. Searches can be highly specific or very general at the user's option. The result of a search is a computer-printed listing of citations and CA abstract numbers by which the user can be led either to the source documents or to the corresponding CA abstracts.

Subscription price for CA Condensates is $4,000 per year. The magnetic tapes are the standard ½", either 556 or 800 bpi. Four tape drive units are required. Upon request CAS will supply complete documentation for operating software and search programs compatible with the IBM 1401 or any 360. However, the service does not provide technical support at the installation . . . subscribers with other computers have to do their own programming, using the CAS programs as a guide.

(Continued on page 178)

news briefs

CAS is also producing biweekly machine-language tapes containing the complete CA abstracts for articles appearing in 35 chemical journals. Called *Basic Journal Abstracts*, the service is being offered publicly to allow wider evaluation of the usefulness of whole text searching of abstracts. Printed copies of the abstracts are provided with the tapes. Subscription price is $4,000 per year; in conjunction with a Condensates subscription, the cost is $1,000 per year.

CHICAGO FIRM OFFERS EDUCATIONAL DP SERVICES

A young Chicago company has carved out a new area of the dp field as educational consultant to school system administrators. The Benjamin C. Willis Educational Services, Inc., operating nationwide, was founded in Sept. 1966 by Dr. Willis, former superintendent of schools in the Windy City and who has been in education for over four decades. Company projects include school cooperatives using dp to solve administrative problems in student identification, testing, curriculum, research and development.

The company's services include aid in dp, finance, personnel, and public relations-communications. One client is the Educational Development Cooperative, Homewood, Ill., which serves 65 member school districts of over 300 schools with a combined student population of 150,000 in 500 square miles. The cooperative acts as a joint body to assess, evaluate, share and implement a resource center through data processing on a three-phase, three-year development plan for improvement and applicability of curricula for student needs. The BCWES is building up a student data file for future curricula need decisions.

Another computer use is offered as a service link between college students needing loans and the National Defense Student Loan Program of the American National Bank of Chicago. The Willis company screens applications from over 100 colleges and refers those selected to the bank. The firm hopes to reach every college in the country eventually with this service. NDEA student loans are completely serviced by the bank, relieving colleges of operational details on student loans.

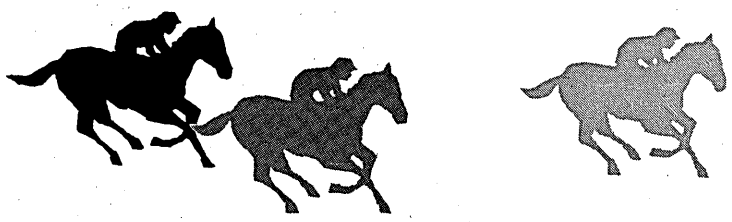
● Mesa Industries in Fairfax, Ala., is another new firm entering the disc pack arena and offers the Mi Disc Pack, which is compatible with the IBM 1316. The company claims its pack meets or exceeds IBM specifications and offers an identical warranty. President is Robert L. Elliott, formerly of Perfection Plastics, and the company expects to make single and 11-disc packs available in three months.

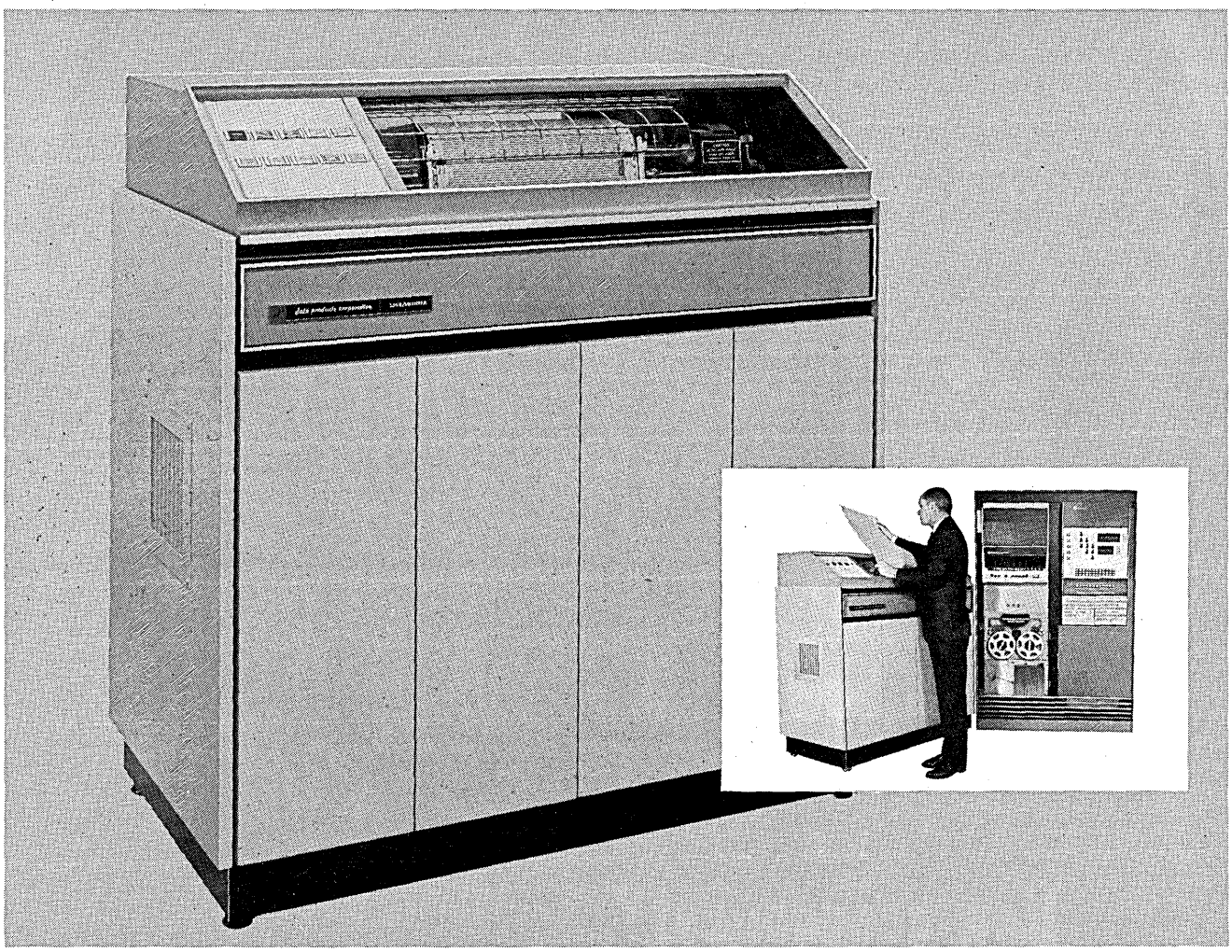
● California Blue Shield's 70 keytape order ($525K value leasing for about $12K a month) is the largest yet received by Honeywell for the input preparation devices. These will be used to transcribe data needed for health insurance claims under Blue Shield, Medicare, Medi-Cal (Medicaid), and CAMPUS, a voluntary medical insurance plan for military dependents. CBS receives 110,000 claims per day and each claim averages two documents. The keytapes will replace punched cards as input media to the $6 million worth of computers: two each of H400's, H200's, and H2200's plus one H1200.

● Hughes Computer Systems, Bethesda, Md., has acquired the data processing assets and practice of Universal Computer Associates, Washington, D.C. Both firms have been active in

(Continued on page 181)

American Totalisator goes to the races ...and the LINE/PRINTER* goes with them!





■ American Totalisator's computerized Multi-Tote System, incorporating the Data Products LINE/PRINTER, was designed expressly for race track use, to provide fast and accurate recording of all ticket sales... with no margin for error. Within seconds after the close of ticket selling, the information is processed and the LINE/PRINTER prints out a complete record of the dollar value and number of tickets sold in each pool, and an audited report on the price calculations. It has to be fast... and it has to be *right*. To make it tougher, Multi-Tote Systems are often transported from one race track to another, and must be operating quickly, without time-consuming set-up and adjustments.

That's why American Totalisator chose the Model 4500 LINE/PRINTER. With a double-numeric drum, it prints at 1200 lines-per-minute with unparalleled reliability. The one-piece hammer, a Data Products exclusive, is virtually friction-free, and requires no periodic adjustments to keep producing sharp, non-smear, multi-copy printout. Maintenance and down-time are minimal.

More and more LINE/PRINTERS are becoming a part of more and more computer systems... and you don't need a racing form to know why. Write Data Products, 8535 Warner Drive, Culver City, Calif. 90230, for our latest LINE/PRINTER literature.

Data Products manufactures LINE/PRINTER™, DISCFILE®, Core Memories, Off-Line Printer Systems, Card Readers & Punches

*LINE/PRINTER is a trademark of Data Products Corporation

data products

"the peripheralists"

the application of computer technology to accounting problems. Plans are to set up branch operations in New York, Boston, and other eastern cities early next year and to focus teleprocessing and time-sharing facilities on accounting data transmission. In addition, Hughes Computer Systems conducts a series of computer-management courses for those interested in computerized accounting applications. The acquisition of Universal Computer Associates will add another half dozen people to Hughes' staff of 35.

● A patent has been issued to Robertshaw Controls Co., Richmond, Va., that covers the use of computers in environmental control. Robertshaw installed what may be the first such system in the International Monetary Fund building in Washington, D.C., last year. That system consists of a Westinghouse Prodac 50 computer which determines air conditioning needs and operates equipment to provide the correct amount of cooling; starts and stops ventilating fans; turns lights on and off; and monitors operation of the heating plant.

● Hybrid Systems, Inc., a new company formed as a result of the acquisition of the Geo Space Computer Div. by Sunasco, Inc., is now operating in Houston and will continue to produce the SS-100 analog/hybrid computer. A wide range of new products and services are planned, including several new computers from desk-top size to a full medium-scale hybrid system. One new service is the lease of equipment manufactured by the company, which employs about 60 people and projects first-year sales of $1.3 million.

● Scientists at the Univ. of Rhode Island are studying the effects on marine life of waste disposal at sea with the use of a simulation program on a 360/50. This study is preliminary research for a proposed project that calls for loading garbage on ships equipped with incinerators and hauling the refuse to sea where, after being burnt, it is dumped. The scientists, under the direction of Saul B. Saila, are attempting to determine if the ocean would become polluted by such activities, and where possible dumping grounds might be. Dr. Candace Oviatt, a marine biologist and Harvard research associate, is acquiring data for the simulation program from a floating research station with meters, gauges, dredges and deepsea divers. This equipment obtains such data as: velocity and direction of ocean water at the test site (18 miles off Point Judith, R.I.); average direction and velocity components for ocean currents; wind speed, ocean temperature and height of waves; and water and bottom sediment samples. Dr. Oviatt has so far discovered that incinerated waste produces only a low-grade toxicity on marine life in the dump area, and that hardshell clams and lobsters are particularly resistant to such waste. The study has been funded by a grant from the National Center for Urban and Industrial Affairs.

● The largest common carrier petroleum products pipelines in the nation, Williams Brother Pipe Line Co., Tulsa, will use 14 Westinghouse Prodac computers and associated equipment along the 6,788-mile pipeline going through 10 states. The equipment will be at terminals along the pipeline and will allow a customer's truckdriver to load his own truck. When the truckdriver inserts a wallet sized card into the reader the computer verifies his and his company's eligibility, credit limits, and products which may be drawn. The computer notes which product and how much he withdraws (to cred-

it limits), plus logging any additives—type and amount—date, time and related information. The control equipment will not allow truck loading until certain safety conditions are met (such as grounding the truck).

● Programming Sciences Corp., New York, is now offering a special "System-360 Compatibility Survey Service" at a fixed fee of $500 plus travel expenses for a PSC consultant. Aimed at manufacturers of peripherals who desire to enter the System/360 market, the individual surveys cover such topics as interface requirements, OS and DOS modifications, remote and local connection and systems support. The survey requires about a week-and-a-half to complete. For information:

CIRCLE 236 ON READER CARD

● The Data Systems Div. of Litton Industries has awarded Planning Research Corp. a sub-contract of more than $900K to assist in the design and development of computer programs for the Army's Tacfire (Tactical Fire Direction) system, which will automate selected field artillery operations through a completely integrated network of computer centers at Army fire direction centers located in various military levels of command within the field army. Purpose of the system is to increase fire support effectiveness through increased first-round accuracy, better and more rapid use of target information, and greater efficiency in determination of fire capabilities.

● NN Corp., Milwaukee-based financial services complex formed by Northwestern National Insurance Co., has acquired controlling interest in Executive Computer Leasing, Inc., Oakbrook, Ill. This is the second step in NN's planned development of a national computer organization; the first was the acquisition of Agency Service Bureau Corp., Los Angeles.

● ITT Data Services, pursuing its plan to offer the Reactive Terminal Service (RTS) time-sharing system to 20 major metropolitan areas by the end of next year (see May, p. 101), has begun operations in San Francisco. The system was introduced in the New York City area in April and has since been expanded to New England, Washington, D.C., and Southern California.

● California Computer Products, Anaheim, has reached tentative agreement to acquire Airform, Inc., Venice, Calif., precision sheet metal manufacturing operation, for an undisclosed stock consideration. Airform sales for the 1967 calendar year were approximately $800K. It will operate as a subsidiary of CalComp, with no changes in management, personnel, or business objectives.

● Table Lookup, the first of several optional special features of Informatics' MARK IV file management system, is now available to users of the package for $2,500 ($500 for each additional user installation). It allows a reduction in file size through the use of codes which are automatically translated by MARK IV to produce reports.

● Computer Sciences Corp. has acquired City Planning Associates, Inc., an urban development planning organization employing some 100 civil engineers, architects, economists, and political and social scientists at its Mishawaka (Ind.), Youngstown (Ohio) and Falls Church (Va.) facilities, in a transaction involving an undisclosed amount of CSC common stock.

● Computer Learning Corp., in its drive to make the company the "lead-

ing computer education firm from coast-to-coast," has acquired Universal Computer Institute, Los Angeles (more commonly known as ITI). ITI is the fifth education center to be acquired or opened by Computer Learning since its formation less than a year ago. The firm now operates three centers in the Washington metropolitan area, one in Norfolk, ITI in L.A., and two more are scheduled to open before year's end.

● A new data communications peripheral equipment manufacturer, Tel-Tech Corp., Silver Springs, Md., has announced its first product—a general purpose multiplexer—and has received a contract to build multiplexing equipment for TIM, Inc., Chicago, which provides time-sharing service to motor carrier utilities.

● Calculation time per patient for radiation therapy analysis has been reduced from a month to 10 to 15 seconds through the use of an IBM 360/30 at St. Francis Hospital, Wichita, Kansas. The computer is fed data on the location of the tumor, along with information on each possible technique of treatment. It then determines how much radiation will be delivered by each technique, in terms both of exposure of the tumor and other tissues in the body. The technique minimizes exposure of the patient and allows selection of the desired radiation to the tumor.

● A LINC-8 computer is being used at the Lying-In Hospital (of The Univ. of Chicago Hospitals and Clinics) in a preliminary study to monitor the condition of expectant mothers where probable complications are indicated. The computer samples incoming signals from electrodes attached to the patient, producing a visual screen display which is sent via closed circuit television to the patient's room for the obstetrician to study.

● The Medical College of Georgia and NCR have developed a computerized system which can be used in the control program for communicable diseases. The programs, which required two-man-years of effort to complete, are available to any public health agency having access to a 10K NCR 315 computer with four tape handlers. The system has been tested in tuberculosis control and is now in operation in two counties. Other computer projects of the college's R&D Div. include a medical audit system for hospitals, a medical record system for out-patients, and a complete hospital patient information system.

● The Univ. of Denver Research Institute has received a $121K grant from the U.S. Office of Education to support a one-year study of the "Characteristics of Ultramicrofiche Systems and Their Application to Colleges and Universities." Ultramicrofiche is an extension of existing microfilm technology which permits the reproduction of more than 3,000 pages of printed matter on a single 4″ x 6″ reproducible film card. DRI has formed a team of engineers, psychologists, economists and librarians from the university to evaluate the components of the system, test the response of users and determine the optional criteria for the establishment of standards.

● Six /44's are being used by Western Geophysical (division of Litton Industries) for producing detailed cross sections of the earth's crust as an oil exploring service to the international petroleum industry. The computers are used at WG's offices in Shreveport, Los Angeles, Houston, London, England, and Milan, Italy. The seismic sections show the most likely places for underwater oil exploration. Input to produce these sections are mag tape recorded reflections of underwater sounds picked up by cable sensors as

(Data) Central!

a proven direct access information retrieval system ready now to store your type of information on your computers or in our information centers

(Data) Central is an information storage and retrieval system that's amazingly fast and easy to use. It's designed for direct access dialogue *in plain English* with any 64K or larger IBM 360 system, but can be adapted to other similar size equipment.

(Data) Central is easy to use. It develops its own keyword dictionary from information used to build files. All words are filed for instant retrieval except articles, conjunctions and similar terms. You can use any word in a unit of information as a "handle" when you're searching for information.

The program has been in actual use for over two years ... retrieving information ranging from chemical abstracts to legal cases. *It's available to you right now.*

Complete browsing capability gives you the information you want in seconds. You learn how many different units of information match your request before you order printout. This tells you if you haven't been specific enough in your request, and lets you modify and narrow instructions without starting over.

And all answers appear immediately.

The program is ready now to install ... in your own hardware or through remote console units at *(Data) Central Information Centers* in Dayton, Ohio and Washington, D.C.

To learn more, send for our new booklet, "*(Data) Central* —A Proven Direct Access Information Retrieval System", and reports on how the program is working today with numerous information banks.

Information Systems Division (Data corporation)

7500 Old Xenia Pike, Dayton, Ohio 45432

A SUBSIDIARY OF THE MEAD CORPORATION

CIRCLE 91 ON READER CARD

news briefs

sounds bounce from the ocean floor. These are then computer analyzed to determine the type of earth layers. Land probes are similarly made and mag tape recorded. Later this year the company will use an IBM 2938 array processor to speed up the whole electronic process and tell more details of rock layers under the earth.

● California Peripherals, in business just over two months, announced that it intends to aim its auxiliary memory product line at the low end of the market: the small computer or control systems manufacturer who is attempting to build his system for less than $10K. CP has already announced an $800 mini-drum memory, and is preparing to produce discs, drums, and an incremental tape recorder. In addition, the firm will be looking at the paper tape device market. CP is located in Northridge, Calif.

● System Interaction Corp. claims to be the first independent consulting service specializing in the analysis and recommendation of applications packages, systems packages, and time-sharing packages. The New York-based firm, which began operation in September, is composed of Richard Hess, president, a former marketing manager for Computer Sciences Corp., and Michael Neuman, vp, formerly a national account marketing representative with IBM. Additional personnel will be employed on a part-time basis as needed.

● Australian banks and finance companies have spent more than two years in studying the feasibility of installing credit card facilities. Unwilling to copy U.K. counterparts, representatives have examined U.S. and Canadian methods. The bankers recognize the need for sophisticated computer installations to make their credit systems operate. However, stepped-up computer spending and staff training problems will hit them at a time when they are having difficulties accommodating to recent automation moves.

● ITT Corp. and Associated Credit Bureaus, Inc., have signed an agreement that will provide ACB member bureaus with computerized credit reporting services. ITT, in cooperation with Credit Bureau Automation (a computer service subsidiary of ACB) will complete development of the system, which will offer credit bureaus a choice between using time-shared computer services at ITT Data Services' computer centers, or using individually owned computers operated by ITT or the credit bureaus. ACB has been working on a computer package since August 1965, and has operated pilot projects at member firms in Houston, Dallas and Chicago.

● Bryn Mawr, Haverford, and Swathmore Colleges, all in the Philadelphia area, have pooled their resources to acquire an $800,000 computer center. (A NSF grant of $500,000 didn't hurt a bit either, but some of the federal funds must go to cover operating costs over the first three years.) The main computer, located at Haverford, is a 32K 360/44. Satellite computers, also to be used as remote terminals, will be located in the other schools; two PDP-8/I's, an IBM 1620, and an IBM 1130 round out the hardware system. George A. Michael, formerly associated with the Lawrence Radiation Lab of the Univ. of California at Livermore, will be the director of the new facility. Other local schools, colleges and secondary schools will be invited to share the facilities.

(Continued on page 186)

news briefs

● The Computer Response Corp., a recently formed time-sharing and remote batch computer utility, has announced the appointment of Robt. S. Wiggins to the position of president and chairman of the board. Wiggins, who spent 13 years with IBM, had held positions with them ranging from applied science representative to systems manager in the Systems Development Div., was the Cleveland branch manager for IBM t-s computing office prior to joining CRC. The new company sells time on its 1108.

● A computerized truck routing system, applicable to most local delivery operations where routes are fixed and customer delivery frequency can be predetermined, was announced by A. T. Kearney & Co., Chicago. The Computer Assisted Route Development System (CARD) was originally developed for use by the linen industry, but is generally applicable since it takes into account such items as truck size, number of bundles which can be delivered by one truck, and lunch periods of customers serviced. "What the computer does," explained Don L. Weston, vp in charge of Kearney's Transportation and Physical Distribution Group, "is catalog a map of the city or delivery area, including detailed information about street intersections and point-to-point driving times. Delivery requirements and restrictions for each customer are then fed in and the computer produces a highly efficient routing for each truck and driver for each day of a one-month cycle." The system can handle up to 16,000 customers, its writers claim, ordering food, dairy products, beer, publications, or other goods. For information:

CIRCLE 237 ON READER CARD

● The U.S. Dept. of Transportation's Federal Highway Administration has awarded grants totalling over $500K to Cornell Univ., Sperry-Rand, and TRW for the development of a computerized traffic control system for use in urban areas. The objective is to create a unified hardware/software package which could be applied to any urban traffic network with a minimum of modifications necessary for individual applications.

● Comprehensive Designers, Inc., a Philadelphia engineering service company, and Digital Industries, Inc. an Encino, Calif., lessor of computer hardware and software, have formed a new company, Compdata Services Corp. The location of the company had not been decided at time of writing. Compdata Services will be an "edp contract service" company: it will provide personnel and technical assistance in programming, machine operations, maintenance, etc. Ownership of the new company will be equally divided between the two parent organizations.

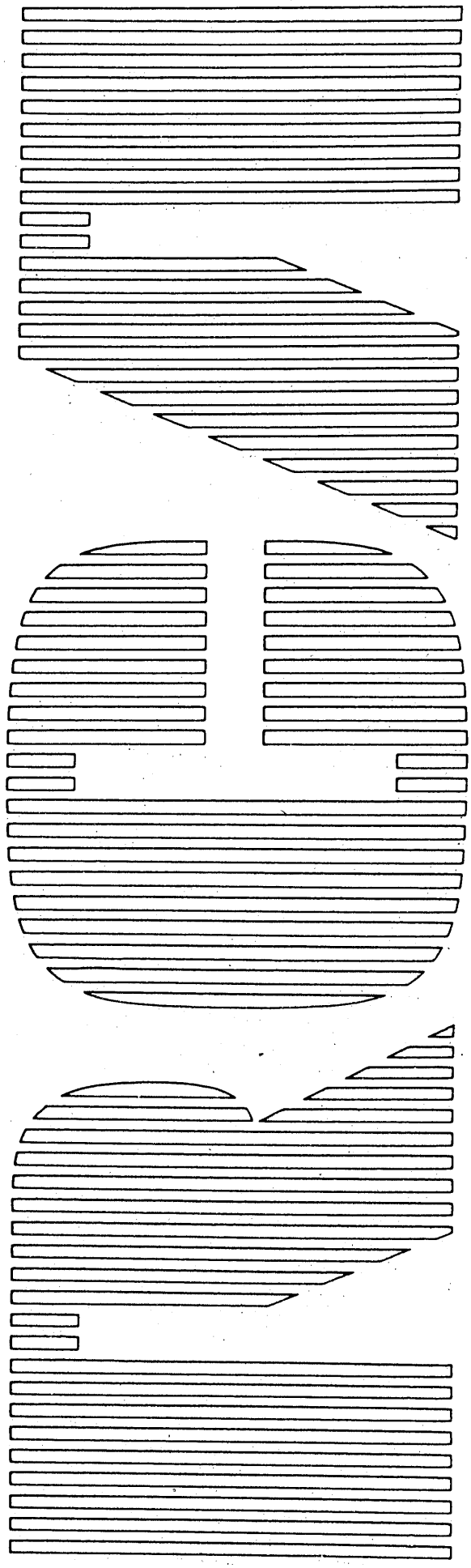
● IBM has developed a graphic communications technique which makes computer-assisted map-making "technically feasible." An IBM 2250 crt is used to display map data and to permit changes, redesign, and updating through use of a light pen. Although the new technique has only been applied to modifying existing maps, IBM believes it portends the development of a computer-based method for producing entire maps from start to finish.

● Management Assistance Inc., which now markets Memorex disc drives and Potter tape drives, will enter the battle for a share of the data

(Continued on page 190)

Computer Money Stretcher

RCA Spectra 70/35 gives you twice the processor power of a 360/25... for the same price.



This point-by-point comparison tells you how and why.

	SPECTRA 70/35	360/25
Monthly rental		
Memory size		
32,768 bytes	**$2560**	$2560
49,152 bytes	**$3410**	$3410
65,536 bytes	**$3990**	*
1401 Emulator	**$ 100**	$ 100
Operations per second		
Add full word	**52,631**	20,202
Add two fields (10-digit)	**17,883**	8,230
Memory move 6 bytes	**39,308**	15,873
Branch	**94,697**	35,842
Compare two 10-byte fields	**21,478**	8,888
Also . . .		
Registers	**43**	16
Multiplexor rate (KB)	**61.5**	30
I/O channels	**3**	1
Selector channel data rate (KB)	**694**	30

*Model not offered

Here's what twice the power means to you.

You save money.
You get more work done during an average day because the 70/35 puts a lot more speed at your disposal. As a result, operating costs drop. And when you rent a computer from RCA, it's yours to use 24 hours a day. *There's no extra charge for extra shifts.*

You get broader system capability.
It all adds up to greater efficiency. Increased input/output efficiency comes from the 70/35's superior data rate. You can have two high-speed selector channels handling as many as 256 peripherals apiece and a multiplexor channel with up to 192 peripherals. All three operate concurrently. And computing overlaps with I/O, of course.

For more efficient task handling, you can have 6-level multiprogramming. It gives you multi-job streaming with monitor control, an advanced feature that reduces software overhead.

You get add-on advantages.
Memory expands to 65K. And you can add a lot more peripherals—tapes, mass random access memories, up to 16 disc drives.

Already using 360? We're compatible.
It's part of the plan. Spectra 70/35's compatibility with 360 makes for fast, easy installation. No retraining of personnel. No extensive reprogramming. No disruption of your work flow. You have nothing to lose, everything to gain.

What do you need?
Batch processing? Scientific computing? A communications-oriented system? Spectra 70/35 does it all. Language is no problem, either. You have a choice of COBOL, FORTRAN, Assembler, RPG with a Disc Operating System.

And that's not all.
The 70/35 also gives you simple operation based on a typewriter keyboard. Sophisticated error recovery. More efficient use of computer resources. And you get the total support you'd expect from RCA. Our systems specialists help design your system, train your personnel and bring your system into full operation.

It's a great buy.
Spectra 70/35 is a lot of computer for the money. All things considered, it's the best value on the market today. You can power up with a 70/35 now. Just call or write your nearby RCA sales office. We'll fill you in on the details.

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John J. Murphy 634-6131
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Paul H. McNamara 536-0880
CHARLOTTE
Haines A. Maxwell 377-5971
CHICAGO—NORTH
Gordon W. Moore 782-0700
CHICAGO—SOUTH
Joseph P. Ganley 782-0700
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C. M. Young 579-0880
DALLAS
William T. C. Gaskill 351-5361
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RCA
Information Systems

CIRCLE 95 ON READER CARD

recorder market. The firm has given a "multimillion dollar contract" for the design and manufacture of a data transcriber to Digital Information Devices, Inc., Norristown, Pa. MAI has provided specifications (not publicly available) to DID which call for a source data-to-magnetic tape conversion unit. When asked why MAI is entering what appears to be a crowded field, an MAI spokesman noted that many of the small new firms do not have the already established marketing and service organization that MAI has. The firm intends to add more peripheral products to the line of its wholly owned subsidiary, MAI Equipment Corp.

● Information Network Corp., a subsidiary of Wabash Magnetics, Inc., is going into operation with a commercially oriented t-s service. They say that their system, based on the 360/44, can handle up to 100 terminals, and as many as 50 at one time. The installation is located in Phoenix and offers services to customers in the Southwest and far West, but a nationwide network of 20 installations is already planned. Basically, Information Network is offering its users access to large-scale data bases through a typewriter-like terminal addressed in individually-tailored languages. Each customer can expect the computer to converse with his office personnel in a jargon that the staff understands. This latter feature is implemented through a specially written command language which interfaces with SHARP (IN's lower-level applications language). In addition, office personnel can trigger messages on what to do next by typing a question mark.

● If the IRS approves, the transfer of shares of common stock to shareholders in Tracor, Inc. will give birth to Tracor Computing Corp. The new firm, which will take over the computer activity now conducted by Tracor and its affiliate, will begin operation with 11 existing computer installations. Building around a Univac 1108 in Austin, TCC will also have 360 mod 30's and 40's in cities across the country, including Los Angeles, Chicago, and Washington, D.C. The smaller installations transmit work that they cannot handle to Austin at present, but another 1108 will be installed in D.C. shortly, and others will be added as required. Dr. A. F. Wittenborn, group vp of Tracor's Sciences and Systems Div., will be president of the new organization. Dr. Wittenborn has stated that TCC will sell computer services—programming and operating time—and also market small computers and peripheral equipment. One of the parent company's subsidiaries, Berkeley Scientific Labs, is already producing a small computer called Clindata which is mostly used in pathology labs. The plan seems to be to buy software for this machine and generalize its applications; however, the company will be selling services based on whichever computer seems best suited for a particular customer's needs.

● Computer Applications Inc., main offices New York City, has named presidents for two newly formed divisions (see Oct., p. 77). Howard I. Morrison, vp and director of the company, was named president of the Information Sciences Div., which includes CA's traditional businesses of consulting, analysis, and programming, as well as two subsidiaries, Policy Management Systems and Management Software Development Corp. President of the Computer Services Div., which includes Electronic Business Services Corp., Suburban Data Processing Center, Inc., and Peninsula Tabulating Services, Inc., will be Joseph A. Dela-

You don't have to wrap a thing. That's the point. This case doesn't fly into uncontrolled writhing when you flip back the latch, so naturally you won't have to tame it to get it back around the reel.

Ours opens benignly — just enough so you can lift out the tape. The case stays connected at the latch, ready to welcome back the reel. Drop it in. It rests on a patented shelf, aligned with the dust seal as you click it closed.

And ours is just as thin as the others, has an optional hook for suspension storage systems, a finger hold for roll-in storage, and the toughness to survive people who are always dropping things.

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CIRCLE 40 ON READER CARD

news briefs

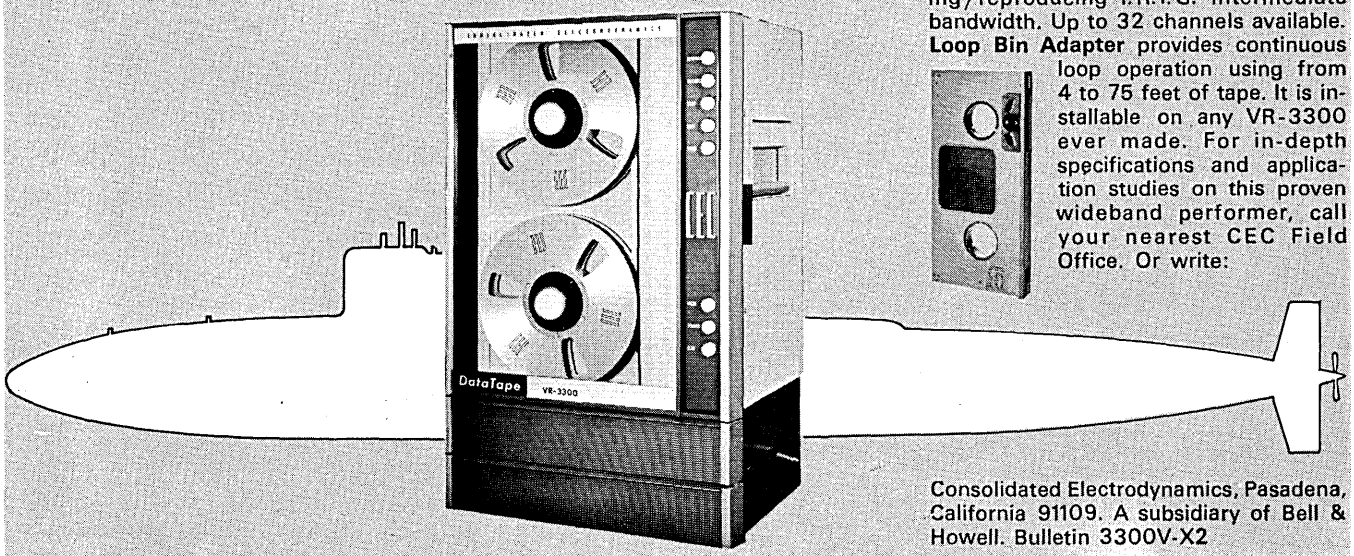
rio, also a corporate vp and director. The appointments of presidents for the remaining CAI divisions, the Direct Mail-Graphic Arts-Publishing Div. and the Market Research Div., will be announced later.

● Informatics, Inc., Sherman Oaks, Calif., will acquire Computing Technology, Inc., Paramus, N.J., for 3,000 shares of Informatics common. The decision is still subject to the approval of the boards of both firms, CTI stockholders, and regulatory agencies. CTI is primarily engaged in non-governmental software work, and is desired as a supplement to Informatics northeast and Washington, D.C., operations.

shortlines . . .

ADAPSO's new by-laws now enable software firms to become full members of the association. Committees are at work developing approaches to patents and copyrights, contractual analysis, and legal protection of computer programs. . . . Programming Sciences Corp., Sherman Oaks, Calif., has changed its name to International Analytics, Inc., to avoid confusion with New York PSC. . . . Univ. of Southern California is now offering MS and PhD degrees in computer science. . . . And Weber State College, Utah, will give a BS in data processing—they've offered a two-year technical program for the last five years. . . . Around the first of the year, Univac will open a new DP Div. assembly plant in Jackson, Minn., to produce electronic sub-assemblies for its computer systems. . . . Merrill, Lynch, Pierce, Fenner and Smith's corporate research files covering approximately 15,000 companies will be available in about a year for general distribution on microfiche copies to be marketed by NCR. . . . The Univ. of Michigan's Administrative DP Center had to rerun all jobs in process from the beginning when lightning struck near the installation this summer. Because of computer speeds, a lightning strike of only ¼ of a second could interfere with more than 80K calculations. . . . Another identity crisis overcome: Cybetronics, Inc., of Waltham, Mass., has changed its name to KYBE Corp. CyberTronics, Inc., of New York, keeps its sound-alike name. . . . TELEMAX, Inc., Fairfield, N.J., is offering Sanders 720 crt terminals to subscribers to its international travel reservations service. . . . Information Development Co. has been selected by Digital Equipment Corp. to produce the first BASIC interpretive programming language for the PDP-8 series. . . . Leasco Data Processing Equipment Corp. had apparently acquired more than 90% of the outstanding common stock of Reliance Insurance Co. at the close of its tender offer for Reliance shares early last month. . . . The Univ. of Florida's dept. of electrical engineering wi hold the first Winter Institute late ne month. Prime objective of the insti is to provide a tutorial account, in form of a short lecture course, on a t ic of current interest in computer a information sciences. This wint course will be on the interaction software and hardware in moder computer systems. . . . RCA Magnetic Products Ltd. has been formed as a jointly owned company of RCA (75%) and Britain's ICL (25%) to manufacture and market magnetic tapes and other magnetic products, including discs and disc packs. A plant is scheduled to open in South Wales in 1970. Joseph Stefan, RCA Consumer Products and Components Div. vp and gm, will also serve as chairman of the board and managing director of the new company. ■

Reliability in depth:



It's a matter of record through all 32 channels of command.

True laboratory-calibre reliability is not a shallow generality when applied to the VR-3300. Off its eight-year service record aboard subs, surface ships, aircraft and mobile vans, these vital specifics of no-compromise, long-life, easy-maintenance construction and versatile operation come through loud and clear: all-metal surface magnetic heads, voice track standard. Straight line threading path. Front accessible amplifier mounting assemblies for adjustment and test. Torque motor drive for uniform tape tension. Proven high reliability with synchronous motor drive and dual differential capstans. Six speeds (60, 30, 15, 7½, 3¾, 1⅞ ips) with peak-to-peak flutter as low as .3%. Tape speed accuracy within ±0.25%. And a recording/reproducing I.R.I.G. Intermediate bandwidth. Up to 32 channels available. **Loop Bin Adapter** provides continuous loop operation using from 4 to 75 feet of tape. It is installable on any VR-3300 ever made. For in-depth specifications and application studies on this proven wideband performer, call your nearest CEC Field Office. Or write:

Consolidated Electrodynamics, Pasadena, California 91109. A subsidiary of Bell & Howell. Bulletin 3300V-X2

CEC/DATA INSTRUMENTS

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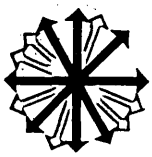


system spotlight

This is one of a series of descriptions of new computer-based systems of general interest. The equipment discussed is already installed and operational.

Information for the series is compiled by Compata, Inc., consultants in digital systems, logic design, and applications programming.

fault

isolation

automatic production test system

Litton Guidance and Control Systems Division
Woodland Hills, California

computer and peripherals

Control Data Corporation CDC 1700 computer with:
- 32,768 16-bit words of memory (1.1 usec cycle time)
- CDC 853 disc storage unit (1.5 million words)
- CDC 1742 line printer (300 lpm)
- CDC 1729 card reader (100 cpm)
- CDC 1722/1724 paper tape reader/punch (300/120 cps)

Litton Digital Tray Test Station:
- Programmable power supplies
- Digital and analog stimuli
- Digital and analog measuring devices
- CDC 1582 keyboard printer
- Module adapters

application

Manufacturers of complex electronic equipment are faced with a need to perform tests on in-process products from the point of incoming inspection of components through final system test and at intermediate levels of assembly. The nature of the test performed ranges from a detailed multiparameter analysis of an integrated circuit to the substitution of an unverified major assembly in a known good system. In general, the difficulty of isolating faults to a replaceable part increases at successive levels of assembly.

The Factory Test Department at Litton's Guidance and Control Systems Div. has developed the computer

Litton Guidance and Control Systems Div. automatic production test system.

controlled system of automatic checkout equipment shown in the accompanying diagram and photographs. The system provides an improved test and fault isolation capability for the analog and digital assemblies which comprise the avionics systems manufactured at their Woodland Hills, Calif., plant.

test stations

The system makes use of individual test stations, which have been custom-designed for a given product family, to test units presently in production and is capable of being expanded to as many as 20 stations. Each test station contains stimulus generators and response measurement equipment appropriate to the product and is controlled by the central computer, which is time-shared in its execution of test programs from the system file. Two or more test stations of the same type may be added to the system to accommodate an increased volume of testing for a given product. In addition to the several test stations, which are connected through digital I/O adapters, the computer is equipped with a full complement of standard peripherals to support the continuing preparation of test programs during millisecond "lulls" in test activity (i.e., foreground/background operation).

testing process

Testing is initiated by a station interrupt to the executive program following the selection of an adapter assembly, connection of the unit under test (UUT), and attachment of a test probe fixture. The executive schedules the test in accordance with system priorities, allocates available memory, and locates and loads test program pages from the disc file. The test program defines, by means of 16-bit data and control words transmitted to the test station, the stimulus patterns, instrument modes, and other test parameters. Responses from the UUT are sampled by the test program, compared with stored ideal response patterns, used as a basis for selecting among following test sequence alternatives, and for printing instructions and fault isolation information to inform the operator. The system executive makes use of UUT connect/disconnect times, settling delays, and periodic file access requirements to execute program pages currently in core memory for other test stations.

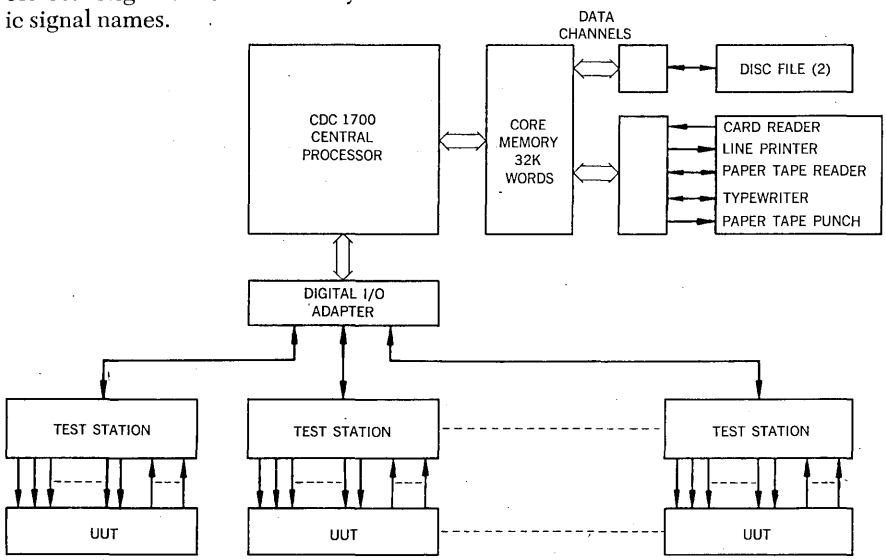
software

Test programs are written in FORTRAN, making extensive use of several test-oriented subroutines which permanently reside in a protected region of memory along with the executive and current foreground programs. These test-oriented subroutines include such functions as SET TRUE, COMPARE, OPEN, CLEAR, SENSE, DELAY, STEP, etc., and permit the test designer to specify signal parameters symbolically, using names read directly from the logic equation, logic diagram, or schematic diagram description of the UUT.

Considerable use is made of an interpretive debug feature for executing test programs in the background without interfering with on-going foreground use of the test stations. This method of checking programs involves reading UUT responses from the card reader unit (instead of the test station) and printing stimulus and control information, normally sent to the test station, on the line printer. Interpretive execution thus permits the checking of program decision paths, possible memory protect violation, and correct assignment of values to symbolic signal names.

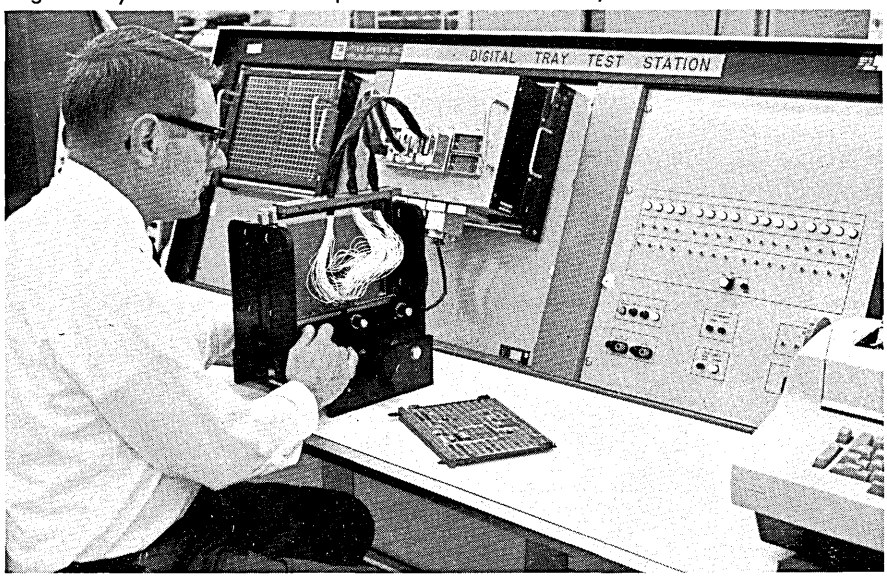
hardware

The Digital Tray Test Station is a typical test station containing interface unit electronics, adapter assemblies, four programmable power supplies (2.5 volts to 15 volts), a 10-bit-plus-sign analog-to-digital converter with a 16-channel multiplexer, a typewriter keyboard and printer, and a control and display panel. Display indicators show power status, call for operator action, and include four program controlled lights. Interface unit electronics provide 10 one-shot outputs to the UUT and 272 two-way lines, which may be connected either to a digital stimuli holding register or to level discriminators and a response holding register under program control. The Digital Tray Test Station also contains provisions for making internal measurements and may be completely self-tested by a diagnostic program prior to each use. ■

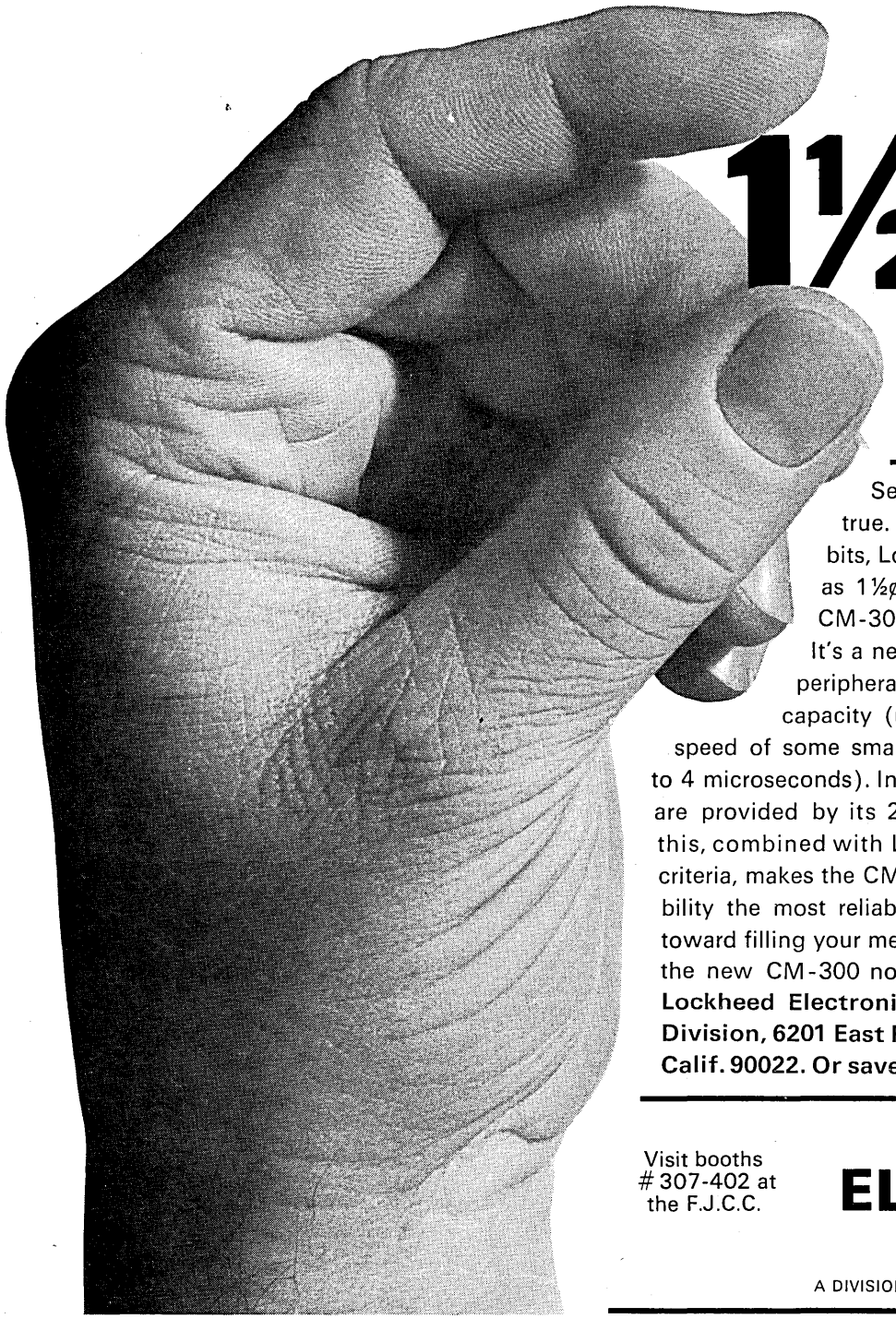


Production test system block diagram (above).

Digital tray test station with operator console and tray test fixture (below).



Lockheed's new bulk-capacity memory system costs just a little bit a bit.



Seems a bit hard to believe, but it's true. Based on 1 million words at 32 bits, Lockheed's CM-300 costs as little as 1½¢ per bit. □ Lockheed built the CM-300 to fill the memory system gap. It's a new class of random access, EDP peripheral storage system. It couples bulk capacity (up to 32 million bits) with the speed of some smaller systems (full cycle time—2 to 4 microseconds). Inherently high operating margins are provided by its 2½D, 2 wire organization. And this, combined with Lockheed's worst-case design criteria, makes the CM-300's peripheral storage capability the most reliable today. □ Take the first step toward filling your memory system gap. Inquire about the new CM-300 now. **Write: Memory Products, Lockheed Electronics Company, Data Products Division, 6201 East Randolph Street, Los Angeles, Calif. 90022. Or save time and call (213) 722-6810.**

Visit booths # 307-402 at the F.J.C.C.

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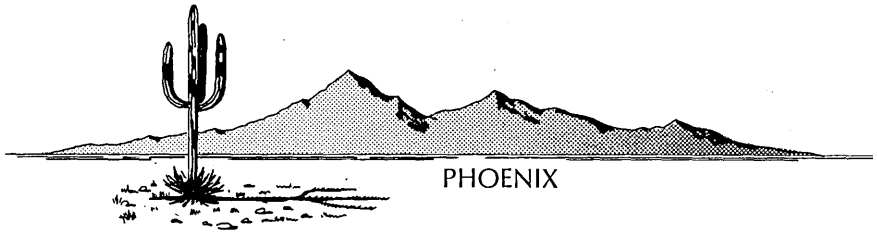
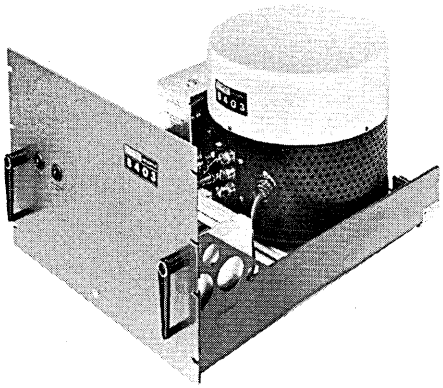


8401 **MARCH 1968**

First in a series of head-per-track DRUM memory systems. Priced under $1000.00 for low quantity and minimum capacity requirements. Data Storage capabilities expandable from 5,000 to 500,000 bits.



JULY 1968 **8403**

The second member of the 8400 head-per-track DRUM family. A 1.4 million bit data base with 64 tracks. Available with or without a modular set of completely self-clocked, peak detected device oriented electronics, utilizing medium scale integrated circuit logic.

8502 **NOVEMBER 1968**

NEW head-per-track DISC memory! Available from 32 to 128 data tracks, giving a storage capacity from 1.2 to 4.7 million bits depending on file organization. The Model 8502 features an average access time of 8.5 or 17 milliseconds.

EARLY 1969

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Large mass storage at .00003¢/bit?
Very low cost terminal memory?
Parallel read/write capability?
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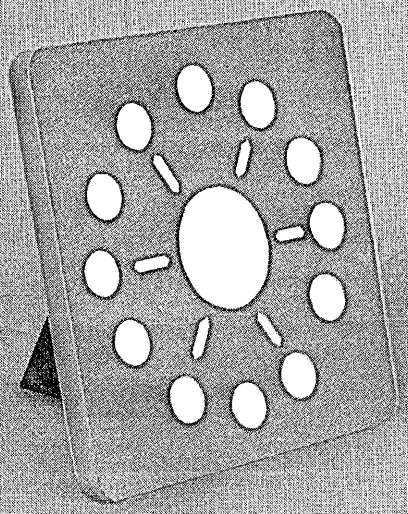
CIRCLE 110 ON READER CARD



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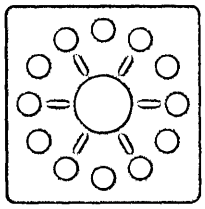
A demonstration of CTS capabilities convinced several of the country's largest time-sharing users as well as many smaller companies of the singular position of CTS among time-sharing services.

CTS, using its own personnel, developed a powerful interactive time-sharing system combining the features of unique data manipulation, unlimited amounts of data storage, and the capabilities of a large scale computer. A demonstration of the results was sufficient to convert prospects to customers.

Take advantage of our total service capability... and economy! Give us a chance to show you how CTS secured 50 customers in 90 days. Call us today, or see us at the Fall Joint Computer Conference.



COMPUTER TIME SHARING, INC.

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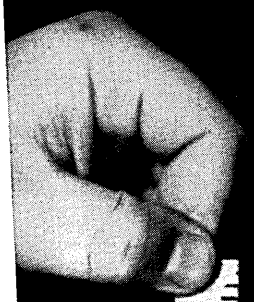

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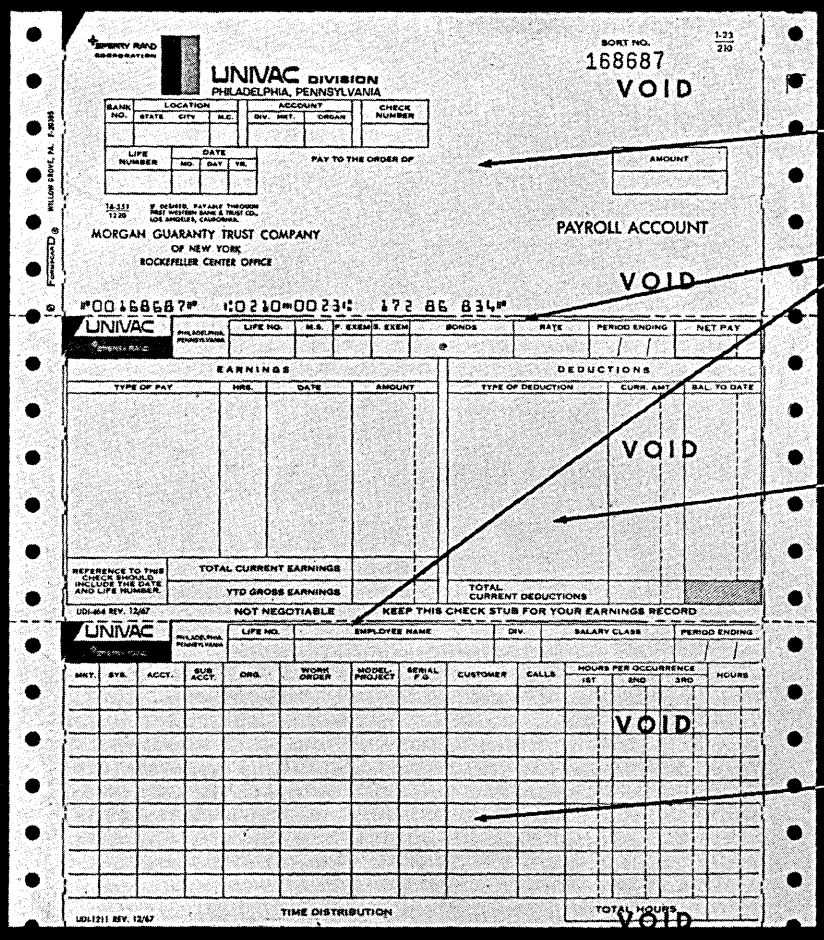

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Never a medial strip between documents

Earnings and deductions voucher, for employee records

Weekly time card (PRINTED TWO SIDES), returned by employee and key punched to up-date earnings for issuance of payroll check for next pay period.

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CIRCLE 112 ON READER CARD

A generation which talks your language

With fourth generation computers, the user is free at last from traditional hardware, language limitations. He can adapt the logic design of his machine to optimize the system for differing types of problems. The secret is micro-programming. It is the basic reason for the tremendous improvement in cost-performance ratio over a broad area of computer applications. Machine language independence and problem adaptability make fourth generation computers extremely versatile and remarkably economical. These computers embody all the technical advancements of third generation machines and then some.

We were the first company to ship a fourth generation computer and so far we have shipped more of them than anyone else.

If you want versatility with low cost, we're talking your language.

IC-4000— one of Standard's fourth generation computers. 500 nanosecond control memory compiles up to 4,000 FORTRAN statements per minute—other models offer time sharing, emulation of prototypes, simulation, optimized problem adaptation.
Full information and documentation on request.

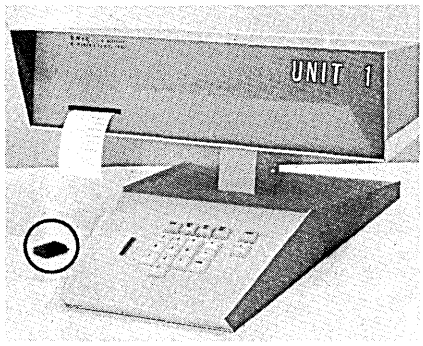
Standard Computer

STANDARD COMPUTER CORPORATION 1411 West Olympic Boulevard, Los Angeles, California 90015 (213) 387-5267

new products

credit key memory

The UNI-Key is a matchbook-sized device (circled in photo) designed to replace credit cards. When inserted into a reading device (UNIT-1) it will identify the customer, disclose his credit limit, subtract his purchase cost, and retain the balance in its memory unit for future reference. The reading unit issues multicopy sales slips for the



customer, the store and central records. If the UNIT-1 is in a network on-line to a computer, the UNI-Key can be updated immediately in terms of recent payments and debits. The key features a proprietary ceramic memory that the company claims is virtually impossible for unauthorized persons to read, alter or copy, eliminating the chance of forgery. The key may be recoded at any time and if it is lost, it can be invalidated by coding all UNIT-1's to reject it on presentation. The reading device will lease for $50 a month. The cost of the UNI-Key to the user has yet to be established. DIGINETICS, INC., Glendale, Calif. For information:

CIRCLE 193 ON READER CARD

key-to-disc system

The KeyProcessing System is a computer-controlled keyboard input system that can have up to 32 individual keystations, all independently entering or verifying data simultaneously on 32 different jobs. As data is entered through a keystation, it is processed by computer and stored in locations unique to each keystation on an IBM 2311-compatible disc with a 7.25 million character capacity, and then outputted to tape, disc or cards for storage. The basic system includes the processor, disc storage, 6 keystations and the system software. Optional devices such as crt's, communication modems, and automatic card punching devices will become available on a scheduled release basis following initial system deliveries, which are planned for April '69. Sale price of a basic KeyProcessing System is $70K, and it leases for $1,400 a month, with additional keystations at $75 a month each. COMPUTER MACHINERY CORP., Los Angeles, Calif. For information:

CIRCLE 194 ON READER CARD

data conversion

System 21 is another of the proliferating systems for conversion of source data to computer storage medium. It will operate as an off-line system for data conversion to tape cartridge, and subsequently to computer tape or punch cards, or as a terminal to transmit cartridge data to a computer or other System 21 data stations. The basic part of the system, renting at $39/month, consists of a 320-character-capacity crt, standard keyboard plus special symbols and control keys, two tape cartridges and drives, and a microprogrammed logic unit that uses MOS circuits and has 512 microinstructions and a small video-driving memory. Viatron claims this is the first use of large-scale integration in a peripheral system.

One tape cartridge provides data formats, the other stores up to 1K 80-character records. (Price: $4 each.) The drives also use MOS circuitry. A $100/month converter translates tape data onto punched cards through an 029 keypunch; another unit is available at $250/month, with IBM-compatible tape drive, for cartridge-computer tape conversion. A $20/month printing control unit attached to an office Selectric allows hardcopy printout from a cartridge.

A communications adapter ($20/month), with Bell 202 or 103 data sets or acoustic coupler will permit: on-line transmission of cartridge data to computer and, in turn, receipt of computer data on a tape; communication between two System 21's displayed on the crt's and/or recorded on tape; transmission of information from one 21 to the crt's of up to 24 System 21's or 24 standard television sets. The crt processor, cartridges and keyboard of the System 21 (size 4″x12″x12″, weight 10 lbs.) can be detached from the unit's crt and connected to the VHF antenna screws of any conventional television for at-home or on-the-road data entry and display. The unit may also be hooked up to a phone by acoustic coupler for tape-computer transmission. Deliveries are to begin between June and September, 1969. VIATRON COMPUTER SYSTEMS CORP., Burlington, Mass., for information:

CIRCLE 195 ON READER CARD

data conversion units

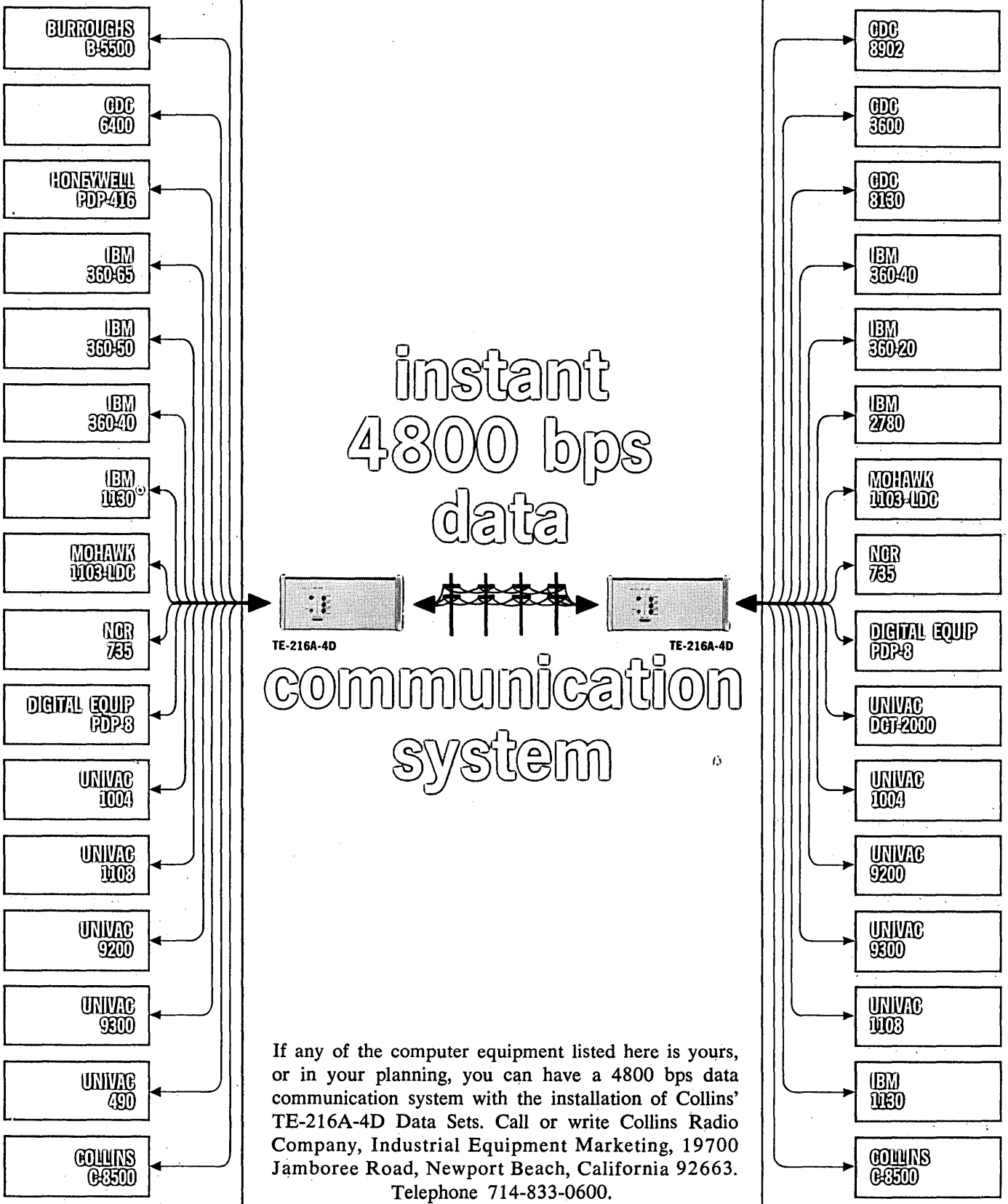
Potter Instrument has come up with its version of the Mohawk and Honeywell source-data-to-magnetic-tape conversion units. The KDR 3100 consists of a console with keyboard and digital readout panel for verification and correction; an 80-character core mem-

PRODUCT OF THE MONTH

PI SORT is a System/360 DOS disc sort. Functionally identical to IBM's DOS disc sort, it sorts the same files more than twice as fast, according to the company, and at the same time requires less work space on the disc, making it possible to handle larger files than the IBM sort. It operates with files that contain fixed length records on 360's with 65K of memory or more, and provides all the capabilities of the IBM DOS sort. The prototype version of PI SORT has demonstrated a speed advantage of better than 3 to 1 at several installations, and in no case was the advantage less than 2 to 1. The savings in time and work space is achieved through the use of a proprietary sort algorithm that allows significant overlapping of I/O and cpu processing.

PI SORT is priced at $4,500 as a one-time charge under a long-term licensing arrangement. If a company wishes to operate the sort on more than one 360, there is a charge of $1,000 for each additional computer to be used. Maintenance of the sort will be provided by the company for the life of the product. This includes modifications required to maintain compatibility with the IBM DOS sort. PI SORT will be available Feb. 1, '69. PROGRAMMATICS, INC., Los Angeles, Calif. For information:

CIRCLE 196 ON READER CARD



If any of the computer equipment listed here is yours, or in your planning, you can have a 4800 bps data communication system with the installation of Collins' TE-216A-4D Data Sets. Call or write Collins Radio Company, Industrial Equipment Marketing, 19700 Jamboree Road, Newport Beach, California 92663. Telephone 714-833-0600.

COMMUNICATION / COMPUTATION / CONTROL

COLLINS

CIRCLE 114 ON READER CARD

ory; and Potter's single capstan magnetic tape transports (556 or 800 bpi, 7- or 9-channel). No specific price is given, but it is expected to be in the $7000 range, as are its direct competitors.

The advantages Potter claims include the "easier tape handling" provided by a single-capstan transport, the provision of left-zero-fill as a standard offering rather than an option, and "better human engineering," examples of which are a larger desk than competitors offer and the ability to dial in data, rather than flip a series of switches.

The 3100 operates in the entry, verify, search, display, and record/read modes, selectable via a five-position switch. In entry, the control program enters memory from the keyboard or tape. Source data is entered on tape in six or eight-bits, plus parity. After tape recording, the unit backspaces to the beginning of the record for check against memory. To verify, the operator re-enters source data into memory. In search, the operator keys information on the block sought into the comparator logic. And in the display mode, data is monitored via indicators and can be advanced through memory by pushing a space bar. (Unlike Mohawk, Honeywell, and Potter, Sangamo's similar unit provides alpha-numeric, rather than digital, readout for display and verification.)

All other things being equal between Potter and its competitors in this area, the crucial factor would be service. Potter, which has primarily been an oem supplier, says it is now staffing up to meet the needs of the more dispersed end-user market. POTTER INSTRUMENT CO., INC., Plainview, N.Y. For information:

CIRCLE 197 ON READER CARD

data collection system

The Datacon System 250 converts source data to punched tab cards, bypassing keypunching and verifying operations. The system consists of a console for entering repetitive and variable data, plus a compact card punch that automatically produces an 80-column output tab card. All semi-fixed data to be entered on a series of output cards is accomplished by presetting a 10-column pinboard unit, eliminating the need for prepunched cards. Next to this unit are 20 leversets that are positioned to enter variable data. A plastic overlay mat with specific column and field header designations simplifies data entry by unskilled personnel. Typical applications include inventory control, job costing, billing, and payroll systems.

Also, up to 40 remote Datacon consoles at a single installation can be interfaced to one central keypunch, using a special scanner. Optional equipment includes badge readers, card readers, and printers. The system can also be used with Teletype and other terminals. Rental starts at $23/month. DATACON INTERNATIONAL, Oak Forest, Ill. For information:

CIRCLE 198 ON READER CARD

software translators

Systems Management Processor is a file maintenance system for program source language, designed to increase effectiveness of systems and programming personnel. SMP is written in 360 assembler language to function as a preprocessor to the COBOL compiler. Its functions permit storage and maintenance of program source language in a medium other than punched cards. It reduces writing for a COBOL program through use of abbreviations and synonym names, provides automatic documentation and translates decision tables to COBOL. SMP is for 360/30 and above. With training, reference and tutorial textbooks, installation on-site and maintenance, and with all options, Systems Management Processor leases for $40K for three years. With all options, SMP requires 131K byte core and five data sets (or combination of five I/O's).

FORTRAN Decision Table Translator translates decision tables to FORTRAN language and can be used with /30 and up, GE 625, and Univac 1108. This requires 65K bytes of memory. Three year lease is $15K.

COBOL Decision Table Translator is written in 360 assembler language and translates decision tables to COBOL. This translator is priced a little higher than the FORTRAN package. TRILOG ASSOCIATES, INC., Philadelphia, Pa. For information:

CIRCLE 199 ON READER CARD

tank farms inventory

A small, transducer-based device that attaches to the outside of a large storage tank has been introduced to get the answer to a difficult question. Called simply Model ICS-100, the system makes it unnecessary to open or even dip-sample the contents of a large tank to determine the weight, height, or volume of its contents. Operable from a remote station, the company claims greater accuracy (± 0.015% full scale) than can be obtained from a float or side-gauge indicator system. In addition, by tying

several tank monitoring systems into one central computer, any number of large tank farms in scattered locations can be inventoried rapidly. Data can be commanded and displayed at a rate of 30 samples per minute under operator control, and at higher rates under computer control.

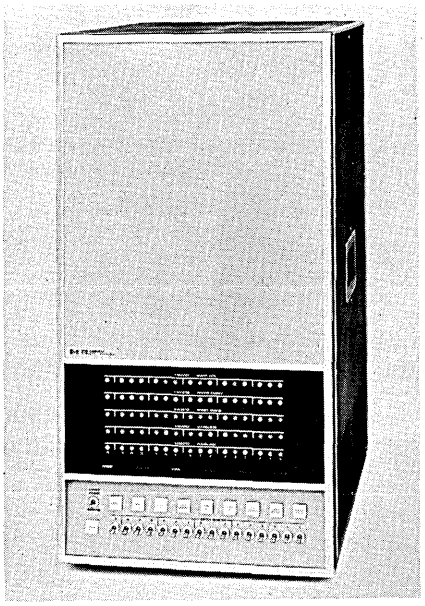
The major elements of the system are: a special pressure transducer on each tank, a logic control station for every 10 tanks, and a command/readout console for each terminal. An electronic pulse, transmitted via the logic control station, activates the transducer, which returns the inventory information to the logic control station. Here the signal is amplified, digitized, and displayed on the digital readout counter. The circuitry of the console requires no modification for computerized installations, its makers claim.

Cost of the system is somewhat under $1,000 per tank, exclusive of installation, for a 10-tank system. The price includes a one year warranty. Although a pilot site has operated for much longer periods, it is suggested that the calibration of the units be checked every 90 days. The company provides this service at a cost of $100 per year per tank. LECTRO-MATION SYSTEMS, INC., Newport Beach, Calif. For information:

CIRCLE 200 ON READER CARD

larger small computer

Model 2116B features reduced core stack size that doubles the amount of memory in the firm's 2116 series computers, enabling a 16K memory to be contained entirely within the mainframe of the 2116B. It has a 1.6 usec cycle time and an add time of 3.2 usec. It has two addressable accumulators, 70 basic instructions, including 39 microprogrammable register reference instructions that can be used to form 1,000 different one-word instructions combinations, and 23 assembly-directing pseudo instructions.



The computer can be upgraded by the insertion of any of 16 pre-wired circuit cards into the appropriate slot for interface with all traditional peripherals. Interface cards and software are in the basic configuration for direct memory access, hardware multiply-divide, parity check and memory protect. A multilevel priority interrupt system is built-in for the 16 pre-wired slots, and an additional 32 slots are available in an optional extender. The price for a 2116B with 16K memory is $34K and delivery time is 14 weeks at present. HEWLETT-PACKARD CO., Palo Alto, Calif. For information:

CIRCLE 201 ON READER CARD

photoelectric keyboard

The Series PK200 Photoelectric Keyboard is designed for data entry, using photoelectric encoding to convert key operations into digitally-coded electrical signals. The photoelectric encoding technique is said to overcome disadvantages associated with mechanical

switch design, such as switch contact unreliability, contact bounce, and radio frequency emitted noise. Keyboard layouts are unrestricted and may contain 10 to 75 keys. Output digital code can be up to 14 bits.

Depressing a key on the keyboard causes shutters to move and interrupt light beams. The resultant pattern of light is detected by photocells. The photocells change their values from 3K ohms maximum (light condition, logic 0) to 200K ohms minimum (dark condition, logic 1). A data strobe is generated with each key depression to ensure the proper sampling of data. A mechanical interlock prevents the depression of more than one key at a time.

The basic unit includes all characters and functions normally required for data input operations. Special function keys may be color-coded. Options include amplifiers that provide solid state logic level outputs, function key locks, mechanical storage latch, and remote keyboard lock. The keyboard measures 5 inches high by 11 1/16 inches deep. A typical 48-key unit is 12 3/8 inches wide, weighs 15 lbs., and costs $450. DIGITRONICS CORP., Albertson, N.Y. For information.

CIRCLE 202 ON READER CARD

graphic display system

Univac's announcement of the 1557/1558 graphic display subsystem and the formation of a Computer Graphics Group (for both hardware and software) signals a strong push by the firm into the graphics field commercially. The subsystem, whose price ranges from $195K-350K, is said to use the "first announced commercial digital deflection technique in graphic displays." This "second generation" concept will

in future be applied to an economy version (about $20K) and to multicolored displays, in which a single color gun will be used to provide up to three primary colors. (Univac also has the Uniscope 300, an alphanumeric crt; 3,000 have been delivered as agent sets to airlines and 4,000 more will go out by 1970.)

The 1557/1558, a controller and display console with software, is designed primarily for the 1108 computer, although it is said to be general-purpose enough to be interfaced with other large-scale systems. Its prime feature, the digital deflection system, is electromagnetic rather than electrostatic, which is claimed to provide better reliability and presentation. Since there is no need for D/A conversion and analog amplification, the differential amplifiers and feedback loops and their attendant adjustments are eliminated. The digital technique is also said to provide more precise positioning control, and thus more "practical" speed than the electrostatic deflection system.

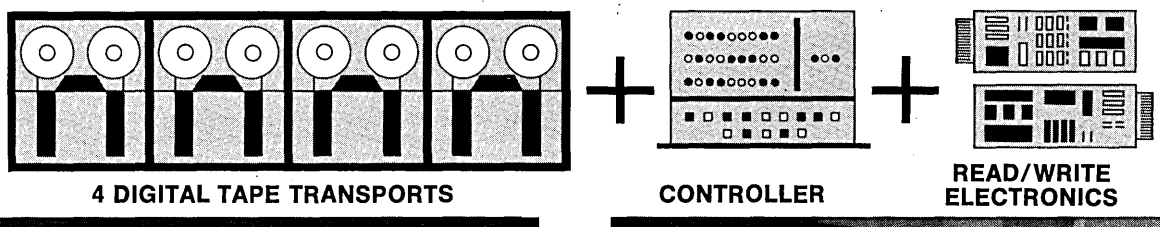
The resolution, speed, accuracy and reliability of the system are needed in applications such as integrated circuit design, mechanical part drawings, automotive design, and mathematical drawings, says Univac.

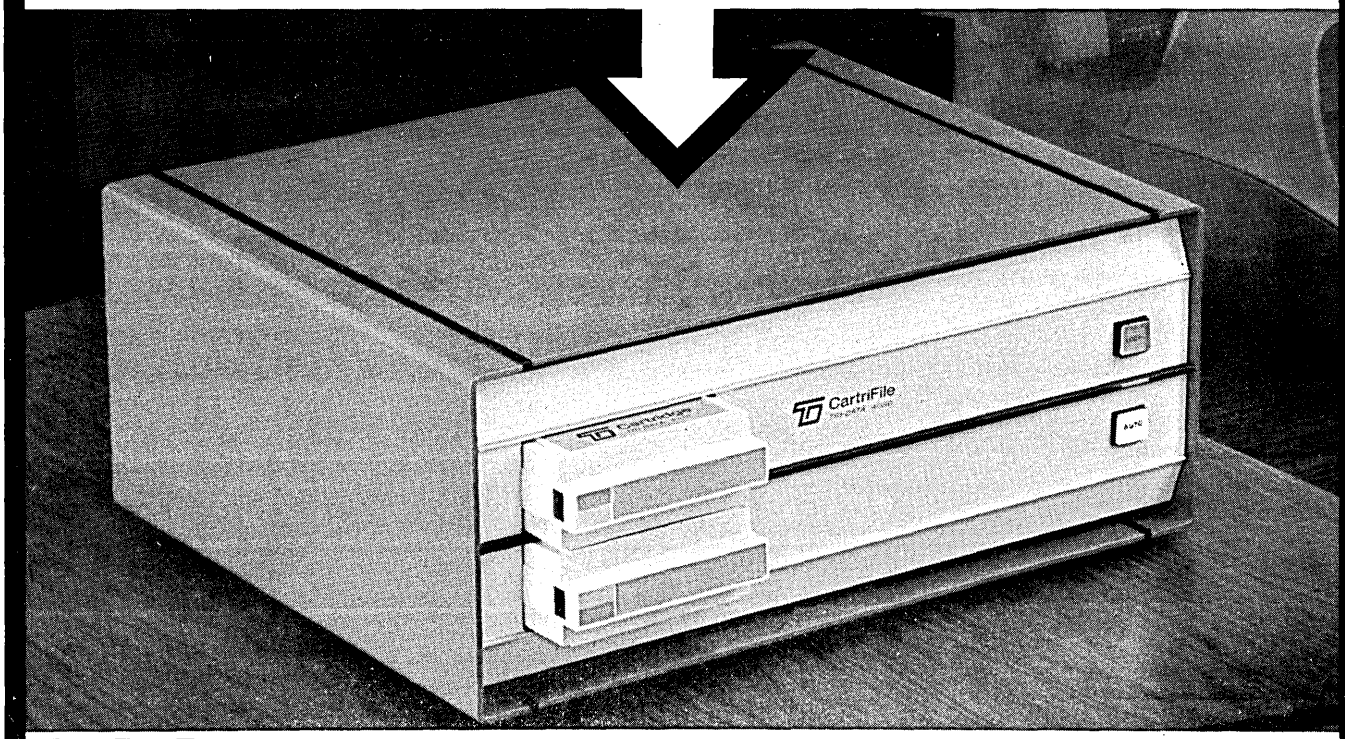
The 1557 controller is a computer with a 700 nsec cycle time, 26-instruction set, and 8K (18-bit) words, expandable to 16K in 4K modules. It has three I/O channels, permitting handling of three 1558 displays simultaneously. Its computing and controlling capability takes some of the load off the central processor.

The 1558 display console has the ability to plot randomly positioned points, vectors, and tabular mode alphanumeric data. The crt has a 12″x12″ usable viewing area, data being positioned in a 1,024x1,024 point matrix. A 90-degree character rotation is available under programmer control. Drawing modes are long vector (absolute or relative to any position writing speed of 32 usec), short vector (relative, speed of 2 usec), and character mode (average paint time of 5 usec, positioning time of 2 usec). Intensity is in three programmable levels; vector texture is solid, dashed, center line, and intensified end point.

The keyboard has a standard alphanumeric set, 40 function keys, and a light pen. Input is keyed-in in 7-bit ASCII, decoded, and entered into a diode matrix that generates, for each stroke in a character, a 3-bit description of the x and y coordinates and a 2-bit description of the intensity level.

The Advanced Graphics Software package is to work under the yet-uncompleted EXEC 8. It consists of the user's Application Program (worker program), which is in FORTRAN V; Graphic Programming Language (GPL), a library of service routines coded in SLEUTH II, which operate on the data structure and provide communication between the controller and the applications program; GPL/Application Link Program coded in





CartriFile
TRI-DATA 4096

4 Mag Tape Transports & Controller

A computer peripheral for program loading, data sorting and data-terminal use

Number of tape units	4 with integral controller and read/write electronics
Number of cartridges	2 — each containing 2 tapes
Simultaneous operations	Data may be written on one tape while data is read from another. Other tapes may be in Load-Point Search.
Capacity of system	600,000 6-bit words
Capacity per tape	150,000 6-bit words in 1,000-character records. Capacity varies with tape length and record length.
Record length	Variable
Word length	Selectable: 4, 6, 8, or 12 bits
Tape speed	10 inches per second
Transfer rate	857 6-bit words/second. Varies with word length.
Inter-record gap	0.2 inch
Start time	15 milliseconds
Stop time	10 milliseconds
Recording density	600 bits per inch
Recording technique	Bit-serial, phase-encoded, 2-track redundant
Error correction	Built-in multi-bit error correction based on redundant tracks and redundancy of phase encoding.
Mounting & size	Desk top or 19-inch rack-mount, 17 x 7 x 13.5 inches.
Price	**$5,200** includes all electronics, power supply and cabinet, two tape cartridges and interface connectors.

CartriFile TAPE CARTRIDGES

File protect	Switch and indicator for each of two tapes in each cartridge.
Tape	Endless loops of ¼-inch-wide computer-grade magnetic tapes, two per cartridge.
Certification	Tapes are tested and certified error-free.
Number of tapes	2 per cartridge.
Length of tape	50 feet 100 feet 150 feet

Interested? Call **Moxon Electronics** in New Jersey, Delaware, Pennsylvania, or the Greater New York City area (201) 343-9490, (609) 665-5444; **Instrument Dynamics** in New England (617) 245-5100, (203) 233-5503, (203) 324-5545; **L. G. White & Company** in Washington, D. C., Maryland and Virginia (301) 585-3111; **Arnold Barnes Company** in Texas, Louisiana, Oklahoma and Arkansas (214) AD5-4541; **King Engineering** in California, Arizona and Southern Nevada (213) 981-0161, (714) 745-2310, (415) 342-9645; or . . .

TRI-DATA Corporation, 800 Maude Avenue, Mountain View, California 94040 (415) 969-3700

SLEUTH II; and the 1108 core resident Network Management Routine (in SLEUTH II) for transmitting and receiving data for the controller. GPL is a reentrant processor and is 1180 core resident only as required by the applications program. The controller also has a resident monitor.

Delivery takes nine months. SPERRY RAND CORP., UNIVAC DIV., Philadelphia, Pa. For information:

CIRCLE 203 ON READER CARD

data sets

Two data sets, L2103A and L2103F, provide "narrow band" fully duplex transmission of data at speeds to 300 bps. Claimed to be fully compatible with the W.E. 103A and 103F, respectively, the new units offer plug interchangeability with their counterparts. Both meet EIA standard RS-232 B. Planned to provide the independent telephone industry with the required equipment for connecting to the switched network, or for private lines, they are available with options that include the provision for answering, disconnecting, or call origination in either manual or automatic mode.

L2103A is designed to operate on the normal exchange network (DDD). L2103F works on private or leased lines to give full duplex operation on a two-wire voice facility at rates to 300 bps for data service and 150 bps for TWX service. The L2103F is on-line at all times and requires no auxiliary equipment; voice operation on the L2103A requires the use of an auxiliary set including a handset, dial, and six pushbuttons. (The W.E. 804BW1 is recommended by the manufacturer.)

Testing of both sets is performed in a manner identical to that employed by the W.E. units, by looping data through the set and checking for transmission accuracy on return to the computer. Additional on-site testing is possible in a "local" mode.

Dimensions of the sets are 9¾" by 9¼" by 5⅝". The company claims a weight of less than half that of their W.E. counterparts. Price, when they become available off-the-shelf in January, will be about $550. LYNCH COMMUNICATIONS SYSTEMS, San Francisco, Calif. For information:

CIRCLE 204 ON READER CARD

time-division multiplexer

An off-the-shelf, modular data communications system called Ultracom has been introduced for packing computer-directed transmissions onto a voice-grade line. The system includes a throughput adapter, which permits a frame from one line to be integrated with that of another, and a computer interface adapter. By selecting from standardized Ultracom units, the manufacturer claims, each installation can custom-fit a data transmission system to its own needs. They cite this example: given a simple point to point nationwide data communications system with 15 west coast printers linked to an east coast computer through 15 leased telegraph-grade lines, an Ultracom system could be chosen—for about $30K—to perform the same functions with a single voice-grade line at a savings of almost $20K monthly. ULTRONICS SYSTEMS CORP., Moorestown, N.J. For information:

CIRCLE 205 ON READER CARD

25-lb. disc system

The 7000 series disc systems come in five models ranging in capacity from 0.15 million to 1.2 million bits. They have fixed, non-positioning, flying heads, in a head-per-track configuration. Average access time is 16.5 msec. Each system includes head address, decode and selection systems, bit and sector clocking, and "functionally packaged" ic boards: one for read, another for write. The discs can operate either in vertical or horizontal position. Maximum track capacity is 37,360 bits. Each system weighs 25 pounds and is 19"x17"x10½". The 7000's are designed to interface with any computer with the addition of customer's controller.

The series ranges from 8-32 tracks and are 10-quantity priced from $1987 to $3493. INFORMATION STORAGE, INC., Detroit, Mich. For information:

CIRCLE 206 ON READER CARD

industrial process control system

Honeywell has come up with general purpose hardware and software for industrial control in its Series 16 System, which is aimed at users with previous experience in process control. The approach recognizes the fact that this market demands tailor-made systems, and Honeywell does not yet have packages for the various industries that would be easy to implement without much user know-how in "defining systems goals." Such packages are in the plans, however.

Series 16 provides either a total direct digital control (DDC) system or a data acquisition system (DAS). The basic components of both are a DDP-516 cpu that is connected by a process interface controller (PIC) to remote

new products

sensors, control elements, and display devices. For DDC, the PIC is interfaced by a DDC analog subsystem with the process value outputs required for control. Each subsystem has the capacity for up to seven groups of DDC backup control stations with a maximum capacity of 72 stations per group.

System integrity is maintained using software error checks. Analog inputs are checked against standards and compared with process variable limits. Entries from an operator's console are recognized as valid or alarmed as invalid. Hardware monitoring is said to ensure correct station addressing and data updating. A new console designed for Series 16 permits the operator to check and change process-variable limits and initiate process-related actions; the units use a visual display and a keyboard.

Two new software packages are included in the system. The first, an operating system called OLERT (On-Line Executive for Real Time), permits the DAS user to add application and control packages in real-time FORTRAN IV and, in the DDC system, coordinates the operation of the cpu and peripherals, allocating resources to meet the demands of the process.

The second software package, called Controlware I, is functional software which provides data acquisition and DDC capabilities for process control, and allows a user to implement his system by simply filling in special tables with his specific process variables. The tables permit "an experienced process engineer" to set up a 200-loop DDC system in "as little as two weeks."

The data acquisition package performs all basic data acquisition functions including scanning, logging, and alarming. It is designed for expansion to more sophisticated operations such as supervisory control, on-line program development, and DDC. The DDC package handles on-line supervisory control, optimization and report generation, while performing DDC.

Price of the system varies from $50-500K, with an average installation selling for around $200K. The system will also be rented, with a typical payout period of three-and-a-half years. Lead time on orders is six months to a year. Several systems will be installed by the end of the year. HONEYWELL COMPUTER CONTROL DIV., Framingham, Mass. For information:

CIRCLE 207 ON READER CARD

bibliography banks

Three bibliography bank systems, coded in COBOL, are being sold as soft-

ware packages for 360 systems operating under OS. Basically, they each produce keyword indexed bibliographies from supplied files. System 010, which operates in 20K, produces bibliographic, author, and Keyword-Out-of Context indexes. System 710 adds a user-assigned static weighting mechanism to develop specialized listings for individual disciplines and individual users. System 810 uses an adaptive learning mechanism to automatically tailor the listing to each user's needs. The two larger systems were written to operate in 256K and to handle a maximum of 1300 user profiles per 150,000 source document words.

The 010 System is priced at $900. System 710 sells for $8,000, and 810 for $25,000. Each is available on a lease-option basis. The supplier also offers a service based on the use of the 810 System. SHARE RESEARCH CORPORATION, Santa Barbara, Calif. For information:

CIRCLE 208 ON READER CARD

crime program

The Uniform Crime Reporting System (UNICRIM) is a software package designed to enable police departments to process all offenses under various crime classifications and the arrest and judiciary activity related to such offenses. The system is aimed at the monthly and annual crime reports requested by the FBI from cities of 100,000 or more in population and can be processed monthly in about 30 minutes. The company sells the package for a one-time initial price of $3K, with installation not included. The system operates on any computer with a COBOL compiler, and can function with a shared facility in cases where a police department does not have its own computer. THE DIKEWOOD CORP., Albuquerque, N.M. For information:

CIRCLE 209 ON READER CARD

data sets

A family of data sets, designated the 1067 series, is compatible with Bell's 103A series, and features originate/reply functions and full dial-up interface for use on direct dialing lines. The 1067 series is available in individual cabinets for installation in any current data terminal and rack and panel mount for call-in in place of the 103A2. TUCK ELECTRONICS, New Cumberland, Pa. For information:

CIRCLE 210 ON READER CARD

PDP-10 disc drives

Two new disc pack drives to be offered by Digital Equip. Corp. for their PDP-10 computer are the RP01, which stores 1.3 million 36-bit words and has a transfer rate of 28.8 usec, and the RP02, which stores 5.1 million 36-bit words, with a transfer rate of 14.4 usec. As many as eight of either drive can be handled by a Digital Equip. Corp. RP10 control unit. The disc drives can also be used with the PDP-6, and will be available on a special quotation basis for the PDP-8 and PDP-9. Prices are $22.5K for the RP01, $26K for the RP02, and $25K for the RP10 control unit, including one disc pack per drive. Deliveries for the RP01 and RP02 are scheduled for May and October of 1969, respectively. DIGITAL EQUIP. CORP., Maynard, Mass. For information:

CIRCLE 211 ON READER CARD

mag tape units

Three magnetic tape units have been added to the Series 200 product line by Honeywell EDP. The new devices record information at 1600 bpi on nine data channels on ½"-wide mag tape; information transfer rates for the 204D-1, -3 and -5 are 76,800, 153,000 and 224,000 characters per second, respectively; tape is read at 36, 72 and 105 ips, respectively. A self-threading feature is optional on all three models. Control units, priced separately from the tape devices, can each handle up to eight tape units. The 204D-1 and -3 models may be used on any Series 200 computer system except the 110; the 204D-5 is especially designed for use on the larger models 4200 and 8200. The units, priced competitively with IBM, are scheduled for delivery in second quarter 1970. HONEYWELL EDP, Wellesley Hills, Mass. For information:

CIRCLE 212 ON READER CARD

a/d data acquisition

The Incre-Data Mark II, which is about the size of a tape recorder, uses 6" magnetic tape reels in cartridges. The system can be cartridge loaded and programmed in the field, and has five basic components: programmable data formater/controller, analog and digital multiplexer, A/D converter, digital clock, and magnetic tape recorder. Data can be recorded at 200 or 556 bpi, at speeds up to 2,000 cps synchronous and 1,000 cps asynchronous. The analog multiplexer sequentially samples 20 differential or 40 single-ended inputs, with single, continual or stop/start scan rates. The Mark II measures 6½" high by 7¾" wide by 13⅜" long, and weighs approximately 29 pounds. Standard power is +28v dc at 4a; optional power converters for +12v dc, and 60 Hz or 400 Hz at 115 v. Price for the 200 bpi unit is $19,950

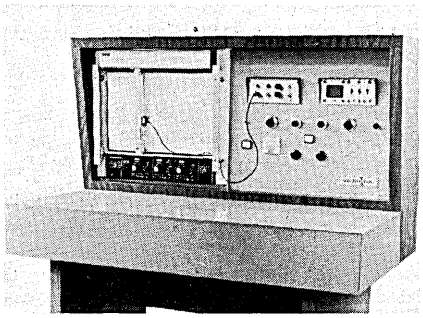
new products

(roughly $1450 per pound). INCREDATA CORPORATION, Albuquerque, New Mexico. For information:

CIRCLE 213 ON READER CARD

analog curve resolver

A specialized analog computer, called the RM-6 Resolution Multiplier, automatically scans and then multiplies the resolution of curves and continuous spectra by deconvolution, recording the results on the input hard copy. Its manufacturer states that the self-contained instrument can increase the resolution of the output from basic ana-



lytical instruments by 5 to 10 times. Its applications include mass spectroscopy, nuclear magnetic resonance studies, and infrared spectroscopy. The system requires no assumptions or computations regarding solutions being sought, and produces results that are not subject to operator interpretation. The self-contained unit sells for about $15,000. MICRO-TOL ENGINEERING CORP., State College, Penn. For information:

CIRCLE 214 ON READER CARD

x-y recorder

The OEM-17 X-Y recorder features a 17″ x 17″ plotting surface; sealed feedback potentiometers; a magnetic paper-hold system; a disposable fibre-tip pen writing system; and static accuracy of ± 0.2% of full scale. It was designed for OEM and is available with its own power supply or it can be powered from the system. The price is under $700. ELECTRONIC ASSOCIATES, INC., Long Branch, N.J. For information:

CIRCLE 215 ON READER CARD

t-s industry directory

The recently published Time-Sharing Industry Directory contains the information a user installation might need to select the computer system best suited to his needs, find the nearest vendor with that equipment, and to compare that vendor's performance and charges with those of his competitors. The Directory includes data on languages and hardware available, as well as rental and sales costs. It is distributed in a ring binder with charts and maps for reference. Optional updates keep the information current. Cost of the Directory is $50; one copy of the Directory and all updates for one year (total of 6) runs $75. TIME-SHARING ENTERPRISES, INC., New York, N.Y. For information:

CIRCLE 216 ON READER CARD

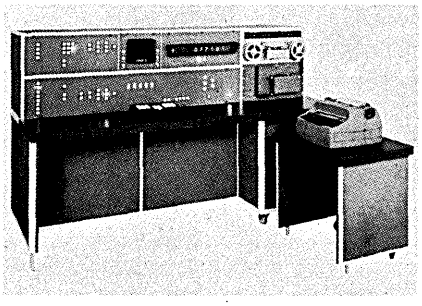
sigma 5, 7 software

An advanced linear programming package, Sigma FMPS (Functional Mathematical Programming System) will be marketed by the company for users of its Sigma 5 and Sigma 7 computers. Uses of the new package include inventory control, production scheduling, product blending, transportation and distribution, and management decision making. The package will be available in the second quarter of '69 and is priced ranging from $12,500 to $22,500, depending on options. Price includes initial customer personnel training, start-up, and software maintenance. The system is fully open-ended and will operate under the batch processing monitor in a 32K word memory system. SCIENTIFIC DATA SYSTEMS, Santa Monica, Calif. For information:

CIRCLE 217 ON READER CARD

computing in color

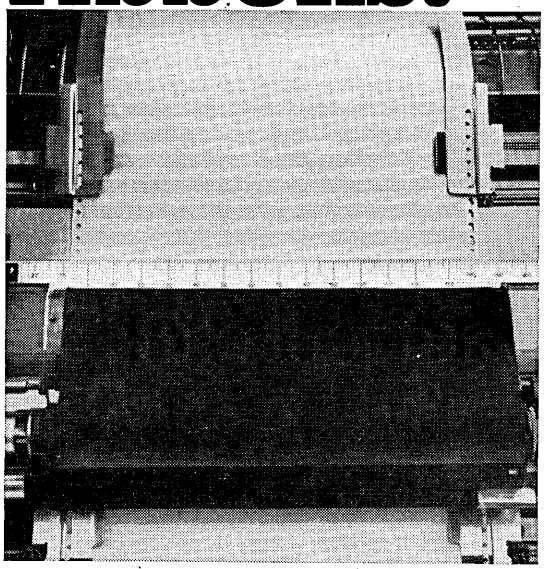
A new computer, with the unlikely name of COMIC II, has recently been developed for use in the plastics, paint, and textile industries. Mismatched dye lots in clothing, carpeting, and paint are no joke, so perhaps COMIC is a misnomer. The computer system is designed for ensuring consistency in col-



ors from one production batch to another. The system, given console inputs or measuring color directly through a special sensing instrument, selects a combination of colorants considering both cost and quality of color matches. The size of a production batch is considered too, so that production personnel receive information from the computer regarding the ac-

Does your printout fade out faster than it should?

Send out an order for Roytype computer ribbons.



Inferior ribbons and frequent ribbon changes cost you in computer down time. And money. And the problem usually isn't with worn ribbons. It's with fading ink.

Roytype, with added technology from its parent company Litton Industries, has the solution. Better ribbons made with longer lasting inks. Our inks are quality tested for viscosity, density and durability. The formulas are secret. The resulting ribbons...well known.

Roytype tough nylon ribbons have tolerances to 2/10,000ths of an inch. Each and every ribbon is tested to deliver uniform printouts.

Give us your specifications. We'll deliver the ribbon. And you'll never have to put up with a big case of the vanishing printout again.

ROYTYPE®
DIVISION OF LITTON INDUSTRIES

J. A. Herauf, Roytype
Royal Typewriter Co.
1031 New Britain Ave.
West Hartford, Conn. 06110 Phone (203) 233-2621

Dear Sir:
Please send me more details on Roytype Computer Ribbons.

Name_____

Company_____

Address_____

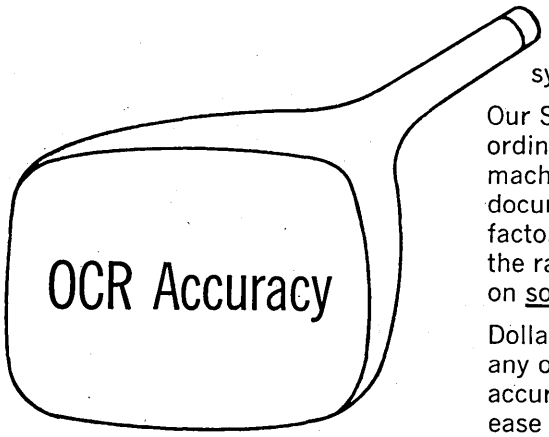
City_____ State_____ Zip_____

Nobody's perfect

BUT

SCAN-DATA'S 300 reads source documents directly with an accuracy rate better than 99.998%

Human inaccuracy is an unhappy fact of life in the age of automation. If you're now converting source data by standard key punch, you know the error rate runs between 2% and 4%. Keystroke direct to magnetic tape is between 1% and 3%, and even retyping documents for scanning systems introduces a similar margin of error.



Cathode Ray Tube

Our Scan-Data 300 OCR page reader converts ordinary typed or printed forms directly into machine language. The operator feeds it source documents, and that's that. Yes, some error factor is still present, but Scan-Data has reduced the rate to less than 2 in 100,000 characters on source documents.

Dollar for dollar, Model 300 will out-perform any other system on the market for accuracy, adaptability, economy and ease of operation.

If such a claim sounds a little audacious, we'd welcome the chance to back it up.

SCAN-DATA CORPORATION

800 EAST MAIN STREET, NORRISTOWN, PENNSYLVANIA 19401 / 215 277-0500

tual amount of pigment, color concentrate, or dyestuff.

The sensing unit can make color separation readings or spectrophotometric readings every 10-20 millimicrons. A number of sensors can be hooked to the computer in addition to the sensor optionally available from the same maker.

With COMIC II, the user receives all programs and software necessary to start operating. Technical support is also available. The basic system and its associated software will sell for about $45,000. The sensing unit is available for about $5,000. KOLLMORGEN CORP., Attleboro, Mass. For information:

CIRCLE 218 ON READER CARD

tape transport

An electronically servo-controlled single capstan unit, the TM-16200 can handle 200, 556, and 800 bpi in 7 or 9 track formats. Its air-bearing tape moving operation is rated up to 150 ips. Its high speed rewind will spin through 2400 ft. in 90 secs. Transfer rates range from 15KC to 120KC. Additional features include head area-chamber isolation, automatic loading and unloading, and capstan and servo tachometers as standard equipment. Optional features include CCRV generation and vertical and longitudinal parity checking. Two models are available, TM 16200-1 (rated at up to 120 ips) and TM 16200-2 (rated up to 150 ips), at prices ranging from $8,000 to $14,000. AMPEX CORP., Culver City, Calif. For information:

CIRCLE 219 ON READER CARD

optical drum scanner

Photoscan is an electro-optical drum scanner that converts photographic transparencies into digital data at a rate of about four minutes per 4"x4" photo. As many as 256 light levels may be differentiated. Photographic density is measured with an accuracy of 0.02 between D = 0 and D = 3 and is presented as output in 7-bit binary form together with the x and y data. The "scanning window," or area of the photo being scanned, is adjustable. Photos are scanned in raster with a line separation of 50, 100, and 200 micron in x and y direction.

Output is interfaced with small computers such as the DEC PDP-8, or tape units such as the Peripheral Equip. Corp. 3800; the latter is offered optionally with the Photoscan. Price range is $25-30K, including tape unit or computer interfacing. Delivery requires three months. OPTRONICS INTERNATIONAL INC., Burlington, Mass. For information:

CIRCLE 220 ON READER CARD

network software

Stations in a remote job entry (RJE) network using IBM 1130 or 360/25 as terminals may now use new IBM programs to operate with a multiprogrammed 360; a 360/50 or larger with 512K bytes of core is required as the main processor. RJE programming for the 360/25 is available now, with support for the /20 scheduled for the third quarter of '69. IBM DATA PROCESSING DIV., White Plains, N.Y. For information:

CIRCLE 221 ON READER CARD

digital drum printer

Versions of the MC 2400 series of asynchronous digital printers are rated at 20, 30, and 40 lines per second (models 2402, 2403, and 2404, respectively). Individual components of the models are actually capable of much greater speeds, says the manufacturer, but underrating and simplicity of design are intended to ensure trouble-free operation. The units use a 12 or 15 character set, and print up to 16 columns—any of which can be zero suppressed. They accept four line coded data input; entry is bit and column parallel. Printing can begin at any position on the drum. In addition, a storage register option is available to further reduce the time that data must be held on an input line waiting for the drum to come into position. Price of the units is in the range of $2,000. LITTON INDUSTRIES, DATALOG DIV., San Francisco, Calif. For information:

CIRCLE 222 ON READER CARD

slide rule decoders

Four types of circular slide rules for converting machine-coded numbers to decimal numbers have been announced by the Computation Aids Co. The Hexadecimal Decoderaide converts hexadecimal numbers to decimal numbers and vice versa; any hexadecimal number of six digits or less may be converted. The Binary-Octal Decoderaide converts any octal number of six digits or less and any binary number of 18 digits or less to decimal numbers. The Machine Language Decoder for the 1400 converts 1401, 1440 and 1460 machine language addresses to decimal number addresses. All machine language addresses representing decimal number addresses one through 15,999 (including modification by in-

new products

dex registers 1, 2 and 3) may be converted. The Machine Language Decoder for the 7080 has similar capabilities for the machine language addresses of that system. COMPUTATION AIDS CO., Seattle, Wash. For information:

CIRCLE 223 ON READER CARD

power supply

In critical applications, where power interruptions cannot be tolerated for even a fraction of a second, the CF (Constant Frequency) No-Break Power System can be used to supply regulated voltage and constant frequency power. The systems, which are offered in ratings from 2.5KW to 1,000KW, operate during short power failures—up to 30 seconds—or can be linked to auxiliary power equipment to provide a smooth transition from the failing source. First developed for missile tracking and space flight ground support applications, the CF systems can be used for computing installations and computer-controlled processing operations. Powered by a patented Stored Controlled Energy Unit, they include generators to supply the power and motors to drive them. IDEAL ELECTRIC AND MFG. CO., Mansfield, Ohio. For information:

CIRCLE 224 ON READER CARD

continuous form envelopes

Computer-Pak is a continuous web of envelopes, in roll form, that can be fed through computer printers. Shingled at the outside margins, with pin hole strips on both sides, the forms are designed without a carrier sheet. The manufacturer states that there is no evidence of a perforation line in the processed envelope. Should be great for chain letters. PAK-WELL PAPER INDUSTRIES, INC., Phoenix, Arizona. For information:

CIRCLE 225 ON READER CARD

computer-based a/d systems

Three A/D data acquisition systems with stored program processors and both mag. tape and paper tape output have been introduced. Designated the Series 685 Systems, they are capable of acquiring raw analog data, converting it, processing it (limit checking, linearizing, units conversion, etc.), and providing on-line control of experiments. Software, in the form of executive and analog diagnostic programs, is supplied. Hardware versions are available for handling a range of channels and a range of throughput rates. Several hardware options, such as D/A converters, discrete input sense lines, output control lines, logging typewriters, and plotters are also available. Basic 685 systems start at $30,000. REDCOR CORP., Canoga Park, Calif. For information:

CIRCLE 226 ON READER CARD

program documentation kit

Products for Programmers is a group of office aids including a program documentation kit that holds source material, listings and control cards in one binder. Other products include a systems documentation outfit, data clipboard and a snap ring data binder that allows sheets to lie flat while binding modules and short runs. NATIONAL BLANK BOOK CO., INC., Holyoke, Mass. For information:

CIRCLE 227 ON READER CARD

accessory marker

The Sharpie is a waterproof marker that will write on tape, light metals, glass and most plastics; it is designed to leave a permanent mark. Shaped like a fountain pen, the Sharpie has a fine point, and comes in eight colors. SANFORD INK CO., Bellwood, Ill. For information:

CIRCLE 228 ON READER CARD

paper tape peripheral

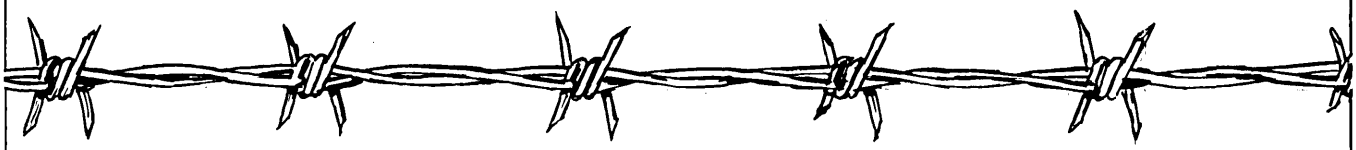
Further evidence that paper tape lives on is contained in the announcement of the 920 paper tape subsystem for the UNIVAC 9000 series of computers. The subsystem consists of a paper tape control, reader, reader spooler, punch and punch spooler. It reads at 300 cps and punches at 110 cps, is capable of handling any 5, 6, 7 or 8 level tape codes. A patch panel controls the selection of codes. A complete 920 subsystem can be purchased for $16,105 and rented on a one-year agreement for $370 a month. A five-year lease is available at $313 a month, with delivery scheduled to begin in the second quarter of '69. SPERRY RAND CORP., UNIVAC DIV., Phila., Pa. For information:

CIRCLE 229 ON READER CARD

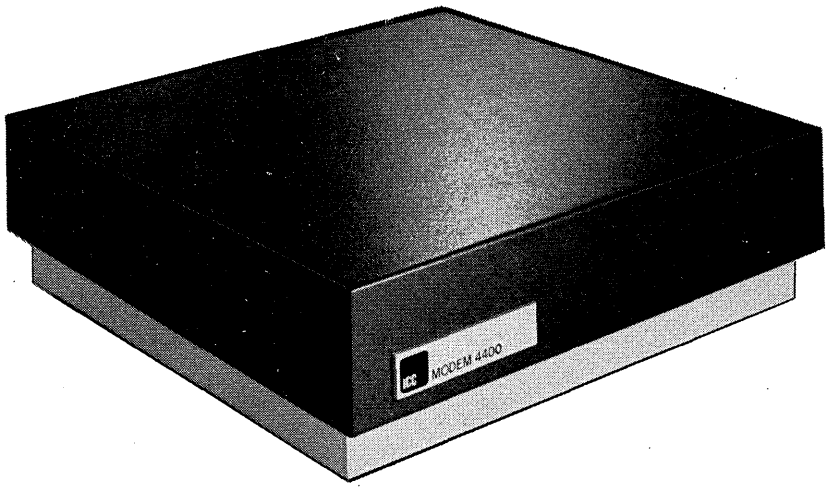
disc pack tester/certifier

PACK-SCAN I is an IBM 2311-compatible disc pack tester and certifier. The unit is able to check each track for writing and erasure, and records errors on a strip printer built into the unit. PACK-SCAN can test all the tracks on a disc pack in about five minutes; it does not involve the use of a computer. Four operation modes—two for unskilled production test personnel and

For data lines like this...



We build data sets like this



MODEM 4400

As data line quality deteriorates, most high-speed data sets have to be adjusted to a lower transmission rate. Some give up completely.

MODEM 4400 data sets need no adjustable speed "feature". They transmit at the speed they were specified for ... over **any** data line.

For the facts about dependable data transmission, send for data sheets and information on MODEM 4400 users near you.

ICC

International Communications Corporation
7620 N. W. 36th Avenue, Miami, Florida 33147

Booth 212, Fall Joint Computer Conference

a milgo company

One's for processing, the other's for interfacing.

They make Automating easier.

Selecting an automation computer is half the job. Interfacing it is the other half, frequently the tougher of the two. We've solved the problem in the simplest way possible.

First, we developed two high performance/low cost computers — one, the SPC-12, the industrial automation computer — the other, the SPC-8, ideal for automation development or experiment use. Both include expandable 4K memories, 2-μsec cycle time, and 12-bit hardware registers.

Second, we've pre-interfaced them for your system, with plug-in modules that each contain all the circuitry required to accomplish a complete interface function. We have them for all types of input/output equipment.

It takes just two 5¼" panels in your standard relay rack to house the lowest cost, complete solution to your automation project. But you'll never know how easy it is until you ask us. Ask about our SPC-12, SPC-8, and system interface units. Just write.

GENERAL AUTOMATION, INC.
Automation Products Division,
706 West Katella, Orange, Calif. (714) 633-1091

two for skilled operators—employ three separate analog tests to measure magnetic coating irregularities. The track width tester permits use with most current disc drives. By adjusting the parameters of these three tests, a manufacturer may set any degree of safety margin he chooses. Deliveries of the tester will begin next month. PERIPHERALS, INC., Phoenix, Ariz. For information:

CIRCLE 230 ON READER CARD

apt for the pdp-8

Numerically controlled tooling programs are now available on a small computer. A version of APT, a couple of post-processors, and a computer to run it all on can be acquired for a total investment of less than $40K. UNIAPT, running on the PDP-8 series computer, will be able to give its users the same kind of service as is available on larger machines with faster turnaround times than are generally realized with large-scale computer processing departments, its producers claim. In addition, UNIAPT is billed as being exactly compatible with other versions of the language. Some alterations were made, however, in the APT executive system, and in the PDP-8 (a disc was added for program and intermediate file storage).

The processor/software package being marketed has run some small parts programming jobs in two to three minutes. Although only two post-processors have been completed, the vendor expects to be able to deliver new ones as requested within the delivery period. In addition, the company states that every effort will be made to keep most post-processors down in the area of $1,000.

Presently restricted to 3-axis machines, versions for 5-axis machines are expected shortly. The smallest unit is equipped with a TTY keyboard, but small card readers and other gear can be added. UNITED COMPUTING CORP., Redondo Beach, Calif. For information:

CIRCLE 231 ON READER CARD

document handling systems

Two large-scale document handling systems, called Monoscan and Monotrieve, have been developed for sheet film and records storage. Originally designed for hospitals, they should be applicable to any large-scale records keeping operation. Monoscan is intended primarily for high activity documents. It permits absolute random placement of files in storage, and individual document retrieval by means of keyboard, punch card, magnetic tape, or paper tape inputs. The system's optical scanners can search up to 1635 folders a second. Although there is no technical limitation, 44,000 folders seem to be the optimal file size. Monotrieve is designed to handle medium- to low-activity documents. Keyboard commands initiate an optical search that results in an entire cradle of folders being returned to the operator, who extracts the specific folder desired. Small versions of both, priced together as one document handling system, go for about $25K. GENERAL ELECTRIC CO., Milwaukee, Wisc. For information:

CIRCLE 232 ON READER CARD

core memory

The F1-3 series contains 26 3-usec core memory systems with 8,192 word capacities in lengths of 6 to 18 bits per word. Maximum access time for the coincident-current ferrite memories is 1 usec; half-cycle time is 2 usec. The systems are available with address register, sequential counter, and memory retention. Their 3D, 4-wire construction uses 30 mil low temperature coefficient cores. All electronics, including +6 and −12v power modules if desired, are contained in the system package at prices starting at $3,580. FERROXCUBE CORP., Saugerties, N.Y. For information:

CIRCLE 233 ON READER CARD

tape transports

A Series 4000 single capstan tape transport is being offered that uses a tape deck constructed from a temperature stabilized casting. Its manufacturer claims that the cast deck will require no periodic adjustments. Both 7-track (200/556/800 bpi) and 9-track (800 bpi only) models are available. Driving the tape with a pressure roller and servo controlled tape tension at 18 ips, the transports can rewind a full 10½″ reel of tape in 1½ minutes. Aimed rather directly at the mid-size manufacturer, the units can be purchased in a variety of standard configurations, including one that incorporates only the capstan and drive electronics and sells for approximately $3,840. Full-blown units with complete read/write data electronics and complete interface logic run about $8,500. TALLY CORP., Seattle, Washington. For information:

CIRCLE 234 ON READER CARD

I'm Edson de Castro, President of Data General.

Seven months ago we started the richest new small computer company in history.

This month we're announcing our first product: the best small computer in the world.

Data General wasn't started on a shoestring.

My associates and I had been with a company where we developed the most successful line of small computers in the business. And we knew the only way to go was big. Right from the beginning.

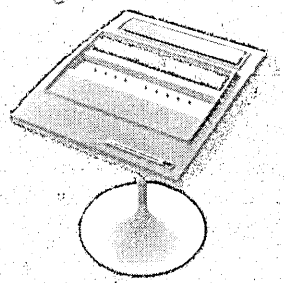
So we got the financing to be big. To build a plant that'll knock out these computers by the hundreds. To develop a large enough technical service organization to really support our customers.

And we designed a revolutionary computer. The NOVA.

Other small general purpose computers are built around an obsolete architecture based on an old technology. NOVA is built around medium scale integration. It's the first with multi-accumulator/index register organization. The first with read-only memory you can program the same way you do core. The first low cost machine that allows you to expand memory or build interfaces within the basic configuration.

One more thing. The price with a 4096 16-bit word memory and Teletype interface is only $7950. And we're offering the best discounts in the business.

Because if you make a small inexpensive computer, you have to sell a lot to make a lot of money. And we intend to make a lot of money.

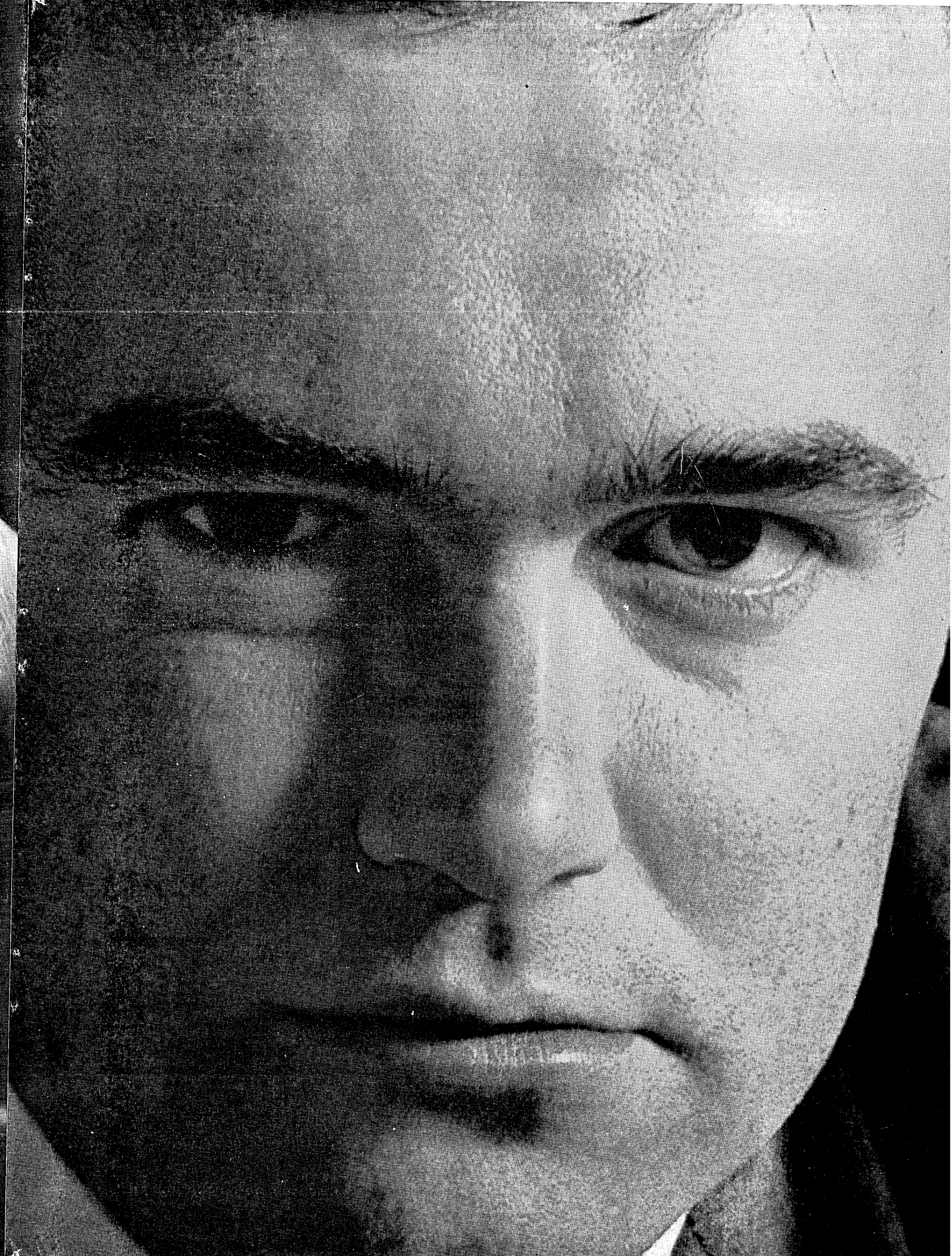


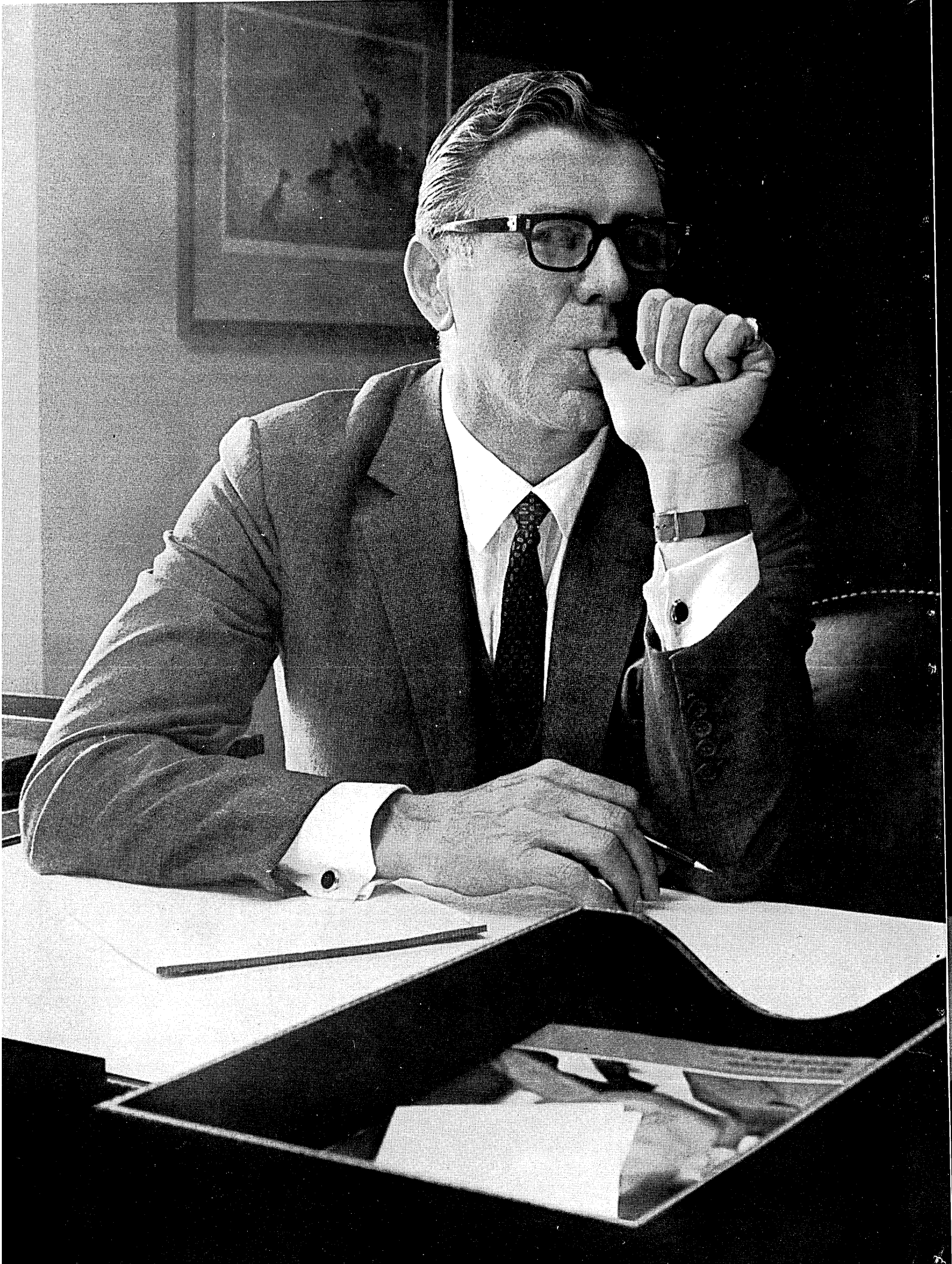
DATA GENERAL CORPORATION

275 Cox Street, Hudson, Mass. 01749

Specifications: NOVA is a 16-bit word general purpose computer. It has four accumulators, two of which may be used as index registers. It offers a choice of core or read-only memory of 1K, 2K, 4K, 8K, and up to 32K 16-bit words (or twice that many 8-bit bytes). NOVA comes in the desk top console shown here or a 5¼" tall standard rack mount package. Both the desk and rack versions can hold up to 20K 16-bit words of memory or interface for a large number of peripheral devices. NOVA has the most flexible I/O facility ever built into a machine of its class. It will include a high-speed Data Channel and automatic interrupt source identification as standard equipment. Write for more information today. Or see us at the Fall Joint Computer Conference on Wednesday.

CIRCLE 129 ON READER CARD





Security is an IBM 1800 computer.

This is an executive. Show him the letters IBM on the front of a computer and he feels secure. Even if the machine behind the letters isn't as good as another one his company could buy.

For example, our SEL 810B is a better computer than the IBM 1800. Judge for yourself:

The SEL 810B is faster—790 nanoseconds versus 2 or 4 microseconds.

Systems Engineering Laboratories can design and deliver custom front-end equipment with the SEL 810B. IBM can't with the 1800.

We can deliver in 90 days. Figure on a year for the IBM 1800.

To top it all, the SEL 810B costs less. In fact, you can buy two SEL 810B's for the price of a typical 1800.

What does IBM have to say about all this? That they're dedicated to service. A noble dedication. But we say a computer is built to perform, not to be serviced.

We know these are pretty brash words. And we expect to be called on them. We invite you to be among the first.

Call us at home collect. Tell us you want to see proof, not just claims. We'll set up a demonstration.

We figure if we spread the word often enough about the SEL 810B, eventually it'll have to filter up through that great big security blanket.

Call Joe Popolo at Systems Engineering Laboratories in Ft. Lauderdale. The number is Area Code 305/587-2900.

Or write P.O. Box 9148, Ft. Lauderdale, Florida 33310.

Systems Engineering Laboratories

CIRCLE 130 ON READER CARD

Albert Einstein had, perhaps, the greatest mind of our time.

But he didn't have something many college students now have.

A UNIVAC® real-time computer system.

With a UNIVAC computer system, an average college student can work out problems faster than any man ever could. Even faster than a genius like Einstein.

Scientific and mathematical experiments that were once much too exhausting, or altogether impossible to perform on campus, have now become possible because of computer technology.

Students and researchers can use UNIVAC computers to analyze and study biological experiments while the experiments are still in progress.

In graduate business schools students gain practical management experience by using computers to simulate actual business conditions.

Faculty members also benefit from on-campus computers. They can spend more time teaching and less time administrating.

Industry and government are other benefactors of on-campus computers. Advanced projects are now under way in the textile, petroleum, design engineering and medical fields, to name a few.

Univac is at work on campuses throughout the world in administration, research and education.

Can you imagine what the world would be like today if the University of Zurich had a computer, in 1904, when Einstein was a student.

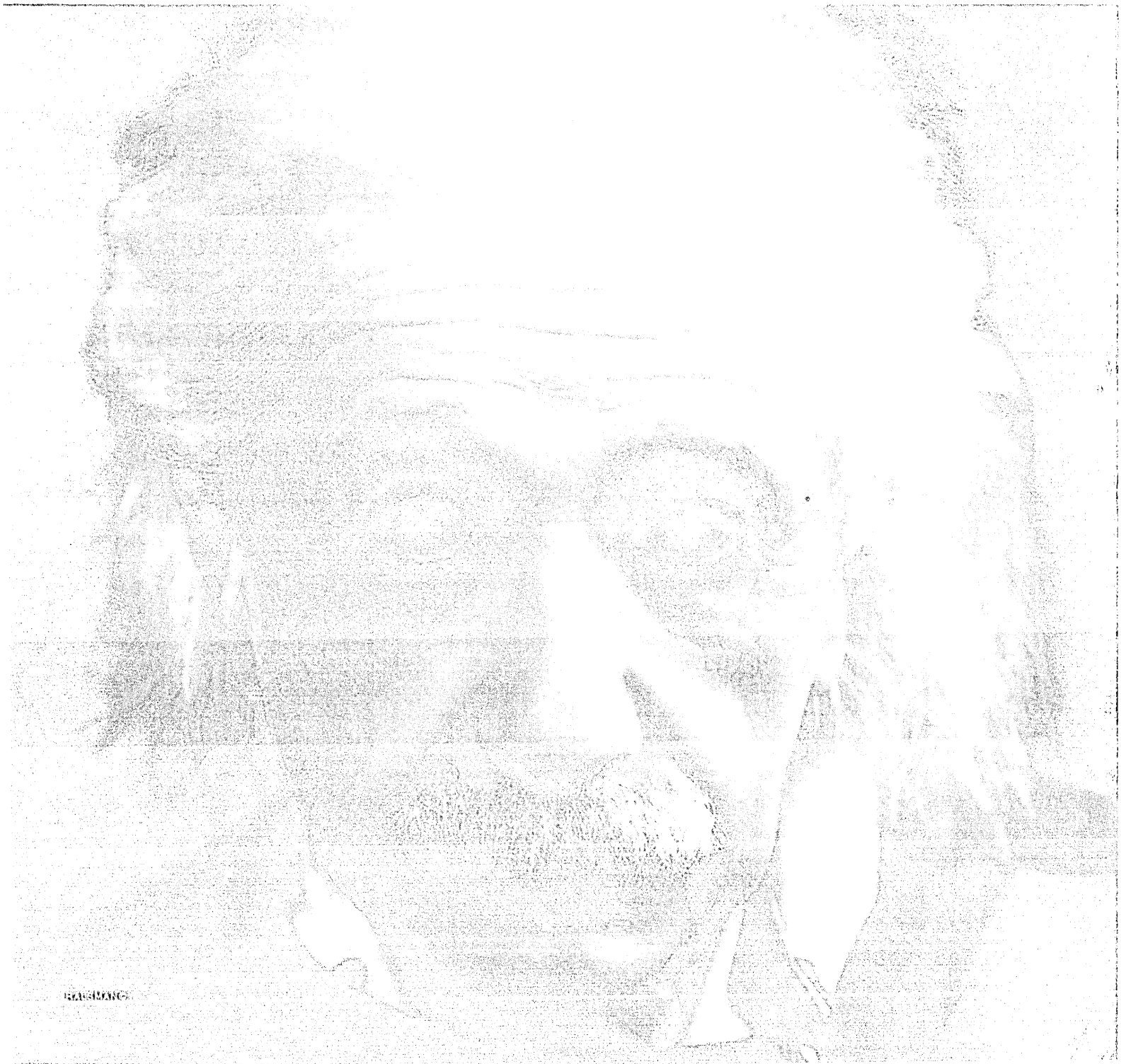
UNIVAC

Univac is saving a lot of people a lot of time.

SPERRY RAND

CIRCLE 151 ON READER CARD

In a few days a college student can re-do the calculations that took this man a lifetime.



Do it on a graphuter

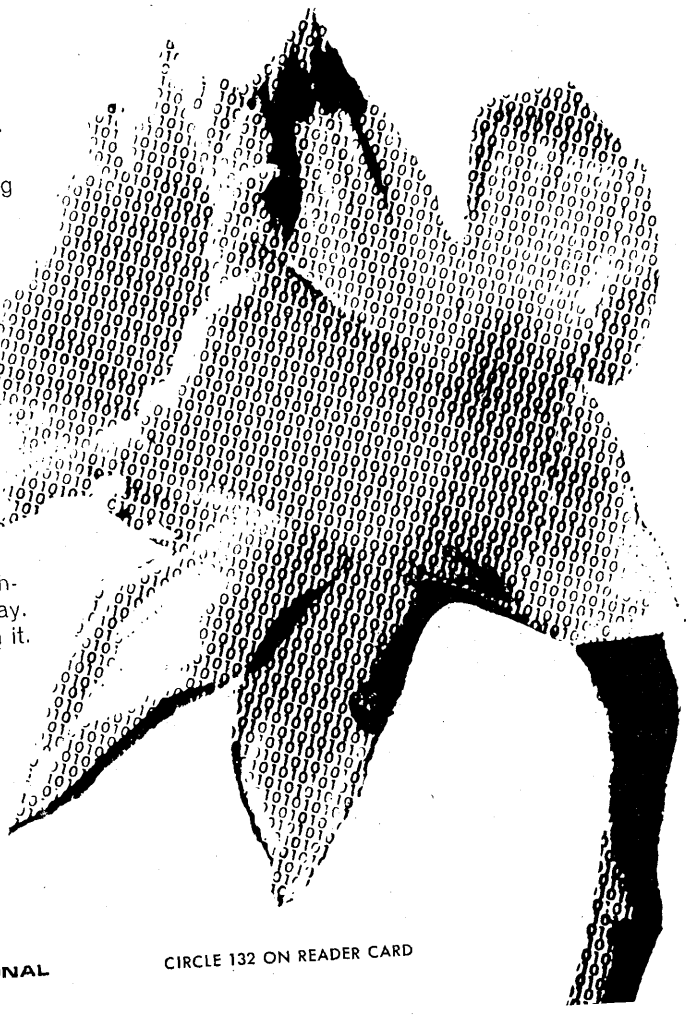
An aircraft designer with an idea goes to a computer-controlled display scope and picks up a light pen. In a few moments he puts the sketch of a new wing structure on the scope face. (The lines aren't uneven, because the computer straightened and smoothed them.)

Now he issues a series of instructions to the computer: "Make the flaps 15% shorter. Widen them to replace the area just lost. Make the trailing edge slant back at a sharper angle. Show me a perspective view." He questions: "What is its length? Width? Wingspan?" And a final instruction: "Give me E-sized drawings of front, side, and top views, with dimensions and listing of sub assemblies."

It took less than 10 minutes of the engineer's time to show what can be done when we learn to manipulate visual information directly. Difficult, yes. But inevitable.

Consider the evolution of information handling. We've done very well manipulating numbers, letters, and arithmetic — with the desk calculator, the teletype, and the computer. There remains a world of graphic information, larger by far than our systems of symbols, to be bent to men's use.

This is what Information International has been doing — making programmed electro-optical systems to interpret visual information and to act on it. We have delivered systems to analyze seismograms and oil well logs, read oscilloscope waveforms, examine biomedical samples (directly through the microscope), interpret oceanological films. Score multiple-choice forms, make charts and graphs from digital data. It's an interesting start. We're pushing the inevitable, you might say. Your inquiry might well hasten it.



Information International Inc.
545 Technology Square,
Cambridge, Mass. 02139
(617) 868-9810

11161 West Pico Boulevard,
Los Angeles, California 90064
(213) 478-2571

INFORMATION INTERNATIONAL

CIRCLE 132 ON READER CARD

new literature

COMPUTERS AGAINST CRIME: Eight-page bulletin describes the attempts of the company's sociologists and public administration researchers to help police do a more efficient job by designing, through systems analysis and programming, methods for relating the activities of the law-abiding and the law-breaking elements of our society to the problems of crime prevention and law enforcement. THE DIKEWOOD CORP., Albuquerque, N.M. For copy:
CIRCLE 160 ON READER CARD

CORRECTIVE MAINTENANCE: 66-page report discusses a computer program which has the capability of generating inherent maintenance task times from the physical configuration of the equipment and descriptions of maintenance task requirements. AD-482 160. Cost: $3; microfiche, $.65. CLEARINGHOUSE, U.S. DEPT. OF COMMERCE, Springfield, Va. 22151.

STORAGE INTERFACE SYSTEM: Four-page brochure gives performance specifications and operations and programming information on the Storage Interface System (SIS) for use with the Univac 1108 computer and IBM 2314 disc storage drive or the IBM 2311 via the IBM storage control unit. Schematic application diagrams for both bulk storage and shared data base are included. DATAMETRICS CORP., Van Nuys, Calif. For copy:
CIRCLE 161 ON READER CARD

PROCESS CONTROL: Data sheet describes Series 2000 process control system for industrial applications. The compact system includes all required peripherals and a 16-bit word length cpu, featuring silicon integrated circuit construction. ALLIS-CHALMERS, Milwaukee, Wis. For copy:
CIRCLE 162 ON READER CARD

MAG TAPE DATA BASES: Univ. of California study projects the role that mechanization will play in the university library and the pace at which it will develop during the next 10-15 years. The report also defines problems that will be faced over the next five-year period in creating the capability to process nationally produced data bases and tying into mechanized information networks. Volume 1, 340 pages, order PB-178 441; Volume 2, 222 pages, order PB-178 442. Cost of each volume, $3; microfiche, $.65. CLEARINGHOUSE, U.S. DEPT. OF COMMERCE, Springfield, Va. 22151.

TAPE GLOSSARY: Eight-page glossary defines many of the terms most commonly used in conjunction with magnetic tape data storage technology. TALLY CORP., Seattle, Wash. For copy:
CIRCLE 163 ON READER CARD

AUTOMATED LIBRARY SYSTEMS: Ten-page brochure describes two types of automated library systems for moderate-sized libraries. Both the autonomous system and the satellite system (for those with access to a computer facility) provide support in the areas of circulation, acquisitions, cataloging, serials and management. HAMILTON STANDARD, Windsor Locks, Conn. For copy:
CIRCLE 164 ON READER CARD

OCR CASE HISTORY: Article reprint describes the use of optical reading at Pennsylvania Power & Light in a mapping project to transcribe handwritten data to mag tape, eliminating keypunching and forming a base for the generation of accounting, purchasing and stores reports. OPTICAL SCANNING CORP., Newtown, Pa. For copy:
CIRCLE 165 ON READER CARD

MAGNETIC HEADS: Twenty-page catalog contains mechanical and electrical specifications and typical response curves for the company's magnetic heads for drum, disc or tape mediums. MICHIGAN MAGNETICS, Vermontville, Mich. For copy:
CIRCLE 166 ON READER CARD

DISPLAY SYSTEM: 24-page report describes a system that uses a crt as the working surface on which an operator can develop or create graphic displays which can be recorded in a magnetic tape library, plotted on an X-Y plotter,

←FOR CAELUS CIRCLE 133 ON READER CARD

How to cut out your programming backlogs.

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7701 North Stemmons Freeway
Suite 707
Dallas, Texas 75247

Give me more information about your Programming Group.

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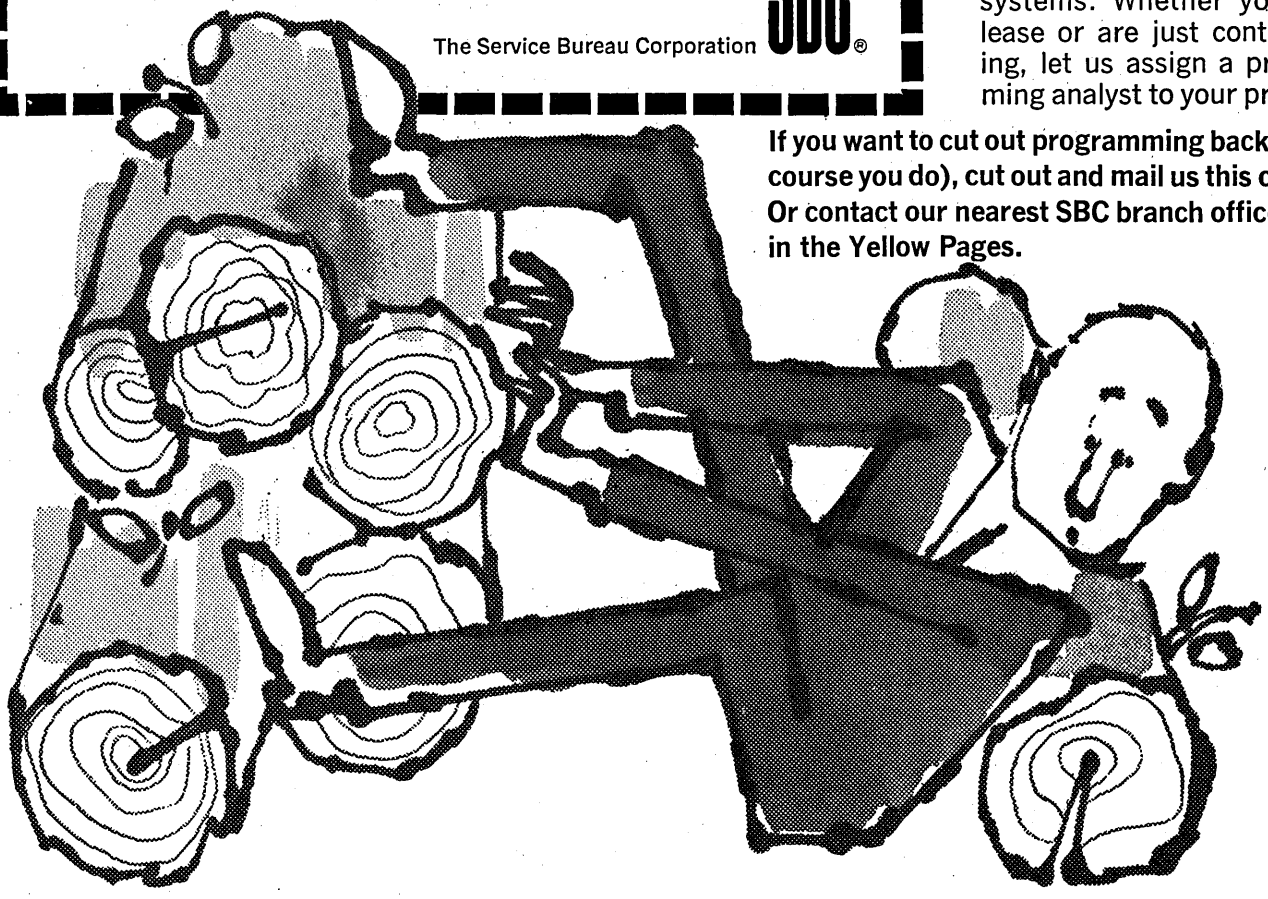
The Service Bureau Corporation SBC®

If you use computers, then we don't have to tell you that keeping up with them is a job for Superman. (There just aren't enough trained people to go around.)

That's why you'll be interested in SBC's Programming Group. These specialists can program any second or third generation computer in any user language, in any operating system. And develop software, too. They've got the technical experience to sophisticate your applications for real-time, on-line or off-line systems. Whether you own, lease or are just contemplating, let us assign a programming analyst to your project.

If you want to cut out programming backlogs (of course you do), cut out and mail us this coupon. Or contact our nearest SBC branch office listed in the Yellow Pages.



CIRCLE 135 ON READER CARD

recorded on punched paper tape or as a frame of a sequential-playback magnetic tape. N68-25002. Cost: $3; microfiche, $.65. CLEARINGHOUSE, U.S., DEPT. OF COMMERCE, Springfield, Va. 22151.

DISC PACK TESTING: 12-page booklet describes the four operational modes of the PACK-SCAN I device for testing the IBM 2311-compatible disc pack. The instrument takes about five minutes to detect, interpret and record location on a self-contained strip printer of every error on a total pack. PERIPHERALS INC., Phoenix, Ariz. For copy:

CIRCLE 167 ON READER CARD

DATA BANK DIRECTORY: "Directory of Computerized Information in Science & Technology" (DCIST) identifies and describes data banks and machine-readable collections developed by leading governmental, research, industrial, academic, library, publishing, and professional society sources. Master index is included. Price of $175 includes full updating service through December, 1969. SCIENCE ASSOCIATES/INTERNATIONAL, INC., 23 E. 26th St., New York, N.Y. 10010.

ORDER BILLING SYSTEM: 20-page booklet describes the company's Order Billing Applied System for use with the Century 100 computer to provide reports containing such information as the profitability of each item or class of items, of each salesman and each customer. Subroutines may be changed to fit user needs. NATIONAL CASH REGISTER CO., Dayton, Ohio. For copy:

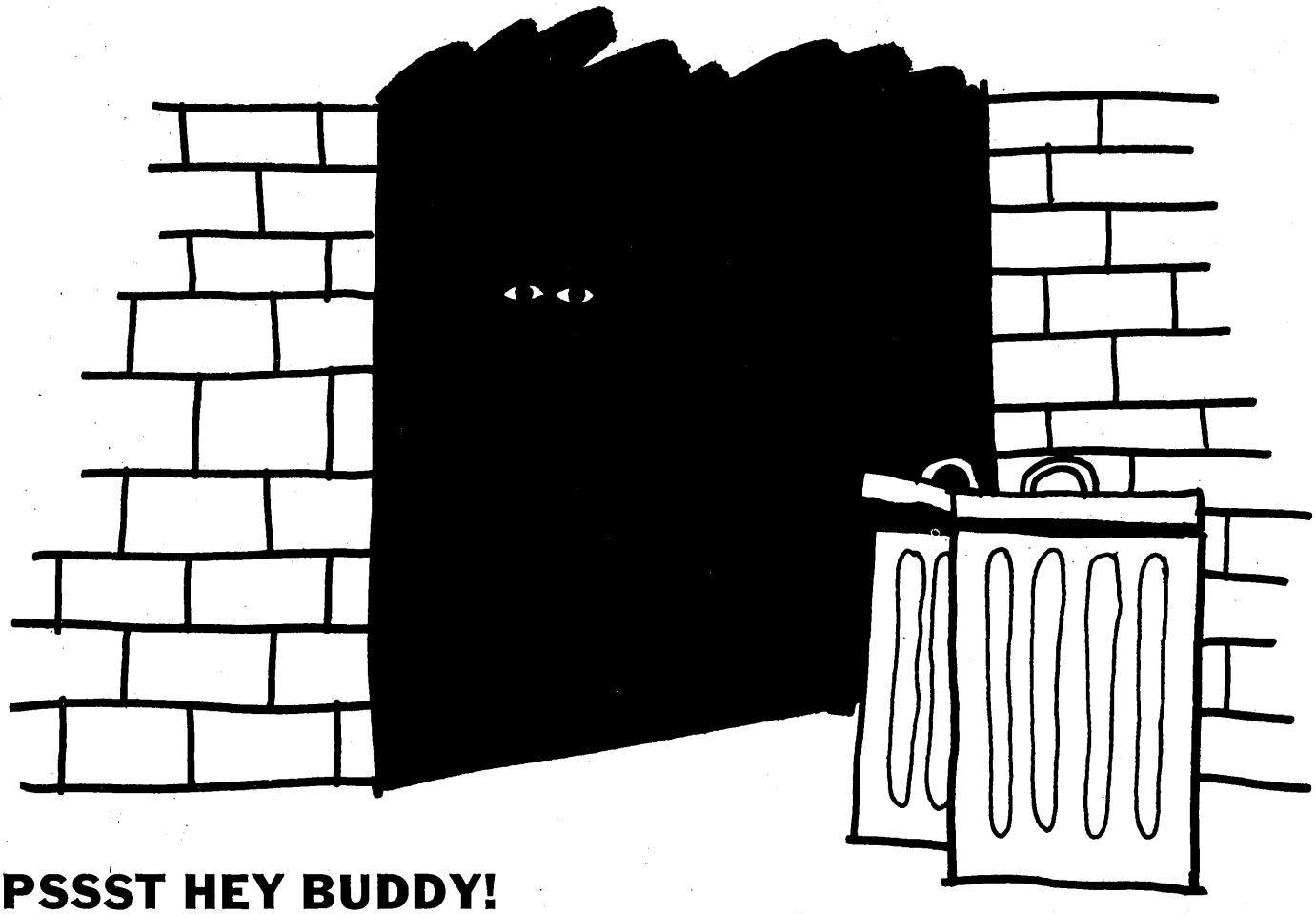
CIRCLE 168 ON READER CARD

CONTINUOUS ENVELOPE: Four-page brochure describes new method of fixing envelopes to carrier strips to permit addressing in computer-driven writing equipment. Edge-to-edge position of envelopes on carrier strip keeps printer time to a minimum. Sample envelope is included. MOORE BUSINESS FORMS, Niagara Falls, N.Y. For copy:

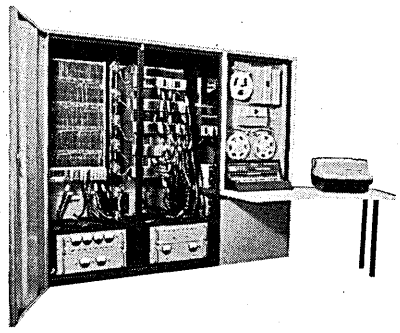
CIRCLE 169 ON READER CARD

COMPUTER TAPE: Four-page brochure gives characteristics and specifications of the 870 Series of computer tape. AMPEX CORP., Redwood City, Calif. For copy:

CIRCLE 170 ON READER CARD



PSSST HEY BUDDY!
You say you're looking for a good deal on a 24 bit computer for less than 17k. SCC's got it... just tell 'em Max sent you.



With over 70 systems installed, the word is getting around. SCC's 24-bit machines are compatible with the programs you've been using.

For $16,800 you can own the 660 CPU with 59 instructions including a set of microinstructions. For $35,500, SCC offers the 670 with 71 instructions that also include a comprehensive set of microinstructions for performing data transfers and logical and arithmetic operations. These fully parallel machines provide either single or multiple as well as simultaneous access to memory.

If you're looking for a computer system, SCC can give you 30-day delivery on a 660 CPU, a 1.75 usec memory with parity, memory adapter, character buffer I/O, 300 cps P.T. reader, 50 cps P.T. punch and Selectric typewriter with 8" platen.

Now that you have the word. . . you'll know where to come.

Whatever Your Computer Application — Be Sure You Talk With SCC Before You Buy

Scientific Control Corporation

P.O. Box 34529 • Dallas, Texas 75234 • 214 — 241-2111 • TWX 910-860-5509

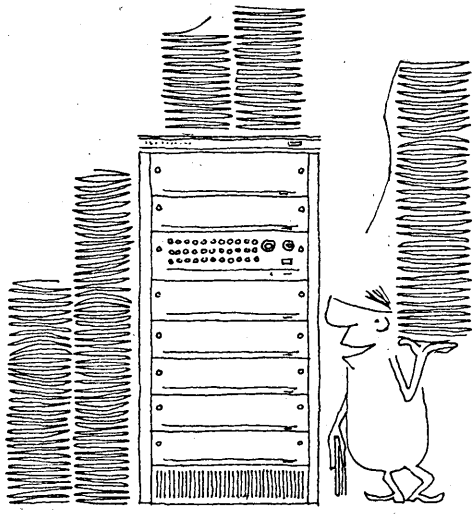
EASTERN REGION: College Park, Md.; Huntsville, Ala.; Parsippany, N. J.; West Springfield, Mass.

CENTRAL REGION: Dallas, Tex.; Denver, Col.; Des Plaines, Ill.; Hazelwood, Mo.; Houston, Tex.

WESTERN REGION: Palo Alto, Calif.; El Monte, Calif.

CIRCLE 137 ON READER CARD

If you're acquiring data, the 703 can get it for you wholesale.



And that means more of it faster, and with less cost, work and worry. Raytheon Computer's $15,000 703 has system characteristics built-in... 1.75 usec cycle time... 16-bit word ...memory expandable to 32K...byte and word manipulation ...real-time priority interrupt... options like direct memory access, multiply/divide, expandable I/O bus.

Peripherals? Up to 256 including all the conventional high and low speed, mass and non-mass devices plus—from Raytheon Computer only—analog data acquisition instruments like the MINIVERTER®, 100KHz ADCs and a long line of analog and digital IC modules for expanded logic, interfacing and control.

Software? A real-time monitor, an executive, assemblers, debugging aids, real-time FORTRAN IV and SENSOR, a unique hardware diagnostic program that spots malfunctioning IC elements so you can plug in a new one and be back on the air in a few minutes.

About the only other thing you'll need to get a 703 into your system is a call to a sales engineer. Raytheon Computer, 2700 S. Fairview St., Santa Ana, Calif. 92704; Phone (714) 546-7160. Ask for Data File CB-161. In Europe and the Mid-East, write Raytheon Overseas, Ltd., Shelley House—Noble St., London E.C.2, England, Phone: 01 606 8991 Telex 851-25251.

RAYTHEON

SEE US AT FJCC BOOTH K10

This is the computer that can foul up your computer.

The human mind is more complex than any computer. But less reliable.

And that's why any business with EDP needs Addressograph's data collection and automated input systems. (To put that in plain English, we make data recorders for 100% accurate input, and scanners to process input information at the lowest possible rejection rates.)

Our systems are compatible with both kinds of computers: human and electronic. And they take into accounting the fallibility of the human kind.

They handle all kinds of information. Make it computer readable. And get it to the computer quicker, with 100% accuracy.

Clerical or non-clerical people have been taught to operate our systems in a matter of minutes.

And once they've learned how, the problems of computer input virtually disappear.

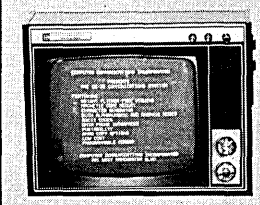
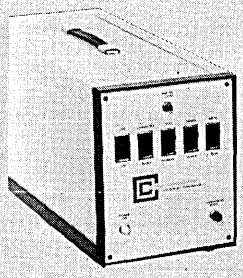
To learn more, write Addressograph Multigraph Corporation, Department 6808, 1200 Babbitt Road, Cleveland, Ohio 44117. Or call your nearest branch office (we're in the Yellow Pages).

We'd love to have you run the facts and figures on our systems through your computer.

Either one of them.

Juno, courtesy of Cleveland Health Museum.

ADDRESSOGRAPH division CORPORATION
...helping people communicate

cāp|  |ability
flex|  |ability*
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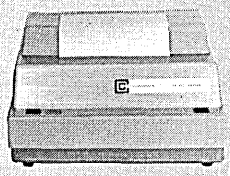
add|  |ability

Ability in computer communications is the touchstone against which the CC-30 Communications Station is judged. By us and by others. That's why ability, and the many important qualities which prefix it, are built into the CC-30.

Consider capability: the CC-301 TV Display Controller, heart of the CC-30 Station, displays alphanumeric or graphic data on a standard television receiver (a big factor in keeping the cost of the CC-30 far below others), accepts information from a keyboard or other input unit, controls all input/output devices at the station, and communicates with any computer (CC-30 Stations are in use with IBM, UNIVAC, CDC, SDS, GE, DEC, and other computers).

Consider flexibility: the CC-30 is being used by hospitals, industries, government agencies, universities, computer manufacturers, and research laboratories throughout the country. It's used to store and retrieve information for on-line compilation and execution, for data inquiry services, computer-aided instruction, management information systems, process control systems, and a wide variety of other systems and applications.

Consider portability: all components of the CC-30 are lightweight and modular, designed for desktop operation in a normal office environment.

Consider addability: a wide selection of models and options — including a light pen, line printer, telephone coupler, and card reader — means the CC-30 Station can be tailored to specific needs.

No matter how you consider it, ability in computer communications means Computer Communications.

Computer Communications, Inc.

701 W. Manchester Blvd.
Inglewood, California 90301
Telephone 213/674-5300

Visit us at the FJCC, Booth 1703-4.

*Since the essence of communications is understanding, we hope you will understand if we indulge in a little poetic license.

CIRCLE 140 ON READER CARD

world report

CONTROL DATA ACCELERATES ACCELERATOR IN EUROPE

Control Data is in one of the active periods that have hallmarked CDC's sporadic progress among European users. The Minneapolis version of PL/1 has stirred the interest of solid IBM customers such as Rolls Royce; the biggest consultancy group on the eastern side of the Atlantic, Metra International of Paris, has bedded down a 6600 with terminals for subsidiary company SIA in London; and installation of another 6600 into the UK for London University awaits completion of new premises. For one of its most important clients, the European Organisation for Nuclear Research (Cern), Control Data is upgrading a machine that was the third production model out of the 6600 stable. The major change is modification of the memory access logic and addition of memory instruction decoding logic to allow incorporation of extended core store for the 6000 series. In the meantime, work is handled by a 6400 and 3800 on site and on hired time at a centre with a 6500 in Zurich. In the long term, Cern promises to be a considerable customer for machine makers. Plans to construct a 300 GeV particle accelerator at a cost of $420 million plus will now go ahead in spite of earlier difficulties in getting all the interested nations to participate. A large slice of the money will go for a super-scale system and a batch of smaller systems for automatic control of the accelerator and for off-line film analysis and plotting equipment.

GERMAN RAILROAD TAKES STOCK OF ROLLING STOCK

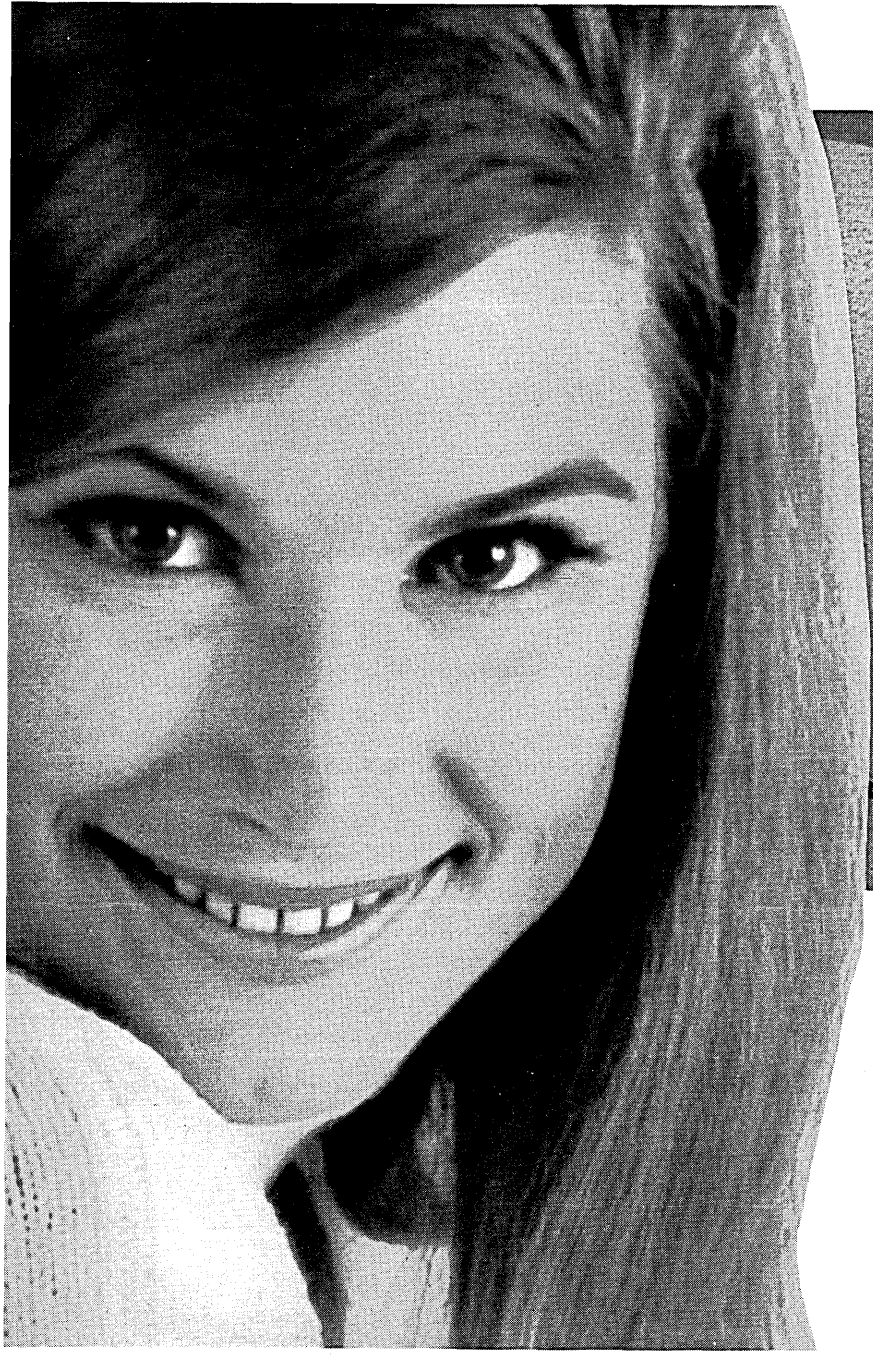
The German Federal Railroad is developing one of the biggest data transmission systems for a modernised rail network carrying traffic at speeds up to 200 mph. In conjunction with Siemens and Brunswick Technical College, the railroad is designing a complex electronic control and signalling system. Key to the project is a cable laid inside the rails. Every 100 metres a special detector will transmit encoded data from passing traffic to a signalling centre. Apart from giving visual signals, the signalling system will feed information on rolling stock to a computer centre for keeping check on the way capital equipment is in use.

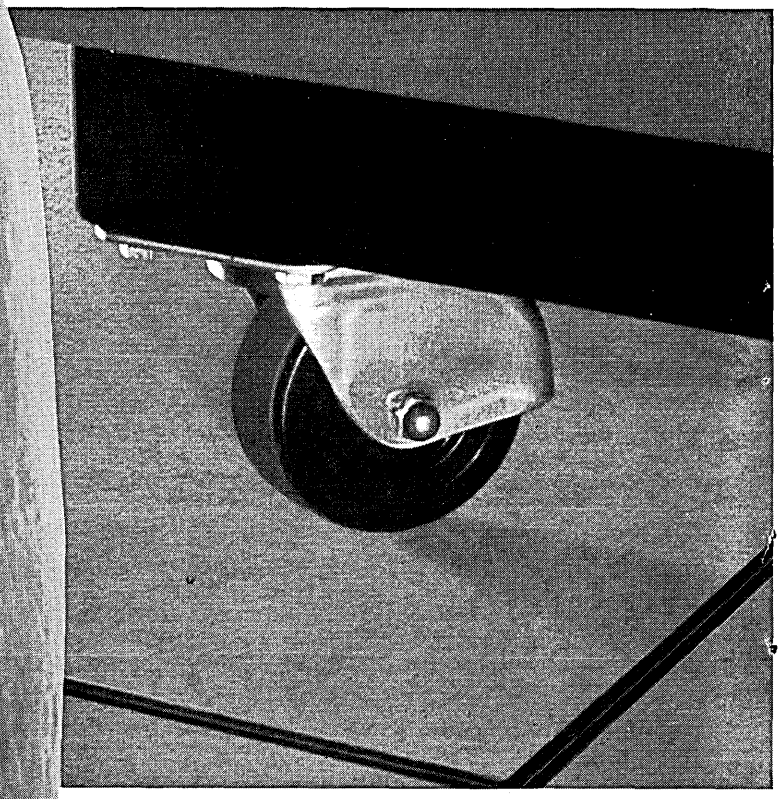
TIME-SHARING COMPETITION TOUGHENS IN U.K.

With bureau business rising at over 25% a year in the UK, International Computers Ltd. has regrouped the bureau divisions that it inherited in recent mergers to form International Computing Services Ltd. Accounting for $7.2 million of the estimated annual total of $25 million spent on services, ICSL is aiming for a bigger slice of a market that should reach $120 million in the UK alone over five years.

But competition in the burgeoning area of time-sharing is toughening with University Computing Co.'s two UK branches in swing, TimeSharing catering to the more modest devotees of the market, International Data Highways expanding into more services, Scientific Control Systems (the rechristened former CEIR Ltd.) poised over the button of an 1108 with terminals, plus the push from makers such as GE and IBM. And all that list includes are some

(Continued on page 235)



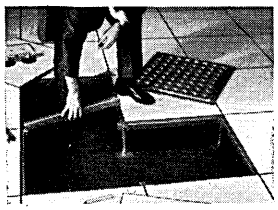


some dimples are cute... but not in a floor surface!

So We Guarantee WacoPlate Floors Against Dimples!

One raised floor looks just like another. Very deceptive. Fact is, WacoPlate alone has extra strength built in to save you problems. Like deflection. Or costly changes a few years from now to meet unforseen requirements. Fact is, WacoFloors give you total accessibility without sacrificing either strength or rigidity. The secret is the patented Snap-Lok Rigid Grid System. Stringers may be quickly, easily removed or replaced; yet they provide essential stability. Don't let looks deceive you.

WacoFloors are installed with panels of steel or wood core. For complete details, dial direct or write.



Stringers are easily removed from the exclusive Snap-Lok Rigid Grid System.

WACOFLOORS

WASHINGTON ALUMINUM CO., INC.

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There is no equal to a WacoFloor

CIRCLE 141 ON READER CARD

names that spring to mind first without intending to detract from the horde of others bent on making their living out of the business. One such is John Hoskyns, a former IBM finance specialist, who has floated several cliff-hanging ideas already, and who has installed an ICL 1901 exclusively for developing client software. Hoskyns was behind a multimillion dollar project Centre-File designed to provide on-line dp for stockbrokers. This was later sold to a major bank. Another scheme with which Hoskyns was associated was a technical information retrieval service called Indata. Devised by a former McGraw-Hill technical editor, Derek Barlow, Indata was sold at the time of the events that led to new ownership for Centre-File. A large engineering and steel group, Guest Keen and Nettlefold, which inherited Indata, has now decided to abandon the service.

COMPUTER SYSTEM FOR MEDICOS DROWNING IN FOOLSCAP

The British Government has allocated $400K for a pilot project to bring on-line computing to the rescue of family doctors inundated with paperwork. A joint research venture between Essex University and community welfare researchers of a leading teaching hospital, Guys Hospital, London, the scheme is intended to bring automated patient record keeping and keyboard visual displays into the surgery. Britain's family doctors, who all are part of the state-run health service, are gradually reorganising into larger units labelled group practices. In principle, this means a group of five or six general practitioners looking after small towns or districts of 8,000 to 10,000 citizens. The idea is to zone the country so that a computer service is available for each population concentration of 100,000. Patient records will be centrally stored at a computer centre for instant call-up on visual display. To avoid ambiguity in note-taking by GPs, the proposal is to use structured data for entering individual details, with standard classification for diseases, diagnosis and drug and treatment prescription. In the pilot scheme, two new towns near London, Harlow and Thamesmead, have been chosen for the investigation. Visual displays will be installed next year in two surgeries with communications links to Essex University's computer department. It will take three years before a final technical and cost-benefit assessment drops on the desk of the Minister of Health. He holds the pursestrings for okaying national adoption of such systems.

BITS AND PIECES

Elbit Computers Ltd., Haifa, Israel, recently sold its 45th Elbit 100 computer in Europe and now claims to be #2 among small computer makers competing on the continent. The firm also announced its new Model "U" Elbit 100 featuring up to 75 different conditional jump operations, logical operations and real-time interrupt at no additional cost....Japanese business circles are working toward the establishment this year of an organization tentatively titled Japan Information Development Ass'n to serve as an organ to spread computerized MIS information. And the president of Nippon Electric said in a recent speech that industry emphasis will now switch from hardware to a balanced hardware-software product and he asked for advice and ideas from users.

Mag tape too expensive?
Punched tape too slow?
Your small computer deserves PEC data power!

High Speed—Low Price

Seems a shame to shackle that fast new computer of yours with slow, maintenance-prone punched tape. Yet digital magnetic tape recorders are so expensive.

Not now, they aren't.

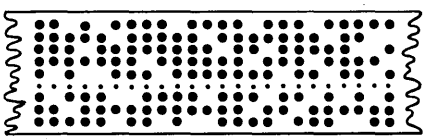
PEC can give your small computer real write/read data power. 10 KHz data transfer rates for under $3,000. 20 KHz transfer rates from $5,000. (Less than $4,000 in quantities).

Discriminating computer users are demanding higher input/output performance on even the smallest machines.

That's why more and more major computer manufacturers are offering PEC digital magnetic tape recorders as standard equipment.

Insist on low cost-high performance PEC data power for your computer.

Compare With Punched Tape

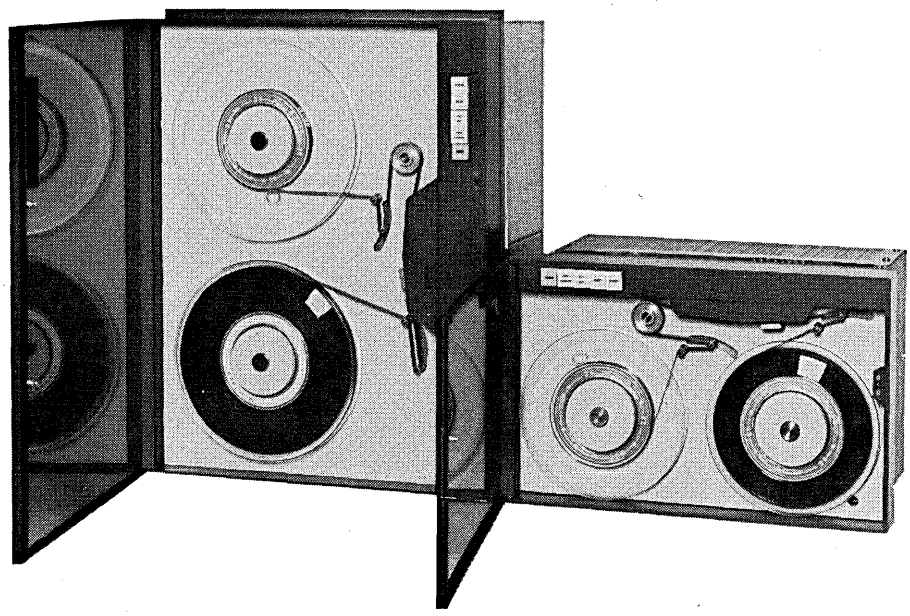


You can store ten characters on an inch of punched tape. You can store up to 800 characters on an inch of magnetic tape. That's 80 times more data per inch!

What about data transfer rates? A paper tape perforator plods along at 150 characters a second. Pretty slow for today's fast computers.

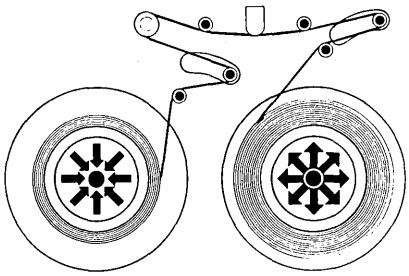
PEC digital magnetic tape recorders zip data in and out at speeds to 25 ips. Data transfer rates up to 20 KHz. That's 133 times faster than punched tape.

PEC data power costs just a little more than punched tape. Yet look at the tremendous increase in storage capacity and data transfer rates you get.



Compare With Other Mag Tape Models

PEC digital magnetic tape recorders use an elegantly simple single capstan velocity servo system. Pinch roller, a major source of skew and tape wear, is eliminated.



PEC recorders cost half as much as competitive makes, yet perform even better.

IBM compatible? You bet. Including the precise requirements for System/360, 9 channel, 800 bpi operation.

Choose the speed you want from 4 to 25 ips, at 800, 556, or 200 bpi. 7 track dual density available too. And up to 4 PEC recorders can operate from a single computer.

Select the data capacity, transfer rate, rack height and price from 3 distinct models.

Three Reel Sizes

Reel Size	Max. Transfer Rates	Tape capacity
7 inch	10 KHz	600 feet
8½ inch	20 KHz	1200 feet
10½ inch	20 KHz	2400 feet

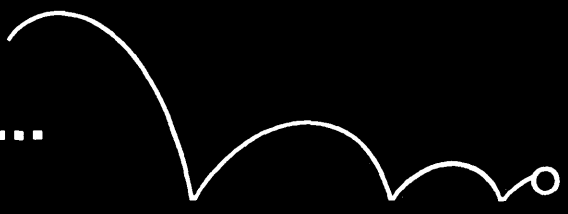
PEC also makes synchronous write-only and read-only recorders. A complete line of incremental models too. Perfect for data acquisition systems, off-line plotters, line printers, and data terminals. Perfect for just about any input or output requirement, for that matter.

Write or phone today for our 8 page brochure.

PEC **PERIPHERAL EQUIPMENT CORPORATION**
9551 Irondale Avenue ■ Chatsworth, California 91311 ■ (213) 882-0030 ■ TWX (910) 494-2093

See us at the FJCC, Booth 104, San Francisco

Name one graphic/alphanumeric terminal that can draw a curve like this with just 9 commands...



— COMPUTEK SERIES 400

Name one that does it for under $12,000

— COMPUTEK MODEL 400/20

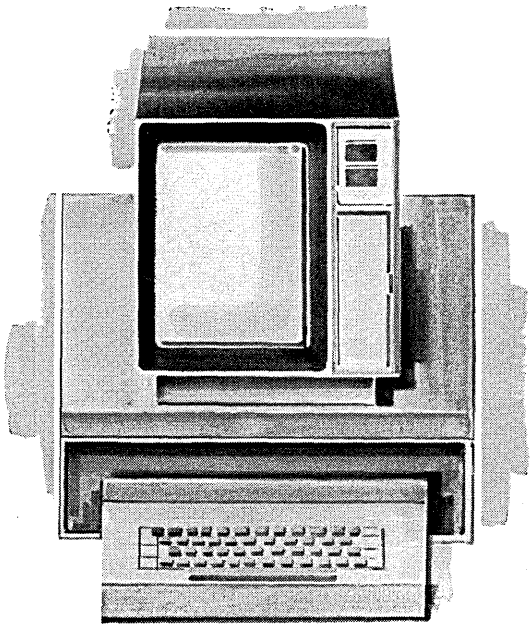
Computek's series 400 features a unique graphic curve generator

- Smooth curves drawn directly rather than by straight-line approximation.
- Smaller display files.
- Lower time-share costs.
- Reduced phone-line charges.
- Faster image buildup.

Computek's model 400/20 features low cost in a stand-alone remote terminal

- Under $12,000
- Curve generator.
- Vector generator.
- Alphanumeric generator.
- Storage-type CRT.
- Data set (modem) interface.

Additional character sets, special symbols, and interfaces for direct coupling with computers are available as options.



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High-priced engineering talent laboring on routine plans or drawings is a waste of time and money. Kingmatic system of computer-aided graphics can free such talent for the creative thinking required to stay ahead of competition.

Kingmatic is a versatile system of NC graphics for general purpose work in engineering, electronics, aerospace, automation, shipbuilding, map-making, textile, and other industries. It is designed for application where high speed good accuracy and a medium size drafting area are required. Various types of input to system may be utilized and output flexibility is enhanced by a variety of drawing heads.

Write on your letterhead for Kingmatic literature and indicate area of application, product or service.

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NC DRAFTING SYSTEMS

BALDWIN KONGSBERG CO., Bldg. 8, Atkinson Square, Cincinnati, Ohio 45246

CIRCLE 144 ON READER CARD

washington report

GAO REPORT INDICATES SUPPORT FOR INDEPENDENTS

GAO will recommend greater federal use of independently manufactured dp system components in an upcoming report to the Joint Economic Committee. But this endorsement will be so severely qualified that the manufacturers aren't likely to welcome it. The report will point out that special hardware and software are often required to mate one supplier's peripheral with another's processor; since many of the interfaces haven't been fully developed or tested, at least according to GAO, the value of the independent's lower prices has to be discounted.

However, GAO is likely to draw the attention of federal dp procurement officers to independently made peripherals that can be plugged in directly to any of several main frames, and this may generate some interest.

NAVY DP MANAGEMENT ON SHAKEUP CRUISE

Norm Ream's departure from the Navy may cause the centralized dp management organization he developed there to lose much of its effectiveness. The decay may already have set in; Ream's successor as Special Assistant to the Secretary of the Navy, James Woodruff, will report to the Secretary through Charles A. Bowsher, Assistant Secretary for Financial Management. Ream reported directly to the Secretary. A single team probably will continue developing standard programming languages for the Navy, but dp system planning for the Navy and Marine Corps is likely to be split, transferred from civilian to military control, and dropped down on the organization chart. That should give individual commands, at the lower levels, more decisionmaking power, and give DOD more trouble in implementing its directives.

Ream is now a CDC corporate-level problem solver.

COMPUTERS MAY BE RUNNING FOR CONGRESS

A determined effort to set up a computerized information service for Congress will be made next year, according to sources in both Houses. The enabling legislation would consist largely of provisions in a congressional reorganization bill, S355, which the House Rules committee filed, and then ignored, last session. S355 empowers the Comptroller General, Budget Bureau Director, and Treasury Secretary to establish and maintain "a standard information and data processing system for budgetary and fiscal data," as well as a standard data classification system. It also establishes a committee to make a "continuing study of automatic data processing and information retrieval system."

CAPITOL BRIEFS

We hear the Center for Computer Technology at NBS will soon become an independent entity; CCT director Herb Grosch will be able to report to NBS Director Allen V. Astin directly. Possibly, Grosch's dp standards work will now attract more money from Congress, and he may be able to get more from industry for joint efforts....If Richard Nixon is elected President this month, the next Assistant Secretary of Defense (I&L) is likely to come from the dp industry; he's one of DOD's severest critics....A top official in the federal dp directorate says the WWMCCS buy will produce "a megamillion dollar monument to obsolescence." What's needed is an open-ended system that can evolve with changes in the state of the art. He thinks the contract should go to a consortium headed by a software firm. The present design effort should be junked, he contends.

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books

***Computers, System Science, and Evolving Society*, by Harold Sackman, John Wiley and Sons, 638 pages, $14.50.**

"The Billion Dollar Brain" got after Michael Caine. An enormous computer fathered Giles Goatboy. The "checkless society" and information pools are upon us, and even a 1401 operator and a satellite tracker might well come to

the conclusion that "computers are taking over," if they had the opportunity to discuss the subject. But few people are able to talk about the computer revolution realistically, given the present literature available to the general public.

How many people really know what is going on? What are the far-reaching consequences of doing business with a computer? Are we already in the grip of machines we won't be able to handle in the future? Can business, military and scientific ventures pool their efforts and come up with realistic "computer power"?

Mr. Sackman is definitely in the center of these questions, and has produced an impressive book. His preface states that his work is, in part, an attempt to bridge the huge gap in computer literature between commercial systems and scientific and military systems. He is also "primarily concerned with the study of realtime systems that incorporate the basic elements of all other types of computer-based systems." This project of unifying is enormous, of course, but the book that follows is excellent and should make a fine text for students of systems analysis in both the scientific and commercial fields.

The book is in three parts: (1) an introduction to the leading concepts of man-made digital systems, (2) an application of system science, and (3) a philosophy for the conduct and direction of these systems within our evolving society. The first and last sections "may be read by the educated layman without specialized preparation." The central section "is more technical and requires some familiarity with realtime computing systems, experimental design, and statistics." But I hope this doesn't deter anyone, because Mr. Sackman writes so well, explains concepts and details so clearly, and generally documents his examples and arguments so precisely that one could even read this middle section in isolation and gain a great deal.

In explaining the application of system science, the author draws heavily on the "SAGE (Semi-Automatic Ground Environment) air defense system, the first of the large realtime computing systems." Mr. Sackman sees the SAGE system as having a pioneering role in computer history and pursues an in-depth analysis of the design and implementation of this network. This military bent would seem to make the book ideal for, say, West Point, but does not limit its usefulness to just the military.

Each chapter begins with a quote from a leading political or literary figure (Churchill, Henry James, Adam Smith, etc.) who has made a statement concerning man-made digital systems. This is one of many "extras" that this thoroughly polished and professional work offers. (I believe if Sandy Koufax had made a relevant statement about edp, Mr. Sackman would have included it.) A great deal of care has gone into the author's research and writing because the direction of his theories and explanations, however detailed, does not bog down. He even includes such fine points as fold-out systems charts and examples of equipment layout at a satellite test center to document his thinking. Each chapter ends with a "Summary and Conclusions," which is certainly an aid to study, even if not completely necessary. Happily, references rather than footnotes are used and are listed at the end of each chapter.

But still, this book is much more than just a fine systems text. It is most interesting and perhaps makes its greatest contribution when dealing with the whys and wherefores of man's computing systems. The development of man-made digital systems is tied in with our own organic evolution, which is seen as "changing organizations of

books

information systems." The DNA molecule, basis of heredity, is viewed as an "information system" which shows man the possibilities for biological knowledge and control. From this point the author progresses through historical information-gathering systems, basing his argument on the philosophical roots of experimental method, and arrives finally at our present computer revolution. And although the computer revolution is considered inevitable and eventually complete, this is viewed as a liberating rather than a threatening force.

In the course of this particular theory, the author performs a service in destroying many of "computer-as-a-Frankenstein" myths that abound even among systems analysts. Man does not stand to lose by increased regulation of his society if we unify our efforts and educate ourselves in the present and future possibilities of our machines. Mr. Sackman writes with the future of information systems clearly in mind and presents society some fascinating alternatives if it is able to keep up with its machines. Buy the book, read it, use it—a philosopher-writer-systems man doesn't come with every new machine.

—SALLY STORY

book briefs

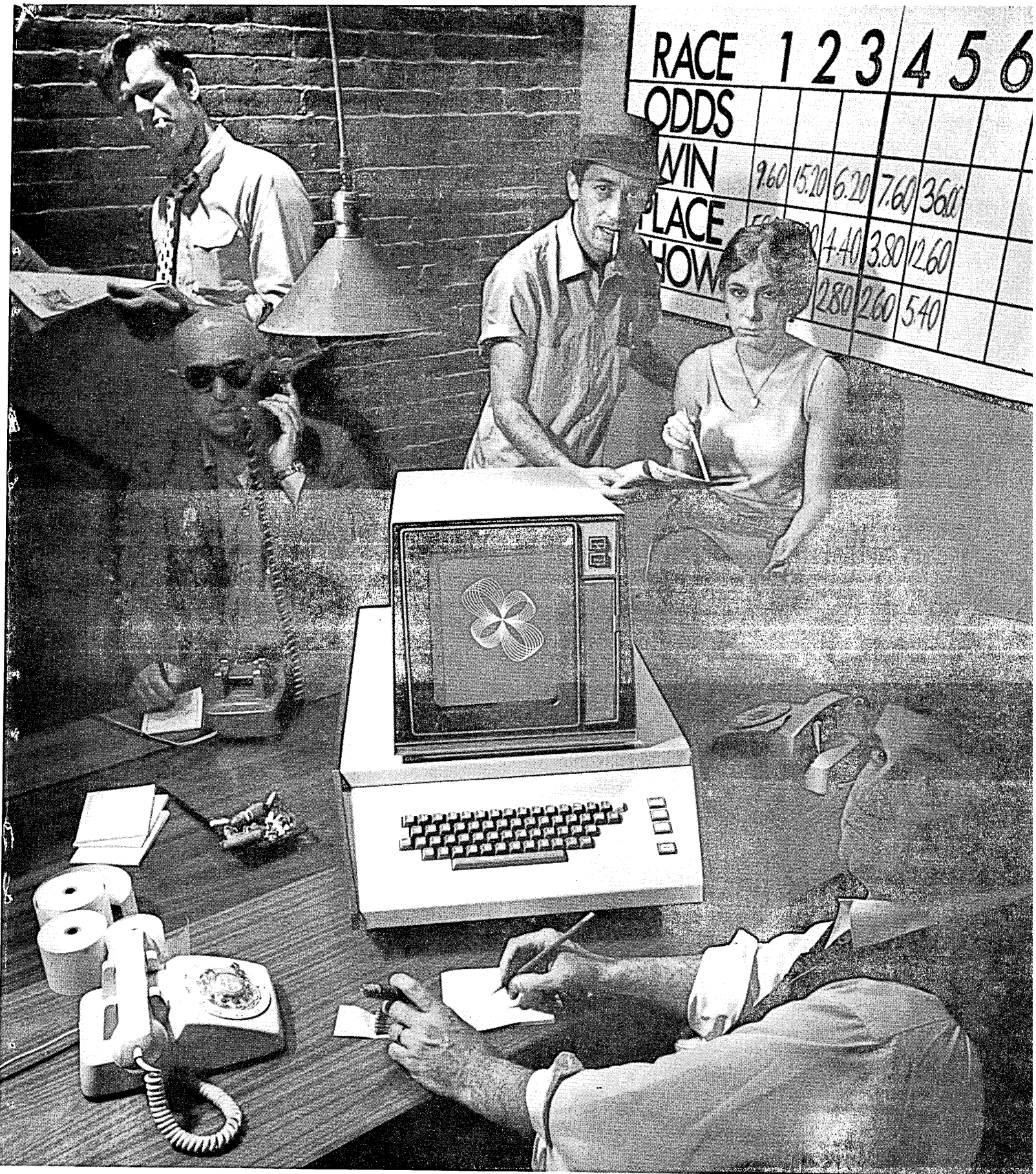
(For further information on the books listed below, please write directly to the publishing company.)

***Switching Theory*, by Paul E. Wood, Jr. Lincoln Laboratory Publications, McGraw-Hill Book Co., New York, N.Y. 1968. 390 pp. $13.50.**

The author considers complete understanding of switching theory to be the basis of a complete understanding of digital systems; he therefore emphasizes, in this book, fundamental results of the theory rather than specialized methods for design. Each chapter includes a series of problems and references, and there is also an appendix listing some American sources for switching theory.

***Principles of Data Communication*, by R. W. Lucky, J. Salz, and E. J. Weldon, Jr. McGraw-Hill Book Co., New York, N.Y. 1968. 431 pp. $14.50.**

Intended as a reference for communications engineers, this volume covers the results of recent research projects and current design principles. It includes material on optimum systems, adaptive equalization and error control; discusses both modulation and coding; and reflects, according to the flyleaf, "the current interest to achieve more efficient utilization of real transmission channels."



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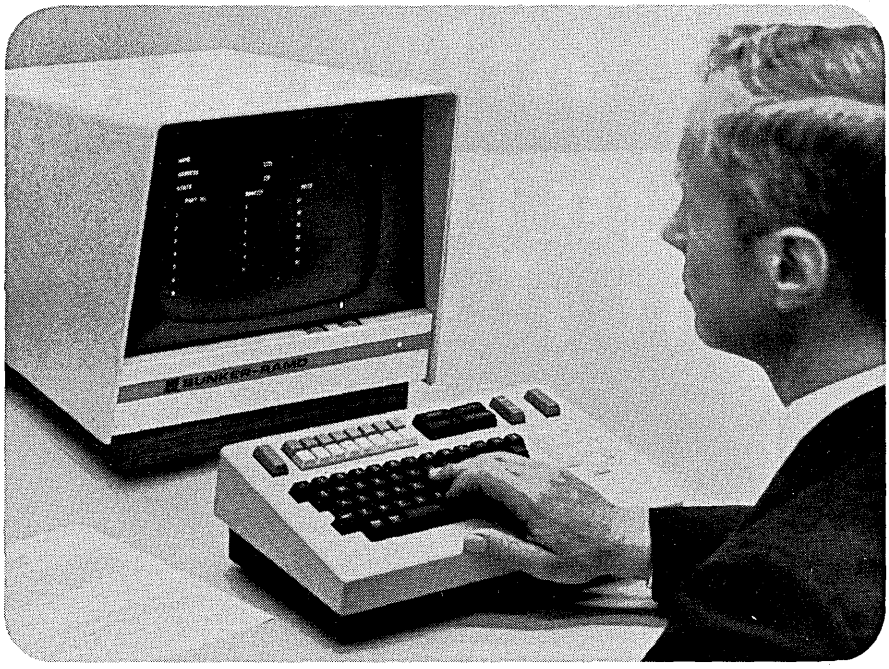

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A host of features permit the system designer to tailor Series 2200 units to his special requirements. Included are:

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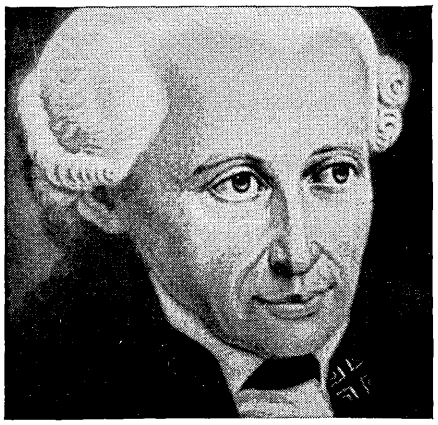
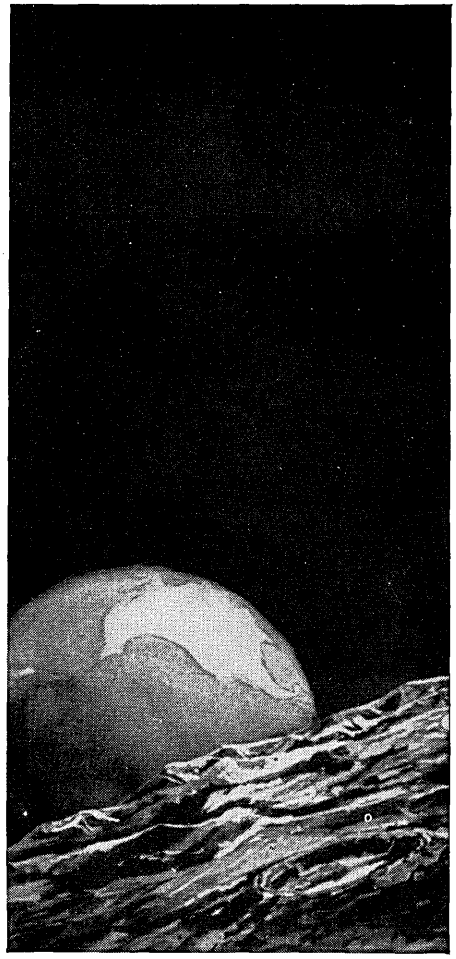
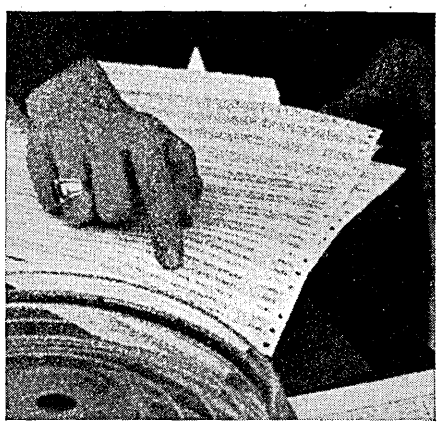


If you're the kind of systems programmer who has a mind that's deep enough for Kant,



broad enough for science fiction,



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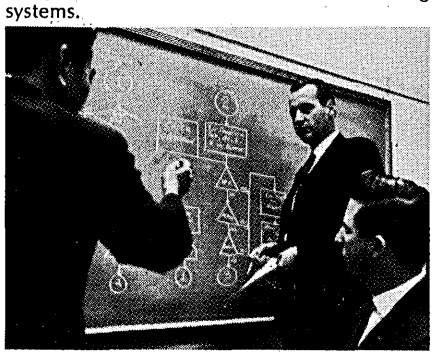
Analysis and development of advanced systems specifications; consultation on systems design, hardware configuration, software trade-offs; analysis of competitive systems. Prefer applicants with BS degrees and 3-5 years' experience and ability to write and test functional specifications in such areas as very-high-speed memories, disc files, drum files, central processors employing large-scale integration, communications and time-sharing systems.



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Develop operating, executive, utility and on-line systems for third- and fourth-generation advanced systems. Positions require a business or science degree and large-scale file computer or software development experience.

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Specification, design, checkout and documentation of digital and digital/analog equipment for use with on-line data processing and data communications systems. Requires BSEE and five years' related experience.

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Will design and develop digital and analog semiconductor circuits, including discrete, integrated and hybrid types. Requires a BS/MSEE and two years' related experience.

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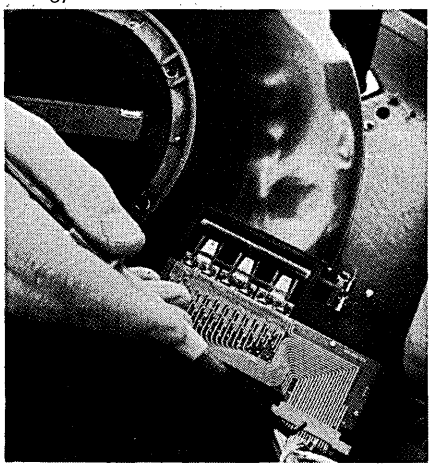
Will design and develop flying magnetic recording heads and the required prototype tooling. Requires BS or MS in EE, ME or physics plus three years' applicable experience. Knowledge of ferrite machining technology and ferrite heads desirable.



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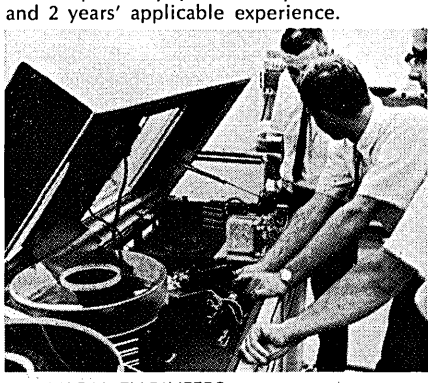
Will develop manufacturing machining processes for various projects. Will be responsible for capital equipment analysis, fabrication tooling and initial production. Positions require BSIE and heavy mechanical/industrial engineering experience.

MATERIALS & PROCESS ENGINEERS

Will evaluate and select metallic or non-metallic materials, develop chemical or metallurgical processes, or prepare specifications for computer equipment. Requires BS or MS and 2 years' applicable experience.



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Positions are available for college trained engineers to assume responsibility for film plating, organic finish analysis, and production plating process functions. Successful candidates will possess a BS degree in chemical engineering, a knowledge of organic coatings, the ability to develop and direct a process laboratory, and 3 to 5 years' experience in electroplating of magnetic thin film materials or chemical process analysis.

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Will be engaged in feasibility model development, or integrated circuit memory or high speed magnetic memory circuit design.

Requires scientific and/or engineering degree and adaptability to a multiplicity of applied research projects.

ARRANGE NOW FOR INTERVIEW AT FJCC

Confidential interviews will be held at the St. Francis Hotel during the Fall Joint Computer Conference in San Francisco, Dec. 9-11. To schedule an appointment, submit detailed resume including salary history to Steve Williams at the Division.

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400 series equipment and a terminal (named TRADAR) developed with Friden (possibly via its service centers as well as through system sales). Its showcase installation is at J. C. Penney in Glendale, (Brand Blvd., just off Broadway) Calif., where on-line register terminals (through phone lines to a 415 in Buena Park) dazzle those customers that know what's happening. The terminals can handle discount, layaway, cash, charge, salesgirl's number, etc., and read tags printed by Dennison.

GE and Friden have since parted company in this effort, Friden having popped with its own point-of-sale register with internal core storage (512 6-bit words). The first units will be tested next summer at parent Singer stores and other sites. Friden has a built-in order from Singer for about 2K units.

ASSOCIATED CREDIT BUREAUS TO PUBLISH PRIVACY STANDARDS

On Dec. 1, the Associated Credit Bureaus of America will release privacy standards it has been working nearly two years to develop. Historically, each of the 2,100 member bureaus had set its own standards, releasing to merchants or to government agencies varying amounts of personal data from its files.

One of the standards to be announced will be happily received. Individuals will now have complete access to the information recorded about them. This is a definite departure from past procedures where one's records were either fully or partially closed to him.

Standardizing the amount and type of information to be released is another step in ACBA's efforts to centralize its 110 million files and provide computerized remote access to them.

IBM SIDESTEPS JUSTICE; VIP LOWERS RATES

IBM has transferred its information marketing group--i.e., Call/360 and Quicktran--to the Service Bureau Corp., apparently to avoid a confrontation with the Justice Department.

Meanwhile, VIP Systems, one of the service bureaus that inspired the Justice Department's interest in Call/360, has apparently decided that competing with IBM on the latter's terms isn't as difficult as it seemed (see August News Scene, p. 87). VIP is now installing a 360/40 in its Washington, D.C., HQ, explains president Joan Van Horn, and plans to offer text processing services at rates equivalent, and in some cases slightly less than, those charged for Datatext.

How can VIP afford to descend to IBM's price level? VIP has found an angel with enough money, and faith, to provide a counter-subsidy. The recent appointment of Louis Frazier as VIP's marketing vp may be a tipoff. He "is presently" an executive of Sterling Drug Company's international division, according to Miss Van Horn.

FORTRAN IV SINGLE-PASS COMPILER COMPLETED FOR DECADE

The software library of the Decade Computer Corp., Huntington Beach, Calif., now boasts a Fortran IV single-pass compiler that meets all the ASA standard specifications, including a complete subroutine library. Designed, naturally, for use with the firm's Decade 70 series of general purpose computers, the compiler operates in 8K 18-bit words of memory at the rate of 1K statements per minute (it uses under 5K of memory, leaving room for general operation).

INFORMATICS NOW OFFERING NEW DISPLAY SOFTWARE

A new software package called DISPLAYALL has been developed by Informatics, Inc., Sherman Oaks, Calif., for on-line applications with OS/360 and IBM 2250/2260 display terminals. It provides a multiconsole executive that supervises the parallel

(Continued on page 253)

control of various display consoles that may be dedicated to one or various applications programs, allowing the user to execute local programs in the background of a multiprogramming environment. It is available now for OS/360 Assembler language and Fortran IV and the firm claims a training period of less than a day for experienced programmers. The price is $9,500 installed and the basic DISPLAYALL will be maintained under warranty by Informatics at no additional cost to the customer. Development of the package for use with other equipment is under way.

PL/I STANDARDIZATION MOVE TABLED

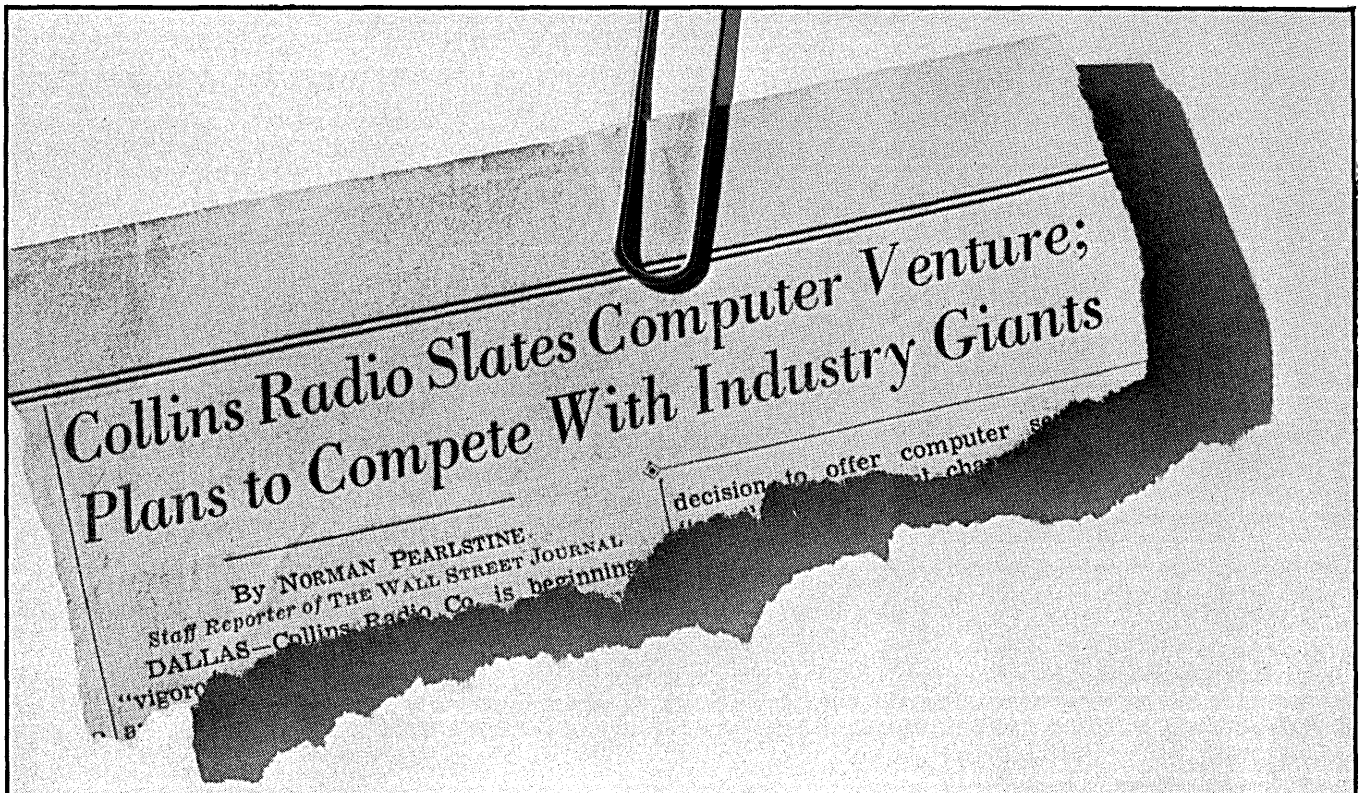
The X3 committee hearing in N.Y. last month on the move to establish a subcommittee to work out a standardization of PL-1 resulted in a tabling of the motion after what we hear was a highly emotional session. Fireworks included an impassioned speech against PL-1 standardization by Alonzo Grace of RCA, abetted by Herb Grosch of NBS; both were inclined to vote against standardization; thus, proponents of PL-1 can count it a small victory that the motion was only tabled. This action further fuels the rumor that the reason for Bill Andrus, IBM's dir. of standards, being exiled to other duties within the company is that he allegedly hadn't done enough to fend off criticism of PL-1, prevent imposition of ASCII as a federal standard, and retard COBOL standardization. Andrus is "on special assignment to J. W. Birkenstock, commercial development vp."

PROSPECTING IN ROLLING HILLS

Turn-Key Computer Applications, Rolling Hills Estates, Calif., is a new business-oriented software company headed up by James R. Ziegler, formerly director of advanced programming research for NCR. The name of the firm tells it...they're ready, they say, for anything from system design and equipment selection to implementation and support or any step along the way. Turn-Key was formed seven months ago on Ziegler's money, billed $73K the first six months, has contracts for over $100K.

RUMORS AND RAW RANDOM DATA

A new Sigma line may be in the offing. SDS is evidently unhappy with sales (Chuck Cole, vp sales, is out) and costs, has reportedly brought Bob Beck back as a consultant to redesign the series, which may become Sigma "prime"...There are rumbles of an announcement from IBM within 90 days about two new machines--a time-sharer between the 50 and 65, and that hardy perennial, a multiprocessor in the sometime 90 series...Some Wall Street sources have it that Xerox is interested in buying GE's computer operations ...Burroughs is set to have about 70 orders for the 6500; first unit should be in operation at the Pasadena factory about the end of the month...Memory maker Fabri-Tek is acquiring Automated Information Management, Inc., Minneapolis-based service bureau/ software firm....Rumors are that Vanguard Data Systems, Newport Beach, Calif., peripherals firm, will announce an IBM-compatible key-tape data entry system soon....Auerbach Corp. is looking for a president of its software subsidiary....CUC is reportedly negotiating with Bell & Howell on the purchase of CUC's home-study programming course....Speaking of the social security number as the standard ID for people, we hear a man in Wisconsin was found to have 5,000 different SS numbers.



Collins' New Data Program Creating New Opportunities

Collins' C-8500 C-System gives users the first completely integrated system with virtually unlimited expansion capability.

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Information processing is a "people" business.

No recruiting firm is better than the people who work there. That's why Source Edp has a staff composed of top Directors of MIS, IBM Executives and Systems Management Consultants. The individual you talk to at Source Edp has already been where you would like to go. So he's able to help you plan your career on an intelligent, long-range basis.

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Source Edp can provide selective exposure that can't be matched. With offices in major metropolitan areas, Source Edp is where the positions are. We stay up-to-the-minute on openings and personally visit our clients to gain a full understanding of their plans, environment and potential for the individual. In addition to openings in the United States, Source Edp is constantly being retained by its clients to fill computer positions throughout the world.

We work full time on your future.

Opportunities for the computer professional today are simply too varied and numerous to allow any one individual to survey the field adequately . . . particularly on a part-time basis. To optimize career success you need the full-time help of professionals. The type of help offered by Source Edp.

You may never know about the best positions of all.

The one best position for you may be available *only* through Source Edp. Many Source Edp openings are exclusive. And most are not advertised. But whether the position is an exclusive or not, it can only be recommended to an individual whose interests and abilities are familiar to us. Since no one can tell when the right position for you might be available it's important that you make yourself known to us *now*.

How can we prove ourselves?

There are three things we can do to prove ourselves.

First, call your local Source Edp office. Make a date to go in and talk. There's no cost or obligation and all calls are kept in complete confidence. When you talk to one of our people ask him about *his* computer background.

Second, if you're attending the Fall Joint Computer Conference visit the fully staffed Source Edp office in San Francisco. It's been serving computer professionals in that area for over two years.

Third, write for our free Computer Salary Survey and Opportunities Analysis. It will give you a wealth of information and show you just how familiar we are with your chosen profession. You can get your copy by circling the reader service number or, for faster service, write directly to the Source Edp office nearest you.

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Detroit—Charles T. Walther, 2990 West Grand Blvd. (313) 871-5210
Los Angeles—Robert A. Harrison, 3470 Wilshire Blvd. (213) 386-5500
Minneapolis—Fred N. Anderson, 801 Nicollet Mall (612) 332-8735
New York—Edward T. Golden, 1414 Ave. of the Americas (212) 752-8260
San Francisco—Richard M. Clark, 111 Pine Street (415) 434-2410

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people

Robert O. Fickes has resigned as chairman of the board and president of Philco-Ford Corp. Succeeding him is **Robert E. Hunter,** former gm of the Euclid Div. of General Motors. . . . **Lloyd W. Cali,** ex-director of Data Systems, Communications and Electronics Div. of Philco-Ford, has rejoined Burroughs as gm of large computer systems organization of the Defense, Space and Systems Group in Paoli, where he is responsible for all

engineering and manufacturing of the B8500 system. . . . **George Goutney,** formerly dp supervisor for Corning Glass Works, has been named manager, eastern region, for the Computer Management Div. of McCall Information Services Co. . . . IBM appointments: **Frank T. Cary,** senior vp and gm of the Data Processing Group, elected to the board of directors; **Robert W. Hubner,** ex-marketing vp, now vp and group executive of the Office Products, Federal Systems and Information Records divisions and also responsible for The Service Bureau Corp. and Science Research Associates subsidiaries; **Jack E. Guth, Jr.,** former division director, systems marketing, White Plains, appointed midwestern regional manager and DP Div. vp; **George B. Beitzel,** asst. gm of the DP Group, and **Dr. John W. Gibson,** president of the Components Div., elected company vp's; **Dr. H. P. Eichenberger** appointed director of the Zurich research lab, to succeed **Dr. M. C. Andrews,** now director of data comunications for IBM World Trade Corp. . . . **William C. Jacques,** former eastern regional applications analyst, has been appointed director of software support for Control Data's 6000 software development organization. . . . At Univac, **James G. Hix,** former national account representative for civilian agencies, has been promoted to vp of Washington operations in the Federal Systems Div.; **James R. Fullam,** former director-market planning, has been named to the new position of director-market development; **Samuel Abbott, Jr.,** ex-western region manager of the Information Services Div., has been appointed national manager of services for the division, another new post. . . . **Neil E. Kennedy,** formerly an IBM marketing manager, has been named president of Unionamerica Computer Corp., a new company formed by Union Bancorp, Los Angeles, to serve the dp and software needs of the parent firm and its subsidiaries, as well as to provide computer services to the outside business community. . . . International Communications Corp., recently formed subsidiary of Milgo Electronic Corp., has appointed **Edward Bleckner, Jr.,** as president and **Sang Y. Whang** as vp/technical director. . . . **Dr. Peter C. Patton** has been appointed midwest regional gm of Analysts International Corp., Minneapolis. Most recently, he was manager of the systems design section in development engineering for Univac's dp division. . . . **Arthur W. Carroll, Jr.,** former manager of systems programming, has been appointed division vp, systems programming, for RCA Information Systems Div. He will be responsible for the design and development of computer software, including operating systems, languages and special packages. . . . Three General Electric division general managers in the Information Systems Group have been elected company vp's: **Jerome T. Coe,** information services; **John W. Haanstra,** information systems equipment; **Arthur E. Peltosalo,** international information systems. . . . Attn **Harry Markowitz** fans: Contrary to Sept. DATAMATION People item, he has **left** CACI for a private consulting practice. . . . **Sheldon F. Best,** vp of Decision Systems Inc., has been appointed as a scientific associate to participate in a special one-year program at New York Univ. This program of "industrial sab-

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"A truism," you say. Certainly. But at URS we put this truism to work—the ideas and aspirations of the individual are important, the humanistic approach is stressed. And we accord the same respect to our clients.

"But what does URS do?" you ask. Principally, we help people make effective use of computers, from concept to operation—analysis, design, programming, and implementation and operation of computing and management information systems.

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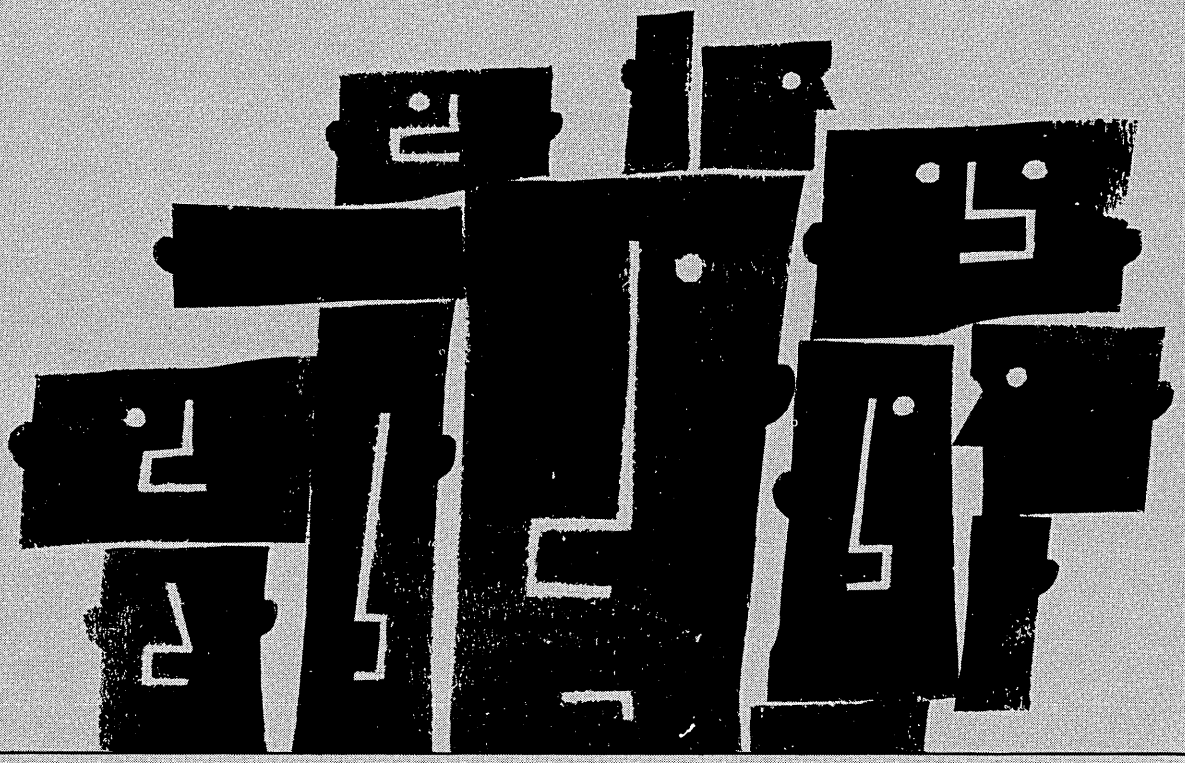

people

baticals," sponsored jointly by the Courant Inst. of NYU, the National Science Foundation and cooperating business organizations, will bring leading software experts to the school for a year of research. . . . **John S. Anderson,** former president, has been elected to the new office of board chairman and chief executive officer of Aeronautical Radio, Inc., and its subsidiary, Arinc Research Corp. **J. Francis Taylor, Jr.,** retired Air Force major general who joined the company early this year as senior vp-planning, has succeeded him

as president and chief operating officer of the Arinc companies, which operate air transport communication centers in major metropolitan areas. . . . Data Automation Co., Inc., has appointed **Edmund G. Benser** executive vp. Prior to joining DAC, Benser was vp in charge of C.I.T.'s nationwide computer leasing operations. . . . **Dr. Dieter H. Ambros** has been named president of BASF Computron Inc., Bedford, Mass., manufacturer of tape and other magnetic storage media and member of the BASF worldwide group headquartered in Ludwigshafen, West Germany. Ambros has held positions with the BASF group for more than 10 years. . . . **Peter O. Cioffi,** formerly with Control Data, and **Donald F. Cote,** Keydata sales director, have been elected vp's of Keydata and Adams Associates. Cioffi will be responsible for directing the marketing and sales of the company's technical services; Cote will direct the expansion of time-shared business dp services throughout the country. . . . **Dr. LeRoy B. Martin** has been appointed director of the North Carolina State Univ. Computing Center and will also coordinate the center's work with the Triangle Universities Computation Center. . . . **C. Robert Wieser,** deputy director of MIT's Lincoln Lab, has been granted a leave of absence to become asst. director of defense research and engineering in the office of the Secretary of Defense. . . . **Dr. Ward C. Sangren,** ex-vp of the western region for Computer Applications Inc., was recently named coordinator of computer activities for the Univ. of California. . . . **Col. Robert G. Todd,** former director of personnel for the U.S. Army Combat Developments Command, has been named deputy commander of Automatic Data Field Systems Command, Ft. Belvoir, Va. . . . Decision Services International Inc. has formed a Computer Sciences Div., to be headed by vp **Charles Stein,** which will provide development, hardware selection, systems analysis, and programming services. . . . **Robert W. McGeary** has been named president of Lever Data Processing Services, Inc., new subsidiary of Lever Brothers Co., NYC, which will offer a variety of services, including time sales, service bureau operations, consulting and recruiting, software and application development, and educational programs. He had been comptroller of Lever Bros. . . . **Roy N. Freed,** ex-Honeywell Computer Control Div. counsel, has joined Harbridge House, Boston, international management consultants. He is affiliated with the defense/aerospace development group, where he will be doing work on legal and judicial processing systems and with education on procurement aspects of computers and computer use. . . . **Per Soholm** has been elected a vp of Recognition Equipment Inc. with responsibility for product operations. Prior to joining Recognition Equipment in 1967, he was a manufacturing consultant for Olivetti-GE in Italy. . . . System Development Corp. has appointed **Dr. Rue W. Harris** director of corporate marketing. He had been in charge of marketing applications for SDC's Military Systems Div.

●

LAWS OF COMPUTER PROGRAMMING

1. ANY GIVEN PROGRAM, WHEN RUNNING, IS OBSOLETE.
2. ANY GIVEN PROGRAM COSTS MORE AND TAKES LONGER. *
3. IF A PROGRAM IS USEFUL, IT WILL HAVE TO BE CHANGED.
4. IF A PROGRAM IS USELESS, IT WILL HAVE TO BE DOCUMENTED.
5. ANY GIVEN PROGRAM WILL EXPAND TO FILL THE AVAILABLE MEMORY **
6. THE VALUE OF ANY PROGRAM IS PROPORTIONAL TO THE WEIGHT OF ITS OUTPUT.

* *This Law is derived directly from Sturgeon's Revelation.*
** *This Law is a special case of Parkinson's Law.*

— RAYMOND E. UTZ

Systems Programmers and Systems Analysts:

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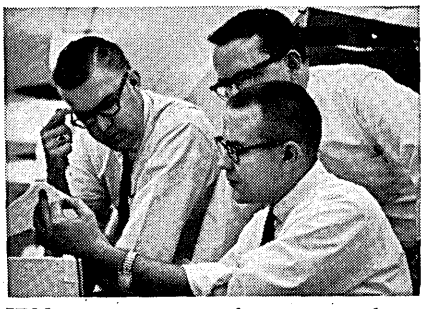
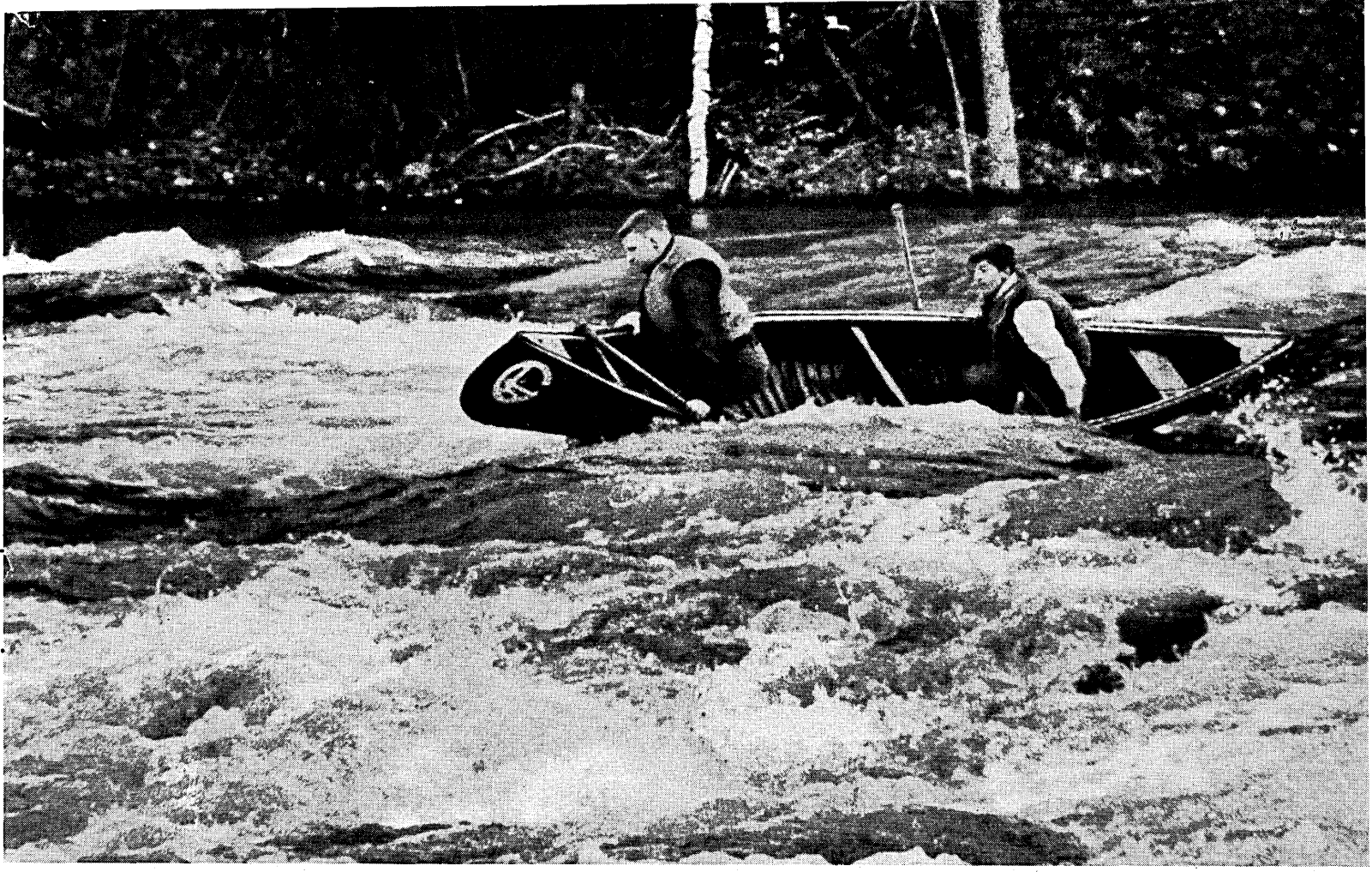


IBM programmers and systems analysts work in small teams on an IBM System/360 computer.



Can there be this kind of excitement in programming?

You hear the rapids before you see them —a distant, almost subsonic roar . . . feel the stream pick up speed . . . then a rush through a smooth, narrow chute—and you're in white water! The dangerous thrust of foam-masked rocks, the sweeping power of fast, broken water and the nimble response of the light canoe to your stroke—this is wild, wet excitement of white water canoeing*.

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The way we see it, both depend upon data. Accurate data. On the past. The present. To project the future. All along the spectrum from marketing and engineering through manufacturing, service and field support.

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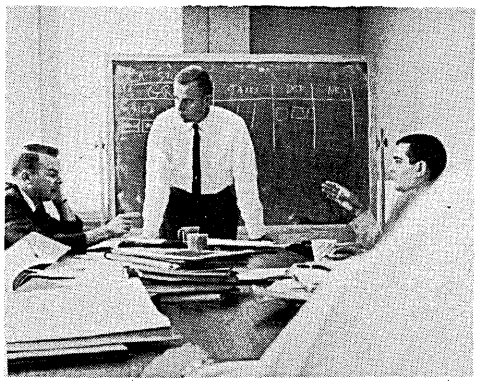

One of the advanced systems you might work on at Xerox is EBS . . . Equipment Billing System. Here, Bud Seiph, EBS Manager, leads discussion of new systems approaches.

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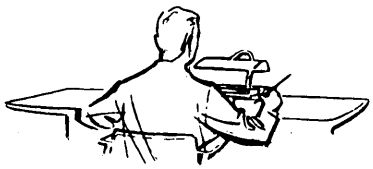

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E. B. Schultz has the audacity

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John joined IBM as an Applied Science Representative after receiving an MS in Engineering. He subsequently held positions as Manager of Systems Engineers and Manager of the IBM Education Center serving Southern California and the Southwestern States.

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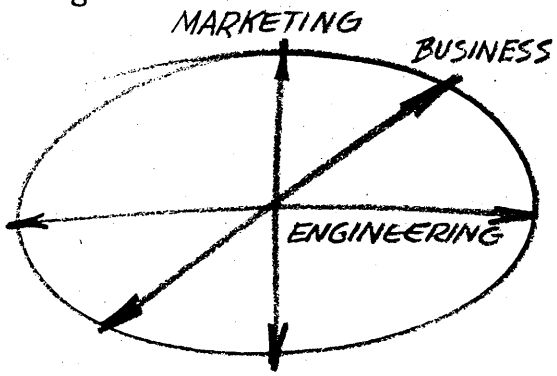

It's the essence of what we mean by our kind of engineer. An interest in and understanding of all aspects of our company's activities. You could call it balance. Whatever it is, it works for us.

* * *

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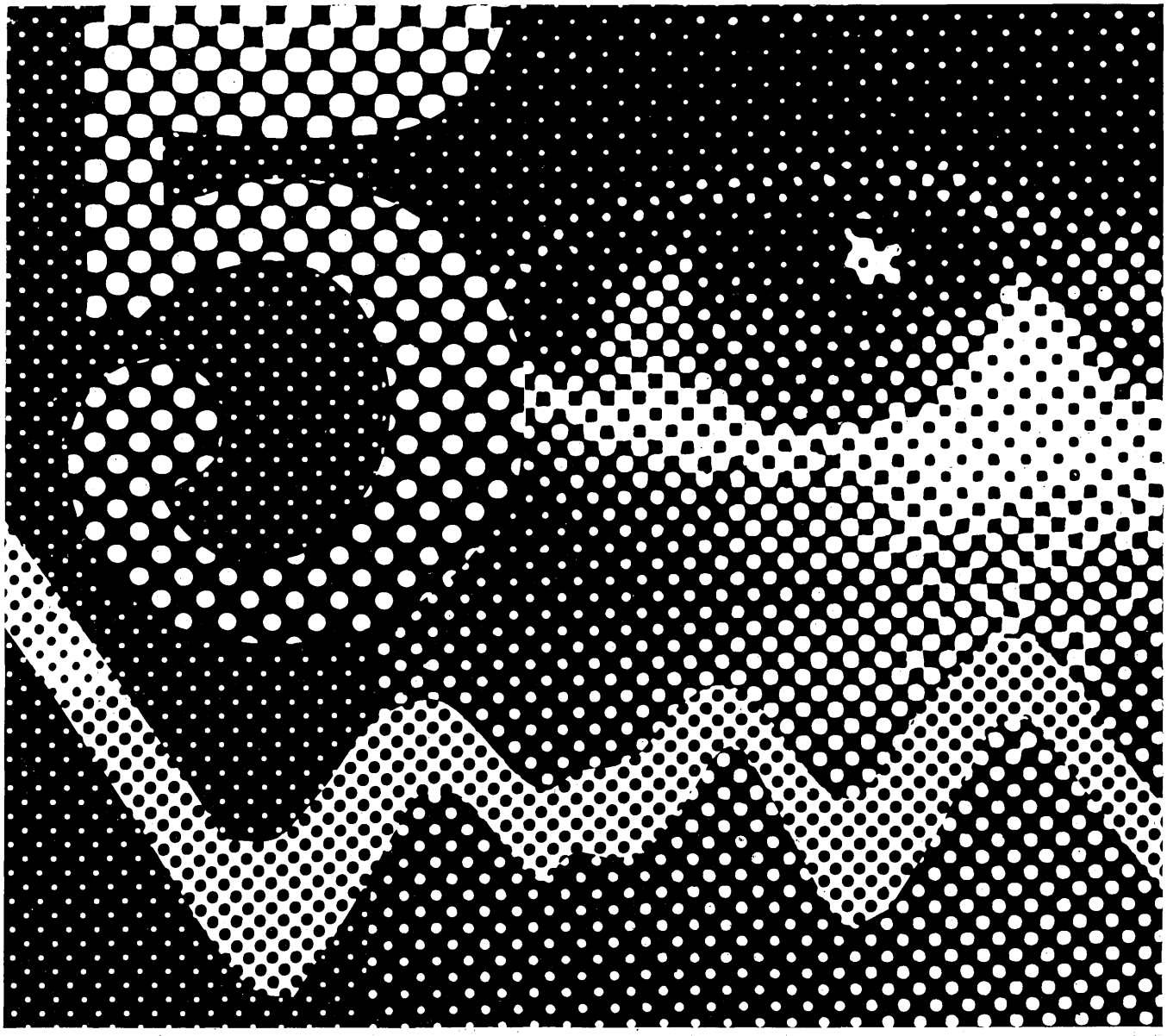

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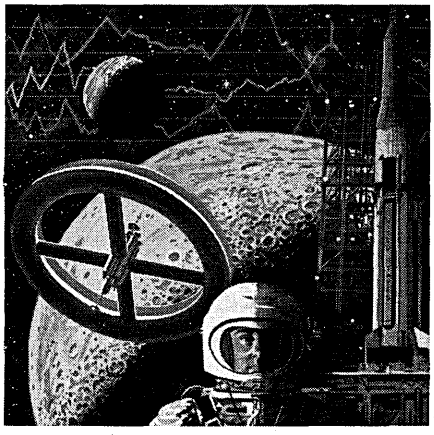

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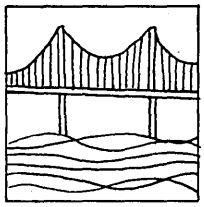

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the forum

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

THE PACKAGE DILEMMA

Computer hardware costs have been spiraling downward for several years now. This is not unusual once a new industry transcends the concepts of research and development and manufacturing techniques become perfected. Unit prices fall as a result of mass production. But it is a tribute to the hardware industry that this has been achieved so quickly.

Normally when an industry improves its production techniques the price per unit drops, thereby opening a larger market. However, the computer industry is divided into two parts: hardware and software. Unfortunately, the software industry has not progressed as rapidly and hardware cannot be sold without software. Software costs are generally thought to be related to the cost of labor and as such will never drop—in fact, if anything, will increase. Consequently it should not be surprising that software costs generally equal or exceed hardware costs in most installations.

In order to realize the full potential of the computer industry and to bring the advantages of automatic data processing to the smaller operation, it is necessary that software costs be reduced. This can be accomplished only by applying mass production techniques to software; that is, to develop software packages. The desirability of software packages is not something to be debated. They are vital for the development of the hardware and software industries and necessary to bring the advantages of computer technology to the consumer. The reluctance of even prominent people in the industry to accept this fact is partially historical. Initially computers were extremely expensive, so that only the largest companies could afford to purchase them. These companies thought of their problems as specialized and built up large programming staffs to handle them. Quite naturally, these companies dominated users groups and set a precedent in the computer industry. However, it is not the same computer industry today.

The average user of today has little desire and few means to acquire, retain, and manage a programming staff, nor can he afford to purchase custom software. In either event, the expense does not seem to justify the return. In short, the small company should not have to be an expert in computer technology in order to enjoy the benefits of computers.

It is further argued that a software package represents a compromise, as indeed it does. However, as has been pointed out, the only way that the staggering programming costs can be reduced is by applying mass production techniques to the software industry as they have been applied to other industries. This requires that a software package be developed and these development costs be amortized over a number of sales. The consumer must understand what compromises are involved, just as he understands the compromise that is offered when he purchases a computer or an automobile. The computer that he purchases was not customized for his requirements. Rather, he evaluated several hardware packages and selected the package which he felt most adequately satisfied his needs.

Clearly these comments apply to application packages, the programs which are required to cause the computer to perform the jobs for which it was purchased.

There is certainly another type of package, however, which has been demonstrated to be of importance to the industry. This is the "system program" package which IBM refers to as Type 1 programs. This class of programs includes such things as assemblers, compilers, operating systems, sort/merge programs, translators, etc. These have historically been purchased or produced by the hardware manufacturer and supplied "free" to the consumer.

There has been much discussion recently involving the separate pricing of hardware and software. Many spokesmen on the subject, while admitting the advantages of separate pricing of hardware and software, exclude the separate pricing of Type 1 software. It is generally felt that this type of software is required in order to utilize a computer, and since a manufacturer can amortize his software expenses over all of his computer sales, the expense per unit is minimized. While this smacks of anti-trust implications, it does not take all of the factors into account.

When a product is developed in an environment free of competition, the product is frequently substandard. The real cost to the consumer is a cost of operating with inefficient software. The best interests of the consumer are satisfied when the software results in the most efficient utilization of his computer or reduces the configuration required for a given operation. Clearly the hardware manufacturer is not motivated to do this, and the customer picks up the tab.

The question most often raised with regard to software packages is that of maintenance. A software package can only be successful if sold to a number of customers. Conversely, the more widely the package is used, the more reliable it is. Maintenance costs must be factored into the selling price of a software package, just as they are now factored into the hardware price. There is no a priori reason to believe that the hardware manufacturer can supply better maintenance than the software manufacturer. Indeed, there is an abundance of

evidence to the contrary. Quoting from Datamation (June 1968, p. 19), "Release 13 Fortran H had 2000 known compiler errors." I don't know of any software firms that have been able to duplicate this feat.

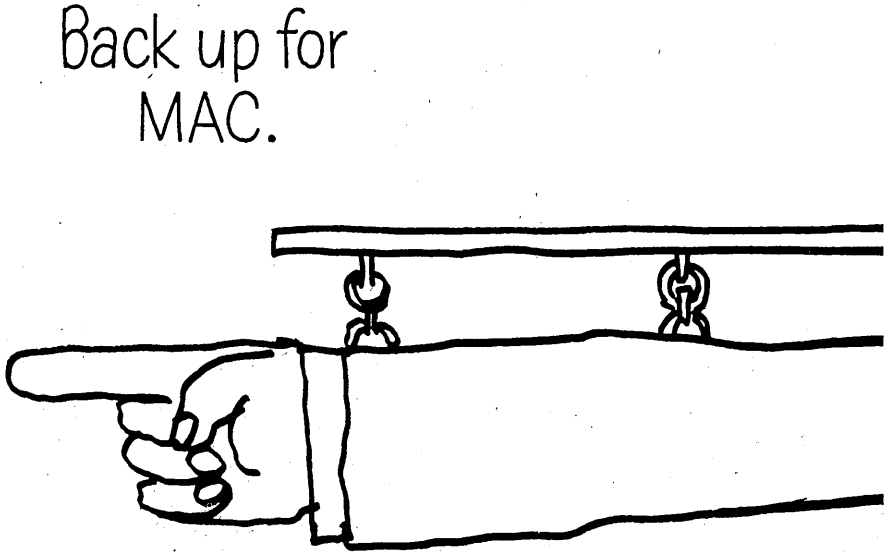
Another problem raised with regard to software packages is that of protection. There seems to be some question as to whether or not a program can be patented, although many patent attorneys today feel they will be patentable in the future. In any event, a patent offers only legal protection, and this can be accomplished to a large extent by a properly drawn contract. The legal protection simplifies prosecution of offenders; however, prosecution is only half the problem. The other half of the problem is detection.

Nevertheless, these fears appear to me to be largely unfounded. The principal motivation for a violation would be resale. A package cannot be resold on a large scale without extensive marketing. Surely this would attract the attention of the original producer of the package, thereby simplifying the detection. Sold on a small scale it would be less harmful to a successful package, and at the same time there is less motivation for the violation. Furthermore, programs are generally sold to companies, not to individuals. Companies generally have a purchasing department which is not oriented towards purchasing "hot" goods. On the other hand, the original purchaser of the package who paid full price is not motivated to sell it to his competitor.

To be sure, there will be violations; however, these cannot be harmful to a successful package. Analogously, the retailer who prides himself on no bad debts is probably being too conservative with his credit.

The software industry is younger than the hardware industry. It has not yet learned all of the problems of computer users, nor has it learned how to manufacture and maintain mass-produced software. It will learn and must learn if the full potential of the hardware industry is ever to be realized. Furthermore, Type 1 software eventually will be separately priced from hardware, not because of anti-trust action or patent legislation, but because it makes more sense economically.

—DAVID E. FERGUSON



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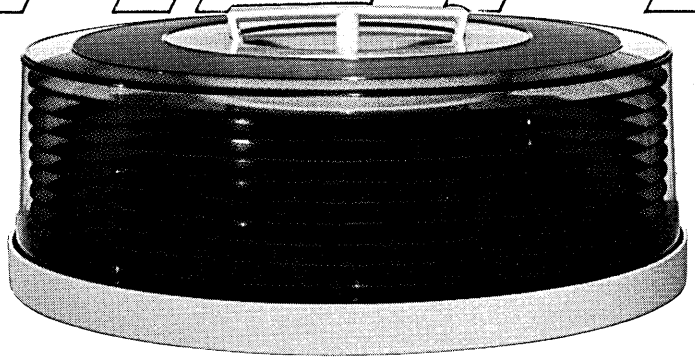

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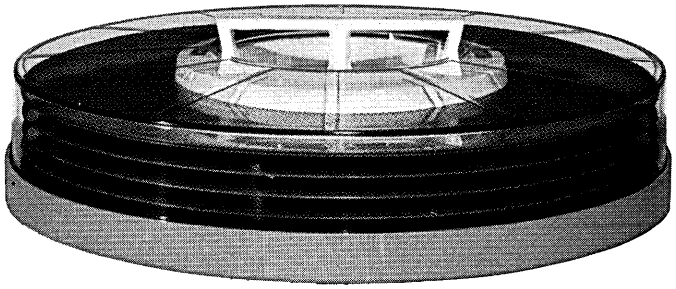

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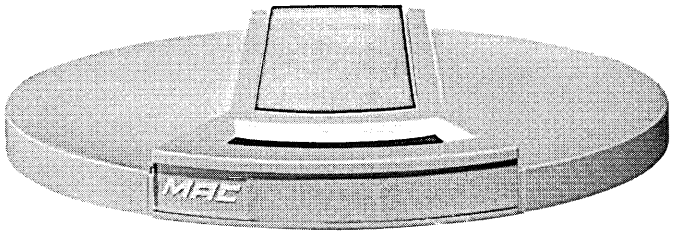

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